6. INDUSTRY AND SIZE EFFECT IN PROFITABILITY-CAPITAL STRUCTURE RELATION: EMPIRICAL EVIDENCE FROM POLAND

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Abstract

This study aims at verifying the significance and the direction of the way profitability affects capital structure of private firms in Poland. We explore the relationship in two cross-sections: across industries and across size groups of firms. The main issue addressed in this study is whether the way profitability impacts financial leverage is industry- and (or) size dependent. In order to answer this question, we estimate panel data models with interactions between variables for selected profitability measures. The study contributes to the existing literature mainly by exploring the indirect effect of industry and firm size as factors responsible for the variability of the relation between profitability and corporate capital structure. Findings provide evidence that the profitability-leverage relationship is affected both by the firm size and its industrial classification, with the stronger impact of the latter.

Keywords: financial leverage, profitability, firm size, industry factor, panel data

JEL Classification: G32

1. Introduction

The profusion of corporate finance literature dedicated to the problem of capital structure determinants should be discouraging enough to prevent addressing the same question all over again. The more so, when it refers to the profitability-leverage relationship, as among an almost uncountable number of capital structure determinants (Rajan, Zingales 1995), whose significance has been verified on multiple occasions, profitability factor seems to have enjoyed particular attention from researchers exploring determinants of debt.

This paper, although it also raises the problem of financial leverage, contributes to the hitherto research in the area in several ways. Firstly, instead of searching for capital structure determinants and verifying their significance, an attempt is made to further explore the already known and commonly accepted determinant of debt by searching for other factors

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affecting the profitability-leverage relationship. The approach adopted in the study could be defined as searching for determinants of capital structure determinants. Secondly, the importance of these secondary factors is explored on a sample of private firms, and not on the most commonly exploited public company data. Finally, the relationship in question is examined across three size groups of firms and in 16 industrial sections, which to the authors' knowledge, is the first attempt of this kind of in-depth analysis in Poland.

2. Profitability as a Capital Structure Determinant – Literature Review

Profitability is recognized as an important determinant of corporate financing choices by two leading capital structure theories, namely the static trade-off and the pecking order theory. Each of them, however, provides arguments in favour of the opposite direction of the profitability-leverage relation.

In the economic reality far from the idealistic world assumed by the irrelevance theory of debt (Miller and Modigliani, 1958), taxes do exist and the interests paid on debt are a compulsory burden for the company. They also increase financial costs from the point of view of firms as tax-payers. As a result of the tax reduction opportunity through the use of debt and the presence of bankruptcy costs, the static trade-off theory was developed (Myers and Mayluf, 1984). According to this theory, firms establish their capital structure by making a choice between the interest tax shield and bankruptcy costs. These two variables are also major capital structure determinants exposed by this capital structure theory. Profitability is another factor affecting leverage considered within the static trade-off theory by Frank and Goyal (2003), who showed that profitable companies should borrow more in order to benefit from the tax shield by reducing the amount of income tax. Moreover, profitability increases corporate free cash flow and the marginal benefit of using debt to discipline managers. Finally, higher profit rates reduce the likelihood of bankruptcy and the cost of financial distress originated by the use of debt. This indicates a positive relationship between profitability and financial debt, as taxes, agency costs, and bankruptcy costs lead more profitable firms towards higher leverage (Gonzalez, Gonzalez, 2012).

However, the opposite relationship is predicted by the other leading capital structure theory. According to the pecking order theory, firms establish their preferences concerning the selection of financing sources by creating the hierarchy of these sources. Thus, in normal market conditions, firms prefer internal financing over external financing and safe debt over risky debt. Finally, the issuance of ordinary shares is chosen as the last resort (Donaldson, 1961; Myers, Majluf; 1984, Myers, 1984). The expected negative profitability-leverage relationship results from the fact that profitable firms accumulate retained earnings, thus becoming less leveraged as higher profitability provides more internal financing (Gonzalez, Gonzalez, 2012).

Although profitability is one of the most commonly tested factors influencing financing decisions, the empirical research in the area provides mixed evidence on the direction of its impact on leverage. There are theoretical and empirical arguments in favour of both positive and negative influence. A positive relationship between profitability and debt is explained by the idea that financial market is reluctant to offer funds to underperforming companies. Moreover, high leverage means a significant interest burden for companies with low rates of return for owners, which in turn decreases the valuation of the firm's equity and reduces the possibility of its issuance (Kumar, 2007; Prasad, Green, Murinde, 2001). A positive profitability-leverage relation was empirically found e.g. by Hallet and Taffler (1982), Barton

and Gordon (1988), Friend and Hasbrouck (1988), Chowdhury and Miles (1989), Chiarella *et al*. (1992), Jensen *et al*. (1992), Downs (1993), Chowdhury *et al*. (1994) (relationship significant only for the profitability ratio of net profit to sales), Hussain (1995), Cornelli *et al*. (1996), Boyle and Eckhold (1997), and more recently by Nunkooa and Boateng (2010), Chou and Lee (2010), Gill *et al*. (2011), Xu (2012) and Oppong-Boakye *et al*. (2013).

However, the opposite, *i.e.* the negative relation between profitability and debt has also been repeatedly evidenced *e.g.* by Donaldson (1961), Myers (1984), Myers and Majluf (1984), Kester (1986), Titman and Wessels (1988) (statistically insignificant relationship), Friend and Lang (1988), Allen and Mizuno (1989), Chowdhury and Miles (1989) (relationship significant only for the historical rates of return), Harris and Raviv (1991), Thies and Klock (1992), Van der Wijst and Thurik (1993), Chowdhury *et al*. (1994), Lowe *et al*. (1994), Rajan and Zingales (1995), Jordan *et al*. (1998), Hirota (1999), Hall *et al*. (2000), Fama and French (2002), Hall *et al*. (2004), Brierley and Bunn (2005), Akhtar (2005), and latterly by González and González (2012), Shah and Jam-e-Kausar (2012), Shubita and Alsawalhah (2012) or Charalambakis and Psychoyios (2012). The authors usually explain the negative correlation by arguing that firms which generate high profits can borrow less, since internal financing is preferred.

The apparent contradictions, recently summarised by Barowicz (2014), between the hitherto results concerning the relationship between profitability and debt – dependent on the sample, the selection of variables or analytical period, indicate the purposefulness of further research in this area, enriched with the introduction of additional constraints in the form of industry or firm size, which, by the way, themselves are recognized as leverage determinants.

3. Data and Methodology Description

The aim of this study is to find the importance of the industrial classification of a firm and its size for the profitability-leverage relation in Polish private firms. Following this aim, the two hypotheses are formulated accordingly:

H1: The profitability–leverage relation is industry-dependent.

H2: The profitability–leverage relation is size-dependent.

The empirical data is derived from the BACH-ESD database (Bank for the Accounts of Companies Harmonised - European Sectoral references Database) published by the European Commission and containing financial data for non-financial incorporated European companies.

The ratios used in this study are weighted means (they were computed by aggregating the data of the numerator, on the one hand, and the data of the denominator, on the other hand) and they are differentiated by industries, firm sizes and years. The analysis covers the eleven-year period 2005-2015. The data from more recent years were not included due to a significant number of missing items at the time of the analysis. The analysis involves aggregated data for Polish firms from sixteen industries and three size groups of enterprises: small companies (with a turnover of less than 10 million euro), medium-size companies (with a turnover between 10 million euro and 50 million euro) and large companies (with a turnover in excess of 50 million euro).

The taxonomy of economic activity by NACE code (Nomenclature statistique des Activités économiques dans la Communauté Européenne) used in the BACH-ESD database is two-levelled: one-letter level (sections) and two-digit level (divisions). This analysis involves enterprises grouped at the level of sections, i.e. sixteen industries. Several industries were

excluded from the analysis due to very limited data availability. Table 1 shows the industrial range of the research as well as the three-letter symbols assigned to each industry which are applied in the following tables.

Table 1

Industrial Sections by NACE

NACE	Section	Symbol
A	Agriculture, forestry and fishing	AGR
B	Mining and quarrying	MIN
C	Manufacturing	MNF
D	Electricity, gas, steam and air conditioning supply water	ELE
E	Water supply, sewerage, waste management and remediation activities	WAT
F	Construction	CST
G	Wholesale and retail trade, repair of motor vehicles and motorcycles	TRD
H	Transportation and storage	TRS
I	Accommodation and food service activities	HOT
J	Information and communication	INF
L	Real estate activities	RLE
N	Administrative and support service activities	ADM
P	Education	EDU
Q	Human health and social work services	HLT
R	Arts, entertainment and recreation	ART
S	Other service activities	OSA

The variables involved in the research are financial ratios based on book values due to the fact that the firms are non-public companies, for which the market values are unavailable. The capital structure is described by probably the most commonly used capital structure ratio in empirical research (Rajan, Zingales 1995), *i.e.* by the relation of total debt to total assets (D/A). As for the profitability, the commonly used standard measure is the ratio of return on equity (ROE). However, in order to perform a more complex analysis of the examined profitability-leverage relationship, another profitability measure was also employed, namely the return on sales (ROS), which is the relation of gross operating profit to net turnover.

The variables are ratios of means, which indicates that they were calculated with the use of the balance sheet data and (or) profit and loss account data averaged for all companies in a given category of industry, size and year. It may be noticed in the descriptive statistics of variables shown in Table 2 that medium-sized companies have the highest mean value of the debt ratio. Moreover, the average debt level is very similar for small and large companies. The same regularity can be noticed when the median is compared across size groups. As for the first profitability measure (ROS), a positive size-profitability correlation can be identified; the average relation of gross operating profit to sales increases along with the firm size. However, the pattern between corporate performance measured by ROE and capital structure is less evident. Although small companies are clearly the least profitable, these are the medium-sized firms which perform best, although only slightly better than the large ones.

Table 2

Descriptive Statistics for Total Population, by Size Groups and by Industries

Variable	Size group, industry	N	Mean value	Median	Minimum value	Maximum Value	Standard deviation
D/A	ALL	499	0.494	0.503	0.079	0.973	0.143
	S	176	0.482	0.498	0.225	0.806	0.104
	M	173	0.516	0.530	0.183	0.950	0.146
	L	150	0.484	0.490	0.079	0.973	0.175
	AGR	33	0.313	0.362	0.142	0.463	0.101
	MIN	33	0.467	0.444	0.329	0.683	0.081
	MNF	33	0.504	0.502	0.443	0.563	0.028
	ELE	33	0.364	0.366	0.273	0.500	0.061
	WAT	33	0.038	0.033	-0.002	0.146	0.024
	CST	33	0.624	0.599	0.514	0.801	0.076
	TRD	33	0.579	0.588	0.527	0.626	0.032
	TRS	33	0.562	0.564	0.477	0.672	0.046
	HOT	33	0.472	0.511	0.271	0.673	0.114
	INF	33	0.496	0.492	0.428	0.562	0.033
	RLE	31	0.255	0.260	0.079	0.379	0.068
	ADM	33	0.654	0.707	0.423	0.797	0.111
	EDU	20	0.549	0.527	0.443	0.748	0.095
	HLT	26	0.574	0.564	0.436	0.973	0.118
	ART	32	0.568	0.598	0.328	0.806	0.163
	OSA	27	0.559	0.584	0.261	0.950	0.158
ROS	ALL	502	0.130	0.123	-0.053	0.364	0.062
	S	176	0.119	0.115	-0.046	0.254	0.047
	M	174	0.129	0.125	0.025	0.263	0.050
	L	152	0.143	0.132	-0.053	0.364	0.084
	AGR	33	0.157	0.171	-0.053	0.242	0.062
	MIN	33	0.191	0.191	0.037	0.340	0.068
	MNF	33	0.097	0.100	0.074	0.111	0.010
	ELE	33	0.142	0.147	0.101	0.174	0.016
	WAT	33	0.195	0.182	0.142	0.321	0.035
	CST	33	0.084	0.084	0.020	0.130	0.025
	TRD	33	0.048	0.049	0.032	0.067	0.010
	TRS	33	0.110	0.109	0.074	0.168	0.024
	HOT	33	0.167	0.164	0.122	0.263	0.031
	INF	33	0.188	0.143	0.103	0.364	0.083
	RLE	31	0.150	0.132	0.078	0.339	0.059
	ADM	33	0.132	0.122	0.062	0.237	0.040
	EDU	20	0.130	0.123	0.057	0.208	0.042
	HLT	28	0.109	0.109	0.084	0.141	0.014
	ART	33	0.048	0.051	-0.046	0.096	0.027
	OSA	27	0.128	0.125	0.010	0.219	0.049
ROE	ALL	502	0.099	0.091	-0.414	1.318	0.119
	S	176	0.074	0.088	-0.414	0.272	0.101
	M	173	0.116	0.101	-0.305	1.318	0.145

Variable	Size group, industry	N	Mean value	Median	Minimum value	Maximum Value	Standard deviation
	L	150	0.108	0.090	-0.255	0.536	0.101
	AGR	33	0.098	0.110	-0.054	0.200	0.058
	MIN	33	0.085	0.096	-0.255	0.356	0.143
	MNF	33	0.118	0.114	0.067	0.170	0.024
	ELE	33	0.043	0.044	-0.011	0.099	0.029
	WAT	33	0.038	0.033	-0.002	0.146	0.024
	CST	33	0.133	0.124	-0.101	0.265	0.080
	TRD	33	0.143	0.136	0.074	0.237	0.040
	TRS	33	0.075	0.083	-0.003	0.156	0.042
	HOT	33	0.060	0.070	-0.095	0.125	0.044
	INF	33	0.121	0.120	0.063	0.195	0.032
	RLE	31	0.026	0.022	-0.002	0.081	0.017
	ADM	33	0.108	0.099	0.041	0.203	0.035
	EDU	20	0.189	0.216	-0.054	0.380	0.120
	HLT	26	0.106	0.088	-0.047	0.536	0.105
	ART	32	0.084	0.103	-0.414	0.544	0.281
	OSA	27	0.204	0.106	-0.091	1.318	0.260

Note: N is the number of industry-year or (and) size-year items representing aggregated observations for groups of companies in each category (it does not represent the number of companies).

As for the industrial cross-section, it is clear that firms from the administration section follow the most aggressive financing strategies with the highest mean level of debt. At the same time, the administration section demonstrates one of the highest intra-industry variation. The sections of construction and trade are also characterised with the relatively high share of debt in the capital structure, whereas companies from the water supply section tend to follow more conservative financing strategies. At the same time companies from the industries of water supply and mining appear as the most profitable when the ROS is considered. The other proxy for profitability (ROE) is distinctly better for service activities and education. On the contrary, the trade section appears as the least profitable when ROS is considered, while the real estate section proves as the weakest performing industry when ROE is taken into account.

In order to examine how the profitability impact on the capital structure depends on the industrial section, on the one hand, and on the other hand on the company size, we estimated a regression explaining the D/A measure. The main explanatory variable in the model was the measure reflecting the profitability of the firms. We used two measures: gross operating profit / net turnover (ROS) in the first regression and Profit or loss of the year / Capital and reserves (ROE) in the second regression. In addition to this main covariate, dummy variables representing various industries and dummies for the three size classes were included in the regressions. The dummies reflected fixed individual effects specific for industries and fixed effects of firm size. As described above, and shown for example by Ciołek and Koralun-Bereźnicka (2014), the type of industry, as well as the firm size, could influence the leverage. To reflect this, the fixed effects were included separately in the regression model. Mathematically it means different values of the regression intercept for each industry and for each size group. Coefficients of these effects could be interpreted as

the specific industry or size impact on the leverage. Obviously, because of perfect collinearity, one of the effects had to be omitted, so the effects were interpreted in relation to the omitted industry or size.

The principle aim of our research was to find the importance of industry and size for the profitability-leverage relation. Therefore, apart from different intercept terms of the regression, different coefficients of profitability impact were estimated. The regression model was expanded by introducing interactions between the profitability and the industry dummies and between the profitability and size dummies. As a result, the following general regression model was estimated:

$$\begin{aligned} D/A_{its} = {} & \beta_0 + \beta_1 prof_{its} + \gamma_1 D_1 + ... + \gamma_{16} D_{16} + \alpha_1 D_S + \alpha_2 D_M + \alpha_3 D_L + \\ & + \delta_1 prof_{its} D_1 + ... + \delta_{16} prof_{its} D_{16} + \rho_1 prof_{its} D_s + \rho_2 prof_{its} D_M + \rho_3 prof_{its} D_L + \xi_{its} \\ & i = 1,...,16;\ t = 1,...,11;\ s = 1,2,3 \end{aligned} \quad (1)$$

where: $prof_{its}$ denotes one of the two profitability measures (ROS or ROE) for *i* sector of firm size *s* in year *t*, D_1-D_{16} are dummies representing sectors, D_S, D_M, D_L – dummies for small, medium and large firms, β, γ, α, δ, ρ are coefficients, and finally $\xi_{i,t,s}$ denotes error term of the regression. It means that, for example, the impact of profitability on the leverage in section 12 (ADM) in large firms would be equal to: $(\beta_1 + \delta_{12} + \rho_L)$. The value of coefficients for every industry and size could be defined analogously. The statistical significance of such sum of parameters was tested using the adequate Wald statistic. The regressions were evaluated for all 16 sectors and 3 size classes in the total available period. The regression model (1) could be estimated as an FE (fixed effect) or RE (random effect) panel data model. We used a Hausman test to indicate the appropriate specification. In every case, the null hypothesis in Hausman test was rejected, which means that the GLS estimator for RE model is inconsistent in this case. Therefore each regression model type (1) was estimated by OLS with standard errors robust for heteroscedasticity and autocorrelation of error terms.

As was explained above, the sums of appropriate parameters could show the profitability-leverage relation in different industries and for different firm sizes. However, the main question is whether profitability impact depends more on the industry or on the size of a firm. To answer this question, we applied a test for joint significance of groups of parameters. First, we tested if all interaction parameters for sectors $(\delta_1,...,\delta_{16})$ were statistically different from zero, which means that the industrial specificity significantly influences profitability-leverage relation. Secondly, we verified if the interaction parameters for size (ρ_1, ρ_2, ρ_3) were statistically different from zero, i.e. whether the firm size significantly influences the profitability-leverage relation. In the case where one group of interactions was statistically significant and the other insignificant, the results would mean that one variable influences the profitability-leverage relation, while the other does not. If both groups of interactions were significant, the conclusion would not be so obvious. Therefore, we estimated two additional regressions with only one group of interactions in each case and then compared the values of Akaike's criterion (AIC) to decide which group of parameters (interactions) better explains the capital structure variability of the analysed firms – the lower value of AIC indicates the higher power of explaining.

4. Results and Discussion

First, the model described by equation (1) was estimated with the use of ROS as the explanatory variable describing profitability. The results are shown in Table 3.

Table 3

Estimation Results of Regression for Total Debt / Assets Ratio (D/A) Depending on ROS

	(1)		(2)		(3)		(4)	
Dependent variable	D/A							
Method	OLS FE		OLS FE		OLS FE		OLS FE	
Interactions:	no		size		Sector		sector & size	
Variables								
Constant	0.296***	(0.070)	0.315***	(0.040)	0.157***	(0.043)	0.207***	(0.055)
ROS	0.013	(0.208)	-0.068	(0.206)	0.943***	(0.236)	0.654**	(0.306)
Section_MIN	0.154***	(0.057)	0.145***	(0.022)	0.320***	(0.063)	0.318***	(0.067)
Section_MNF	0.192***	(0.062)	0.181***	(0.023)	0.467***	(0.068)	0.508***	(0.075)
Section_ELE	0.051	(0.063)	0.045**	(0.022)	0.232**	(0.102)	0.204*	(0.104)
Section_WAT	0.095	(0.062)	0.093***	(0.024)	0.195	(0.119)	0.240**	(0.118)
Section_CST	0.312***	(0.067)	0.300***	(0.026)	0.623***	(0.057)	0.625***	(0.066)
Section_TRD	0.267***	(0.067)	0.251***	(0.027)	0.562***	(0.044)	0.622***	(0.064)
Section_TRS	0.250***	(0.061)	0.238***	(0.023)	0.255***	(0.062)	0.216***	(0.070)
Section_HOT	0.159*	(0.080)	0.154***	(0.027)	0.516***	(0.135)	0.490***	(0.150)
Section_INF	0.183***	(0.055)	0.170***	(0.020)	0.287***	(0.050)	0.303***	(0.057)
Section_RLE	-0.058	(0.058)	-0.071***	(0.024)	0.044	(0.055)	0.043	(0.061)
Section_ADM	0.342***	(0.079)	0.334***	(0.027)	0.301***	(0.071)	0.277***	(0.079)
Section_EDU	0.235***	(0.065)	0.228***	(0.027)	0.339***	(0.071)	0.290***	(0.077)
Section_HLT	0.261***	(0.076)	0.249***	(0.031)	0.292*	(0.160)	0.239	(0.165)
Section_ART	0.257**	(0.104)	0.241***	(0.039)	0.467***	(0.057)	0.426***	(0.064)
Section_OSA	0.246***	(0.063)	0.242***	(0.036)	0.660***	(0.068)	0.650***	(0.069)
MIN*ROS					-1.037***	(0.336)	-1.115***	(0.366)
MNF*ROS					-2.265***	(0.651)	-2.850***	(0.721)
ELE*ROS					-1.178*	(0.705)	-1.059	(0.712)
WAT*ROS					-0.695	(0.577)	-0.997	(0.597)
CST*ROS					-2.913***	(0.488)	-3.113***	(0.556)
TRD*ROS					-4.035***	(0.641)	-5.703***	(1.117)
TRS* ROS					0.354	(0.488)	0.524	(0.518)
HOT*ROS					-2.201**	(0.853)	-2.119**	(0.949)
INF*ROS					-0.713**	(0.288)	-0.935***	(0.344)
RLE*ROS					-0.646***	(0.352)	-0.790**	(0.391)
ADM*ROS					0.485	(0.461)	0.538	(0.496)
EDU*ROS					-0.650	(0.466)	-0.380	(0.496)
HLT*ROS					0.076	(1.504)	0.392	(1.527)
ART*ROS					-2.265***	(0.827)	-1.884**	(0.859)
OSA*ROS					-3.060***	(0.511)	-3.040***	(0.508)
Size_M	0.034*	(0.019)	0.068**	(0.029)	0.034***	(0.009)	0.032	(0.029)
Size_L	0.008	(0.032)	-0.015	(0.029)	-0.010	(0.016)	-0.077**	(0.036)
M*ROS			-0.254	(0.220)			0.029	(0.214)

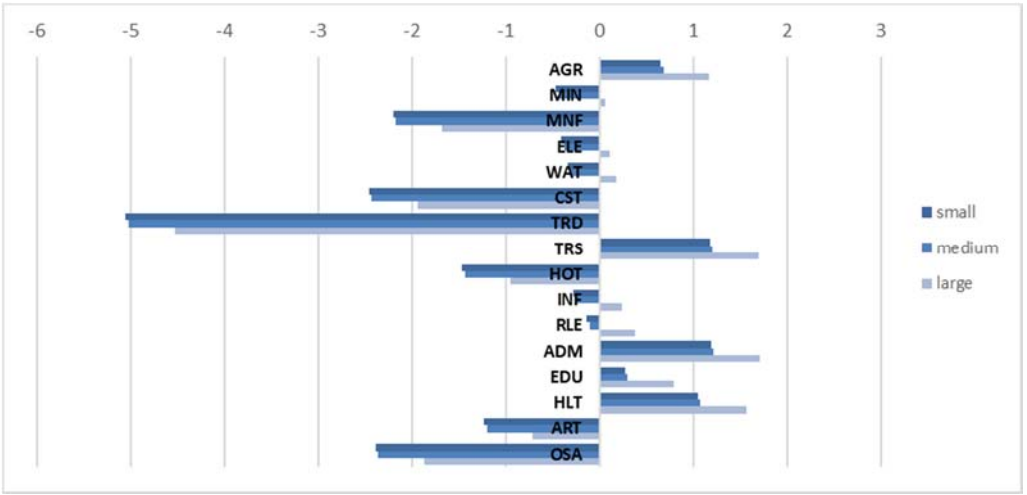
	(1)	(2)	(3)	(4)
L*ROS		0.177 (0.204)		0.520** (0.243)
Observations	499	499	499	499
R-squared	0.599	0.604	0.670	0.676
Heterosc	6.110 [0.014]	4.900 [0.027]	1.250 [0.264]	0.650 [0.420]
Normality	33.92 [0.000]	13.67 [0.001]	32.23 [0.000]	32.42 [0.000]
AIC	-942.2	-944.1	-1009.1	-1014.3
Joint test for sector interactions		-	7.37 [0.000]	6.30 [0.000]
Joint test for size interactions		2.86 [0.058]	-	3.17 [0.043]

Notes: 1) Robust standard errors in parentheses.
*2) *** p<0.01, ** p<0.05, * p<0.1.*
3) Test for heteroscedasticity: Breusch-Pagan / Cook-Weisberg test.
4) Test for normality of residuals: Doornik-Hansen test.
5) Interpretation of parameters in relation to agriculture section and small firms.

To verify OLS assumptions the tests for normality of residuals and for heteroscedasticity were applied. As shown in Table 3 the assumptions were not satisfied in most model's specifications, which means the estimation results were inefficient, so we used robust standard errors for parameters.Taking the significance level of 5% we could notice that the joint test for interactions indicates the significance of the industry–profitability interactions. However, no significance or very slight significance of the size-profitability interactions was found. In other words, the influence of profitability, measured by ROS, on leverage does depend on the industrial classification of a firm, but not necessarily on its size. The same may be visualized in Figure 1, which illustrates the impact of ROS on capital structure across industries and size groups. If the profitability-leverage relation is positive (negative) in a given industry, it usually remains positive (negative) regardless of the firm size. The only exceptions from this rule are the sections of the real estate activities, information and communication, water supply, electricity and mining, where the considered relation is negative for small and medium-sized firms, but positive for large ones.

Figure 1

The Impact of ROS on Leverage across Industries and Size Classes



The application of the AIC criterion (the AIC value is smaller for the model with industry interactions than for the model with size interactions) indicates that the introduction of size interactions into the model brings less explanation of the leverage than the introduction of industry interactions.

In the second case, the regression was carried out for one of the most commonly applied performance measures, *i.e.* ROE as the main explanatory variable. The estimation results are presented in Table 4. Similarly to the previous estimations (Table 3), the results indicate that the industrial classification of firms is an important determinant of the profitability impact on corporate capital structure. In this case, however, as evidenced by the joint tests for interactions, both industry and size interactions proved significant at p<5%.

Table 4

Estimation Results of Regression for Total Debt / Assets Ratio (D/A) Depending on ROE

	(1)		(2)		(3)		(4)	
Dependent variable	D/A							
Method	OLS FE		OLS FE		OLS FE		OLS FE	
Interactions:	no		Size		sector		sector & size	
Variables								
Constant	0.304***	(0.062)	0.338***	(0.022)	0.169***	(0.028)	0.168***	(0.032)
ROE	-0.081	(0.176)	-0.477**	(0.086)	1.211***	(0.233)	1.180***	(0.269)
Section_MIN	0.153**	(0.062)	0.151***	(0.026)	0.287***	(0.031)	0.295***	(0.033)
Section_MNF	0.193***	(0.060)	0.194***	(0.021)	0.304***	(0.042)	0.307***	(0.044)
Section_ELE	0.047	(0.066)	0.038*	(0.022)	0.227***	(0.035)	0.230***	(0.038)
Section_WAT	0.091	(0.067)	0.083***	(0.025)	0.161***	(0.037)	0.163***	(0.039)
Section_CST	0.314***	(0.063)	0.316***	(0.023)	0.466***	(0.038)	0.470***	(0.038)
Section_TRD	0.270***	(0.060)	0.273***	(0.021)	0.399***	(0.029)	0.405***	(0.032)
Section_TRS	0.248***	(0.061)	0.244***	(0.021)	0.398***	(0.030)	0.398***	(0.031)
Section_HOT	0.156*	(0.083)	0.150***	(0.028)	0.330***	(0.035)	0.339***	(0.037)
Section_INF	0.185***	(0.059)	0.184***	(0.021)	0.313***	(0.038)	0.320***	(0.039)
Section_RLE	-0.064	(0.063)	-0.071***	(0.024)	0.103***	(0.038)	0.111***	(0.040)
Section_ADM	0.342***	(0.067)	0.339***	(0.027)	0.324***	(0.058)	0.328***	(0.059)
Section_EDU	0.243***	(0.067)	0.255***	(0.026)	0.333***	(0.042)	0.347***	(0.045)
Section_HLT	0.261***	(0.075)	0.267***	(0.027)	0.339***	(0.047)	0.342***	(0.047)
Section_ART	0.255***	(0.094)	0.207***	(0.040)	0.418***	(0.030)	0.418***	(0.040)
Section_OSA	0.254***	(0.068)	0.238***	(0.036)	0.294***	(0.046)	0.309***	(0.050)
MIN*ROE					-1.369***	(0.278)	-1.401***	(0.269)
MNF*ROE					-1.160***	(0.368)	-1.163***	(0.385)
ELE*ROE					-2.533***	(0.458)	-2.532***	(0.477)
WAT*ROE					0.207	(0.637)	0.245	(0.665)
CST*ROE					-1.486***	(0.279)	-1.515***	(0.286)
TRD*ROE					-1.310***	(0.238)	-1.348***	(0.260)
TRS* ROE					-1.606***	(0.280)	-1.590***	(0.291)
HOT*ROE					-2.088***	(0.466)	-2.176***	(0.478)
INF*ROE					-1.299***	(0.317)	-1.351***	(0.332)
RLE*ROE					-2.827**	(1.116)	-2.960***	(1.124)
ADM*ROE					0.057	(0.454)	0.043	(0.461)
EDU*ROE					-1.061***	(0.270)	-1.144***	(0.293)

	(1)		(2)		(3)		(4)	
HLT*ROE					-0.800*	(0.438)	-0.779*	(0.443)
ART*ROE					-1.723***	(0.248)	-1.746***	(0.262)
OSA*ROE					-0.850***	(0.244)	-0.963***	(0.278)
Size_M	0.039*	(0.020)	-0.010	(0.019)	0.042***	(0.008)	0.027**	(0.013)
Size_L	0.012	(0.028)	-0.019	(0.022)	0.033***	(0.011)	0.036*	(0.019)
M*ROE			0.560***	(0.151)			0.157	(0.107)
L*ROE			0.431**	(0.219)			0.001	(0.146)
Observations	499		499		499		499	
R-squared	0.603		0.632		0.726		0.728	
Heterosc	2.40	[0.123]	0.58	[0.445]	2.05	[0.152]	0.70	[0.404]
Normality	75.211	[0.000]	17.79	[0.000]	7.98	[0.019]	6.71	[0.035]
AIC	-946.8		-981.0		-1101.2		-1102.4	
Joint test for sector interactions			-		18.87	[0.000]	10.93	[0.000]
Joint test for size interactions			19.05	[0.000]	-		2.38	[0.096]

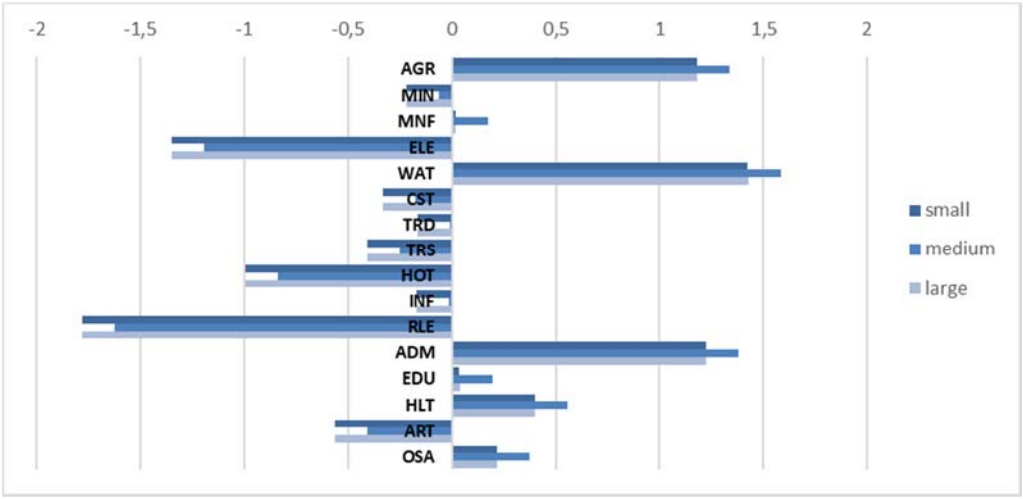
Notes: The same as for Table 3.

Nevertheless, according to the AIC criterion, the model which best describes the variability of financial leverage is the one with both types of interactions, *i.e.* industry and size interactions. The model with only industry interactions taken into account explains capital structure variability considerably better than the model where only size interactions were included. Therefore, in a way, it remains consistent with the regression results from Table 3, suggesting that the firm size is relatively less important than the industry in terms of profitability-leverage relation.

The significance of the firm size in the regressions run for ROE can also be noticed in figure 2, displaying that the sign of the considered profitability-leverage relation depends heavily on the industrial section and does not vary according to firm size. If the profitability-leverage relation is positive (negative) in a given industry, in all cases it remains positive (negative) regardless of the firm size.

Figure 2

The Impact of ROE on Leverage across Industries and Size Classes



5. Conclusions

We employed a panel dataset to study the impact of the firm size and its industrial classification on the relation between profitability and capital structure of private firms in Poland. Our results indicate that the way profitability impacts financial leverage is significantly affected by the industry, where a firm operates. This significance was observed for both profitability measures employed in the regressions, which indicates that the hypothesis H1 is supported. As for the firm size, its influence on the profitability-debt level relation proved insignificant in the case where the ratio of return on equity was employed as a performance measure. However, the size-wise variability of the examined relation was noticeable in the case where another profitability measure was used – the return on sales. Therefore, we found no grounds to reject the hypothesis H2 for the ROS profitability measure, but the hypothesis is rejected when the ROE is employed. However, regardless which of the two ratios is employed as a proxy for profitability, the industrial features matter more than the firm size specificity in terms of their influence on the profit-leverage relation. These conclusions are in line with those obtained by Degryse *et al.* (2012) for Dutch companies, or more recently by Stancic *et al.* (2017) for Serbian economy. They also resemble the findings obtained at the aggregate level for a number of EU countries, which report industrial features to be generally more important than size-related characteristics in terms of capital structure (Koralun-Bereźnicka 2016).

Due to the fact that the profitability–capital structure relation varies along with the industrial classification of firms, both in terms of its significance and sign, our results do not provide support for one capital structure theory. In general, firms operating in such sections as agriculture, administration, education and healthcare are mostly in line with the trade-off theory of capital structure. In these cases the profit-debt relation remains positive regardless of the employed profitability measure. However, firms classified in the sections of mining, electricity, construction, trade, accommodation or arts seem to follow the pecking order theory predictions on the negative relation between profitability and leverage. In the remaining sections (*i.e.* manufacturing, water supply, transport and storage, information and communication, real estate or other service activities), the impact of profitability on debt depends on the profitability measure and (or) on the firm size.

Generally, this research provides support for the importance of the industry effect in the relation between corporate profitability and capital structure. It also indicates the potential occurrence of the size effect in this relationship, although it appears as less significant. On the one hand, our results confirm that profitability is an important determinant of corporate financing choices. On the other hand, however, our findings provide evidence that the relation between the commonly accepted direct determinants of debt and capital structure may vary depending on other, indirect factors, such as industry or firm size. An important implication of these findings is the recognition of secondary factors of capital structure, which may affect the relation between direct factors and debt level. Although the debt to assets ratio is one of the most commonly applied capital structure measures, it seems that extending the range of capital structure characteristics to several other ratios measuring other forms of debt, such as short-term and long-term liabilities, would be useful. Similarly, employing other profitability measures would provide wider evidence for the above findings. This investigation is left for future research.

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