EXAMINING CAPITAL STRUCTURE OF CZECH FIRMS

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Abstract

In this paper we explore two relevant theories of company capital structure – pecking order theory and trade-off theory on a sample of Czech firms. In trade of theory; companies identify their optimal capital structure and weigh up the advantages and disadvantages of an additional monetary unit of debt. To test both theories panel data methodology is used over a sample of 94 Czech companies during the years 2005–2010 with the use of annual data. Because we use lagged dependent variable amongst independent variables to test pecking order theory and trade-off theory we employ Arellano and Bond (1991) GMM and Anderson and Hsiao (1982) 2SLS models. We explore the influence on total debt ratio as a dependent variable in two formats and independent/explanatory variables, which correspond to specific company characteristics depending on previous literature. Our results suggest that both theoretical approaches contribute to explain capital structure in Czech firms.

Key words: Capital structure, trade off theory, pecking order theory, big companies, transitional economy, Dynamic Panel Data Models

JEL Code: C33, C34, G32, G33.

Introduction

The finance literature has traditionally offered two theories of capital structure. In the trade-off theory firms pick optimal leverage by weighing the benefits and costs of an additional dollar of debt. In the pecking order theory of Myers, Majluf (1984), the costs of issuing new securities dominate other considerations. In pecking order theory, changes in the level of debt are usually not motivated by the need to reach a given debt target, but are instead motivated by the need for external financing.

This paper builds upon recent views on capital structure as summarised by Gaud et al. (2005), Harris and Chaplinsky (2008) and Frydenberg (2011) and recent papers providing empirical evidence. We test the actual situation on the sample of 94 big Czech companies. The study is also linked with the previous research on capital structure of Czech companies, which has been recently performed on a sample of Czech SMEs (Jindrichovska et al, 2013).

1 Previous literature

In this section of the paper we review some of the recent empirical studies in relation to capital structure in different industries.

Existing empirical evidence is based mainly on data from developed countries (G7 countries). Recent paper from Visegrad countries by Bauer (2004) provides empirical evidence about the capital structure of listed firms from that region. The author analyses potential determinants of leverage and furthermore, analyses the differences in capital structure of listed firms across Visegrad countries i.e., the Czech Republic, Hungary, Poland, and the Slovak Republic using the data form 2000–2001. The author uses two conditional theories that theories that either predicts the existence of the optimal debt-equity ratio for each firm (static trade-off models) or they declare that there is no well-defined target capital structure (pecking-order model). Different results he obtained when leverage is expressed in market value in comparison to book value. Because of relatively low P/B ratio, leverage in Visegrad countries is higher than in non-continental-European G7 countries. For this reason firms in Visegrad countries show relatively low leverage measured in book value, but relatively high leverage assessed in market value. Furthermore the author shows that according to the results of empirical analysis, leverage of listed firms in Visegrad countries is positively related to firm´s size. This result supports the view of size as an inverse proxy for the probability of bankruptcy. Leverage is negatively correlated with profitability, this finding is consistent with the pecking-order hypothesis rather than with static trade-off model.

Another study from the Czech market by Jindrichovska and Koerner (2008) investigated the empirical evidence on determinants of financing decisions on the pool of respondents among financial managers of Czech firms. The theoretical section provides an overview of prominent contemporary theories on capital structure. Employing Chi-square Sign Test and Logit regression the empirical analysis provides the evidence how the financial managers perceive particular instruments of internal and external financing. The authors find, that firms follow pecking order theory for working capital financing, however the arguments for pecking order theory in investment financing are not that strong. Firms prefer retained earnings among internal financing instruments and bank loans and leasing among external financing instruments.

Ovtchinnikov (2008) has investigated the issues related to capital structure decision especially evidence from deregulated industries in the USA. He also concentrated on industrial structure. The sample consists of all nonfinancial firm-year observations for the

period January 1966 – December 2006. Industrial composition includes entertainment, petroleum and natural gas, utilities, telecommunications, and transportation. The author finds that deregulation significantly affects the firms' operating environment and leverage decisions. Firms experience a significant decline in profitability, asset tangibility and a significant increase in growth opportunities following deregulation. Firms respond by reducing leverage. Leverage is then much less negatively correlated with profitability and market-to-book and much more positively correlated with firm size. There is a significant impact on the firms' operating environment, which affects firms' financing decisions. Leverage declines considerably following deregulation, and this coincides with a decline in profitability, asset tangibility, and an improvement of growth opportunities. Overall, the results indicate that 1. Capital structure is not static but evolves in response to changes in the operating environment, such as deregulation; 2. Profitability, growth opportunities, and expected bankruptcy costs as measured by firm size and asset tangibility are important factors driving capital structure decisions in a manner consistent with the trade-off theory of capital structure; 3. Firms behave consistent with weighing the benefits of leverage adjustment to optimal leverage against the adjustment cost.

Survey of Lemmon, Roberts, Zender (2007) investigated several issues of capital structure and also presents some new challenges to understanding how firms choose their financing. They show that leverage ratios exhibit two prominent features that are unexplained by previously identified determinants (e.g., size, profitability, market-to-book, industry, etc.) or changes in sample composition (e.g., firm exit). They find that corporate capital structures are stable over long periods of time. It means firms that have high (low) leverage tend to remain as such for over 20 years. This feature of the leverage data generating process is present after controlling for firm entry and exit, as well as after controlling for previously identified determinants of capital structure. Thus, their findings show that the majority of variation in capital structure is time-invariant and that much of this variation is unaccounted for by existing empirical specifications.

Jindrichovska, Ugurlu and Kubičkova (2013) performed a research on capital structure on a sample of 260 Small and Medium Companies in the Czech Republic using panel data methodology with annual data during the years 2004-2011. The study has shown, that both the trade-of theory and pecking order theory hold in the Czech Republic, but the results must be interpreted with caution, due to the a lower level of significance of the model. The study shows that the high level indebtedness of Czech companies should be open for further investigation.

2. Methodology and data

We were searching for empirical validity of both the trade-off theory and subsequently for a validity of pecking order theory.

If the models has lagged dependent variable in independent variables these models are called dynamic models. Because of we use lagged debt variable in independent variables based on the trade-off model we apply dynamic panel data models to our data.

The dynamic model with one lagged dependent variables are defined as follows:

$$y_{it} = \gamma y_{i,t-1} + \beta' x_{it} + \alpha_i^* + \lambda_t + u_{it}, \qquad \begin{matrix} i=1,\ldots,N \\ t=1,\ldots,T \end{matrix} \qquad (1)$$

where $u_{it} \sim iid(0, \sigma_u^2)$.

The dependent variable yi,t-1 is correlated with the error term. This result causes the OLS estimator biased and inconsistent even if the error term u_{it} is not serially correlated. To overcome the problem Arellano and Bond (1991) developed GMM estimation and Anderson and Hsiao (1982) developed Instrumental Variable Model.

In the trade-off model framework, companies identify their optimal capital structure and weigh up the advantages and disadvantages of an additional monetary unit of debt.

$$D_{it} = \alpha + \beta_1 D_{it-1} + \beta_2 DR_{it} + \beta_3 GO_{it} + \beta_4 AS_{it} + \beta_5 ROA_{it} + \beta_6 Size_{it} + \beta_7 LIQ_{it} + \varepsilon_{it} \qquad (2)$$

The pecking order theory establishes that the level of debt should be adjusted to the financing needs of the company, taking as exogenous all the variables that form the earlier financing deficit. Gracia and Mira (2008) define the second model to test pecking order theory which is below:

$$D_{it} = \alpha + \beta_1 CF_{it} + \beta_2 Age_{it} + \beta_3 GO_{it} + \varepsilon_{it} \qquad (3)$$

where; D is total debt (consist of two formulation $\frac{\text{Total Debt}}{\text{Equities}}$ and $\frac{\text{Total Debt}}{\text{Total Debt+Equities}}$ thus they are named DA and DB respectively), DR is a default risk ($\frac{\text{Interests Paid}}{\text{EBIT}}$), GO is a growth opportunities($\frac{\text{Long term untagibles}}{\text{Total Asset}}$), AS is an asset structure ($\frac{\text{LT Tangibles+Inventories}}{\text{Total Asset}}$) Size is a natural logarithm of total assets, ROA is a profitability ($\frac{\text{EBIT}}{\text{Total Asset}}$), Age is natural logarithm of number of years and CF is cash flow.

In the trade-off model framework, companies identify their optimal capital structure and weigh up the advantages and disadvantages of an additional monetary unit of debt.

The original sample of Czech data in this study of big firms consisted of 222 firms.[1] We have subsequently deleted the firms with missing years and those showing extremes (outliers in dependent variable) and inconsistent figures in local currency. After cleaning the sample for outliers and omissions we have obtained annual data of 94 Czech firms for the period of five years from 2005 to 2010. Data was obtained from database Albertina[2]. The split according to industries is in table 1.

Tab. 1: Structure of firms according to industry

Ab.	Industry group	Number	%
P	Production	52	55.32
S	Services	15	15.96
T	Trade	23	24.47
D	Transport + telecom.	4	4.26
Total		94	100.00

3. Results

Before econometric model is estimated we test for similarity of sectors based on total debt variables by Kruskal Wallis Test. Kruskal-Wallis test is a nonparametric test used to compare more than two samples. The null hypothesis says that all populations have identical distribution functions. If we reject null hypothesis it means that the population distributions are different in some way, centre, spread and/or shape.

Tab. 2: Kruskal Wallis Test

	DA	DB
Chi-Square	55.709	57.550
df	3	3
Asymp. Sig.	.000	.000

Table 2 shows that the null hypothesis is rejected thus all population disturbances of sectors are different. In other words; mean of the total debt of sectors are different for each sector.

The main reason for using 2SLS or GMM is that we suspect that one or several of the explanatory variables are endogenous. If the instrumental variable estimator is consistent but

[1] According to Czech classificaion a firm can be classified as a Big firm, if it reases turnover of .50 mil. EUR,. and has numner of employees of 250 or total assets more then 43 mil. EUR.

[2] The database includes information from about 2 mil. registered firms in the Czech Republic. The original purpose of the database was to provide information in order to verify of payment discipline the solvency of Czech companies from historical perspective.

inefficient OLS model is valid (URL1). We use three test to control endogeneity which are Durbin (Chi-Square) and Wu-Hausman (F) test for 2LSL and Sargan Test for GMM model.

The test of over-identifying restrictions in dynamic models is commonly tested using Sargan (1958) and Hansen (1982) methods which is known as a Sargan Test. If we reject the null hypothesis that the explanatory variables are uncorrelated with the residual we must use OLS model. The test has an asymptotic χ^2 distribution with degrees of freedom equal to the number of over-identifying restrictions. For 2SLS model; the tests of the endogeneity of the ınstrument variables are Durbin (Score) Test based on Durbin, 1954 and Wu-Hausman test based on Wu, 1954. The tests have χ^2 and F distribution respectively. If we reject the null hypothesis for the 2SLS model and it means that the instrumental variables are endogenous in the model. Under the null hypothesis OLS is an appropriate estimation technique.

Tab. 3: Robustness of the results

Dependent Variable: DA					
	Anderson and Hsiao (1982) 2SLS				
	Full Sample	**Production**	**Service**	**Trade**	**Transport**
Durbin (score) chi2[4]	0.322061 (0.5704)	0.06082 (0.8052)	2.48854 (0.1147)	0.001457 (0.9696)	0.316885 (0.5735)
Wu-Hausman F[4]	0.31322 (0.5762)	0.057684 (0.8105)	2.16591 (0.1496)	0.001288 (0.9715)	0.108493 (0.7584)
	Arellano and Bond (1991) GMM				
Sargan Test	21.526** (0.0105)	18.43098** (0.0305)	21.52984** (0.0105)	28.99095*** (0.0007)	7.698705 0.5648
	Anderson and Hsiao (1982) 2SLS				
	Full Sample	**Production**	**Service**	**Trade**	**Transport**
Durbin (score) chi2[4]	1.63565 (0.2009)	7.80809*** (0.0052)	6.81493*** (0.009)	4.74686** (0.0294)	0.013062 (0.909)
Wu-Hausman F[4]	1.59825 (0.2072)	7.79785*** (0.0059)	6.60343** (0.0143)	4.50653** (0.0378)	0.004359 (0.9505)
	Arellano and Bond (1991) GMM				
Sargan Test	28.749*** (0.0007)	32.80763*** (0.0001)	34.81513*** (0.0001)	18.88048** (0.0262)	7.562922 (0.5787)

Notes: ***, ** and *denote that the coefficient is statistically significant at a 1% , 5% and %10 level, respectively. p values in parenthesis.

Tab. 4: Summary of GMM and 2SLS

Dependent Variable		DA	DB	DB	DB	DB	DB	DB
Sector		Transportation	Production	Service	Trade	Production	Service	Trade
Model		GMM	GMM	GMM	GMM	2SLS	2SLS	2SLS
		Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Independent Variables[1]	D(-1)	-1.28937***	-0.06892	-0.00159	-0.10476	0.018542	-39.7088	-0.0037
	DR	0.022562***	0.001455	-0.16126	-0.41726	-45.8365	9.262796	11.4492
	GO	8.952769***	13.55786	10.60573	-118.755	-3.21528	-4071.78	-0.30276
	AS	0.22249	3.188574	5.320154	36.07806***	-1.40036	567.7702	-0.06381
	Size	0.444033***	0.114216	4.410864***	8.543807***	4.390985	116.9915	11.49355
	ROA	-0.24122	-1.77128	-22.564***	-18.6287	-0.05321	178.3277	0.001993***
	LQ	0.008625*	0.005028	0.002056	0.052569	0.018542	-0.05752	-0.0037
Wald Test		88.79***	6.14	59.13***	78.79***	1.23	1.72	11.47*
R quared[2]						0.0012	0.003	0.2566
1st order[3] autocorrelation		-1.4967	-3.9444***	-1.6499***				
2nd order autocorrelation		.12849	-1.1468	-1.5204				

Notes: ***, ** and *denote that the coefficient is statistically significant at a 1% , 5% and %10 level, respectively. 1 (-1) shows one lagged variable. 2. Overall 3. H_o displays no autocorrelation 4. H_o is variables are exogenous.

Table 3 shows the test results for our models which are mentioned below. For the model which has a DA as a dependent variable, GMM model is valid for transportation sector. For the second model which has a DB as dependent variable except full sample and transportation sector both 2SLS and GMM model is valid. Thus we will estimate GMM and 2SLS models for these equations for the mentioned sectors. Nevertheless, for the rest of the sectors we will estimate OLS model.

Table 4 shows that significant models are transportation sector (0,01 significance level) for DA and service (0,01 significance level) and trade (0,01 significance level) sectors for DB using GMM and trade sector (0,10 significance level) for DB using 2SLS. In the first model except AS all variables are significant DR, GO, Size and LQ has a positive effect on DA also lagged variable of DA has negative effect. In second model in third column Size and ROA are statistically significant and ROA has negative and Size has a positive effect. Nevertheless ROA has positive but very small effect in the last model it is understood that impulse of the variables on total debt is different for different sectors. The trade of theory did not hold on for production and services sector by using GMM and 2SLS.

Tab. 5: Summary of OLS

Dependent Variable		**DA**	**DA**	**DA**	**DA**	**DB**	**DB**
Sector		**Full Sample**	**Production**	**Trade**	**Service**	**Full Sample**	**Transportation**
Model		**OLS**	**OLS**	**OLS**	**OLS**	**OLS**	**OLS**
		Coefficient	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
Independent Variables[1]	**D(-1)**	0.7022***	0.6638***	0.6743***	0.3297***	0.0026	0.2408
	DR	-0.0011	-0.0001	9.57E-05	-0.0069	-0.070	0.0367
	GO	-0.1159	-0.5741*	-0.4992	1.7088	-5.8758	4.5258
	AS	-0.1412***	-0.1405***	-0.0238	-0.4635***	-0.0202	-2.3057**
	Size	-0.0113**	-0.0277***	-0.0015	0.0418***	-0.2388	0.0233
	ROA	-0.4474***	-0.4736***	-0.7851***	-0.725**	-19.064***	-1.2072
	LQ	2.57E-	-0.0070***	-0.0048***	2.12E-	0.0003	0.0156
Constant		0.4353***	0.7314***	0.7314	-0.0025	7.8033	1.5256
F Test		113.86***	0.6672	0.6638	17.27***	0.7328	5.94***
R quared[1]		0.6254	86.48***	-0.00015	0.5641	0.0079	0.7350

Notes: ***, ** and *denote that the coefficient is statistically significant at a 1% , 5% and %10 level, respectively. 1 (-1) shows one lagged variable. 2. Overall.

Although we wanted to test the pecking order theory that is represented in equation (3) we don't have CF variable. Thus, equation (4) is estimated for testing the theory

$$D_{it} = \alpha + \beta_1 Age_{it} + \beta_2 GO_{it} + \varepsilon_{it} \qquad (4)$$

Table 5 shows results of pecking order model. We use Fixed Effect (FE), Random Effect (FE) models. Nevertheless both FE and RE models we have heteroskedasticity problem therefore we use robust standard errors for FE and RE to remove heteroskedasticity. In the table 6 FEM or REM results are given based on Hausman Test where which the null hypothesis is that random effects model valid against the alternative the fixed effects (Green, 2008).

Tab. 6: Summary of FEM and REM Models

Dependent Variable		**DA**				
Sector		**Full Sample**	**Production**	**Service**	**Trade**	**Transportation**
Model		**REM**	**FEM**	**REM**	**REM**	**FEM**
Independets		**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
	Age	-0.03245**	0.112039***	0.020034	0.093168**	-0.08724
	GO	0.805243*	-0.25649	1.445214	0.133776	5.133903***
	Constant	0.622026***	0.254522***	0.491584***	0.42819***	0.484688***
Wald Test		8.42***	-	1.76	5.69*	
F Test		-	10.95***	-	-	12.36***
Hausman Test		2.03	13.03***	0.03	2.58	7.39**
R quared[1]		0,000	0.0179	0.0193	0.0028	0.006
Dependent Variable		**DB**				
Sector		**Full Sample**	**Production**	**Service**	**Trade**	**Transportation**
Model		**REM**	**REM**	**FEM**	**REM**	**FEM**
Independets		**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
	Age	-0.7487**	-0.3448	23.6020	0.204181	-0.26259
	GO	-2.0664	-6.8217	14.1896---	-40.2479	16.43446***
	Constant	4.1025**	2.5783***	-38.8519	3.521042	1.032916***
Wald Test		3.79	1.59		0.59	
F Test		-		1.86		16.06***
Hausman Test		0.99	0.1255	5.36*	0.87	14.62***
R quared[2]		0.0092	0.0193	0.015	0.0004	

Notes: ***, ** and *denote that the coefficient is statistically significant at a 1% , 5% and %10 level, respectively.

In Table 6 the results imply that for the dependent variable DA in Full sample all variables are statistically significant but the explanatory power of the modes is rather low. We have found mixed results for industries. AGE is important in production and Trade, and GO in Transportation. Overall, however, the models are not significant as measured by R^2. Wald test

is significant for the whole sample and for Trade sector. When testing the second dependent variable DB we have found that AGE is again significant at 5 per cent for the whole sample and GO for transportation. For transportation the model is well specified as witnessed by both F Test and Hausman test.

4. Discussion and Conclusion

In this paper we were examining two capital structure models on the sample of 94 Czech firms. In our tests we have used the traditional trade-off model and pecking order model using the specification in previous literature. Our testing has also included the dynamic parameter testing for the speed of adjustment to target debt level. Furthermore we have also tested the industrial differences as the capital structure is co-determined by industrial branch (Lemon et al, 2006 and Ovtchnikov, 2008)

It has been found that variables in traditional model which has a dependent variable is Debt to assets the factors AS, Size, ROA and LQ are significant and sign of the coefficients is same as expected for the full sample. The most significant results are in transportation sector when measured by GMM model. When testing the Trade-off theory for the model which has a DA as a dependent variable, GMM model is valid for transportation sector. For the second model which has a DB as dependent variable except full sample and transportation sector both 2SLS and GMM model is valid. For further testing of the Pecking order theory we have used both fixed effects and random effects to explain the validity of our hypotheses on the whole sample and in individual industries. It has been found that both OLS specifications are valid for the whole sample although with low R^2. The factor of Age is the most important for the full sample and for Production and Trade, whereas the Growth opportunities are the most important for Transport and communication.

To sum up our findings, our results suggest that both theoretical approaches contribute to explain capital structure in Czech firms in a different way and that the impact differentiated across the industries. The most significant factor determining the leverage seems to be the AGE of the firm.

For further research we recommend to test different model specifications to characterize the capital structure and or complement the research with some qualitative characteristics of Czech companies. It would be also interesting to compare or findings with capital structure in other transitional markets similarly as in the study on Visegrad countries

by Bauer, 2004 or to look more closely to some qualitative features that codetermine the capital structure of companies.

Acknowledgments

This contribution is supported by University of Economics and Management.

The authors acknowledge the support of the internal grant of the Prague University of Finance and Administration No 7745 "Preparedness of Czech SMEs for implementation of IFRS", which provided the data for this study.

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