RELATIVE IMPORTANCE OF COUNTRY AND FIRM-SPECIFIC DETERMINANTS OF CAPITAL STRUCTURE: A MULTILEVEL APPROACH

Rumeysa Bilgin*

Abstract

This paper evaluates the relative importance of country and firm-specific determinants of capital structure using a multilevel modelling approach. Annual data for 18,201 public and non-financial firms from 66 countries are analysed for the period 2000–2016. Variance decomposition analysis is employed in order to assess the relative importance of country and firm levels. Additionally, random intercept and random coefficient models are used to analyse direct and indirect effects of capital structure determinants. Our results showed that country and firm levels explain approximately 10% and 60% of the total variability in capital structures, respectively. This shows that managers assign a higher importance to the firm-level factors when making capital structure decisions. Also country-level variables affect leverage choices to a lower extent.

Keywords: determinants of capital structure, multilevel mixed model, panel data
JEL Classification: G30, G32, C33

1. Introduction

Capital structure affects firm values because of market imperfections. Managers should find the optimal financing mix to maximize the firm value. In the empirical literature, the question of "how to find the optimal capital structure mix" has quickly evolved into "how to explain existing capital structure decisions". During the past decades, researchers have tried to answer the second question by investigating firm-specific factors (Frank and Goyal, 2009).

Studies on the country-level determinants have also increased in numbers in recent years (Booth *et al.*, 2001; Giannetti, 2003; Bancel and Mitto, 2004; De Jong *et al.*, 2008; Antoniou *et al.*, 2008; Kayo and Kimura, 2011; Alves and Ferreira, 2011; Fan *et al.*, 2012; Venanzi *et al.*, 2014; Öztekin, 2015; Belkhir *et al.*, 2016). These studies investigate the relationship between the capital structure decisions of firms and financial, institutional and macroeconomic characteristics of countries. A few of them have also searched for a connection between the firm-specific and the country-specific determinants of leverage.[1]

However, the most important level is yet to be decided in the literature. This study is an attempt to answer the question about the relative importance of firm and country-

* Rumeysa Bilgin, Istanbul Sabahattin Zaim University, Turkey (rumeysa.bilgin@izu.edu.tr).

1 Venanzi (2017) provides a complete review of the recent literature on country-specific capital structure determinants.

level determinants of capital structure. A multilevel analysis approach is employed in order to investigate the determinants of capital structure in a global context. In a recent study, Kayo and Kimura (2011) used a similar methodology to investigate capital structure determinants. They provide some evidence on the relative importance of firm-level factors over country-level factors. However, further research is required to confirm their findings.

A panel data set is used in this study. The panel data can be explained as a two-level hierarchical structure. The first level consist of time series observations. Cross-sectional units form the second-level over the first one (Snijders and Bosker, 1999). Higher hierarchical levels can be created by grouping the cross sectional units. In our panel setting, the first-level is time series observations. They are nested in firms, which constitute the second-level. Moreover, firms are nested in countries to form the third-level.

Results show that more than half of the leverage variability comes from the firm-level. The country-level explains only 10% of the total leverage variability. In other words, when making capital structure decisions, managers seem to focus on the intrinsic characteristics of their firms. However, when firm-specific factors are equal, firms from the same country tend to have similar capital structures.

The rest of the paper is organized as follows. Section 2 contains a review of international empirical capital structure literature. The sample and estimation method are explained in Sections 3 and 4. Empirical results are given in Section 5 and lastly, a discussion of the results is given in Section 6.

2. Background

Following the pioneering study of Rajan and Zingales (1995), a literature of the international capital structure determinants has quickly emerged. Large micro panel data sets of firm-level data from multiple countries are frequently used in these studies. Some of them only focus on developed country firms (Antoniou *et al.*, 2008; Bancel and Mitto, 2004; Giannetti, 2003), while others use larger samples containing firms from both developing and developed countries (De Jong *et al.*, 2008; Kayo and Kimura, 2011; Fan *et al.*, 2012; Venanzi *et al.*, 2014). One study uses sample firms only from developing countries (Belkhir *et al.*, 2016).

Research methodology also varies between these studies. Some researchers use aggregate or one-year data to make a cross-sectional analysis (De Jong *et al.*, 2008; Giannetti, 2003) while others prefer a panel data approach and employ methods such as the FE estimation (Booth *et al.*, 2001), the RE estimation (Alves and Ferreira, 2011) or the System GMM (Antoniou *et al.*, 2008; Öztekin, 2015). Moreover, two recent studies use the HLM (Kayo and Kimura, 2011) and the SEM methodologies (Venanzi *et al.*, 2014).

The traditional firm-specific determinants are found to be significant in multi-country studies. Also, country-level variability is observed in leverage ratios. Researchers investigate possible candidates of country-specific determinants. Financial and institutional characteristics and macro-economic variables of countries are investigated as determinants of leverage.

Previous literature indicates that capital structure is affected by the country effect. However, there is no consensus on the country-level factors affecting leverage (Venanzi, 2017).

Moreover, deductions about relative importance of country-specific determinants with respect to firm-specific ones are not conclusive either. Thus, further research is required to clarify this issue.

3. Data Set

The sample data set consists of annual observations on 18,201 public and non-financial firms, including dead ones, from 66 countries. Firm-level data are extracted from the Compustat Global Database. All financial and negative shareholder equity firms are excluded. Our full sample period covers 17 years from 2000 to 2016. Three sub-samples for 2002–2006, 2007–2011 and 2012–2016 sub-periods are also created to segregate the effect of the global financial crisis on capital structure. The first sub-sample covers the pre-crisis years. The second sub-sample consists of the global financial crisis years. The last sub-sample spans the post-crisis years. Another classification is also employed based on the development level of the countries in order to investigate the relationship between economic development and capital structure.

The three-level hierarchical structure is based on the time, firm and country levels. The global company keys in the Compustat database and ISO country codes are used as identifiers for the firm and the country level, respectively.

The dependent variable is chosen as the book leverage in this study. Following Welch (2011), the leverage ratio is measured as the proportion of the total debt to the total assets. The total debt is defined as the book value of short-term and long-term interest-bearing debt. The total assets represent the sum of current liabilities, long-term debt and stockholders' equity. Table 1 presents the descriptive statistics of the dependent variable.

The mean leverage ratios of the countries are within the range from 29% to 64%. The mean (median) leverage ratio of the developing countries is estimated as 44% (45%) while it is calculated as 49% (51%) for the developed countries. The mean (median) leverage ratio of all firms is estimated as 48% (49%), 47% (48%) and 45% (46%) during 2002–2006, 2007–2011 and 2012–2016 time periods, respectively. Firms in the developed countries have higher leverage ratios on average. Also, the average leverage ratio gradually decreases over time.

Following the above capital structure literature, profitability, asset tangibility, firm size, non-debt tax shield and current liquidity are used as the traditional firm-level capital structure determinants (Rajan and Zingales, 1995; Booth *et al.*, 2001; Utrero-González, 2007; De Jong *et al.*, 2008; Antoniou *et al.*, 2008; Alves and Ferreira, 2011; Fan *et al.*, 2012; Venanzi *et al.*, 2014).

Various country-specific variables such as the financial system orientation, the stock market development, the banking sector development, creditors' and shareholders' right protection, inflation rate, corruption index, real interest rate, lending interest rate, stock market turnover, legal origin, religion, geographic region and income group are tested as proxies for the country-level factors. Due to the high level of correlations between some of these variables, only proxies that best explain a factor are included in the model.

Table 1 | Descriptive Statistics of Dependent Variable by Country

Country	Mean	Median	St. Dev.	Min	Max	Skewness	Kurtosis	Firms
Argentina	0.533	0.541	0.201	0.014	0.998	−0.144	2.657	43
Australia	0.342	0.320	0.246	0.001	1.000	0.366	2.118	322
Austria	0.547	0.570	0.209	0.000	0.999	−0.416	2.661	93
Bangladesh	0.451	0.442	0.217	0.018	0.987	0.112	2.448	70
Belgium	0.536	0.554	0.202	0.008	0.997	−0.422	2.891	143
Brazil	0.528	0.543	0.202	0.000	0.998	−0.328	2.925	310
Bulgaria	0.416	0.396	0.250	0.005	0.999	0.308	2.207	65
Chile	0.421	0.435	0.191	0.000	0.968	−0.157	2.705	186
China	0.448	0.452	0.200	0.002	0.999	0.002	2.276	3,181
Colombia	0.369	0.355	0.171	0.026	0.823	0.050	2.179	41
Czech Republic	0.403	0.398	0.210	0.001	0.900	0.085	2.511	32
Denmark	0.506	0.541	0.211	0.000	0.993	−0.451	2.783	127
Egypt	0.439	0.438	0.212	0.005	0.954	0.031	2.169	120
Finland	0.534	0.553	0.160	0.005	0.992	−0.511	3.380	158
France	0.559	0.584	0.193	0.000	0.999	−0.456	2.816	736
Germany	0.548	0.573	0.229	0.000	1.000	−0.263	2.448	893
Greece	0.526	0.549	0.202	0.005	1.000	−0.352	2.631	194
Hong Kong	0.385	0.367	0.207	0.000	0.990	0.251	2.454	169
Hungary	0.415	0.426	0.163	0.026	0.852	−0.130	2.739	39
India	0.468	0.438	0.207	0.000	0.970	0.204	2.209	220
Indonesia	0.479	0.483	0.220	0.000	0.998	−0.020	2.272	365
Ireland	0.410	0.426	0.254	0.005	0.999	0.041	1.924	66
Israel	0.531	0.563	0.239	0.000	1.000	−0.284	2.072	389
Italy	0.600	0.622	0.188	0.000	0.998	−0.547	3.088	327
Jamaica	0.383	0.334	0.207	0.004	0.825	0.329	1.981	10
Japan	0.490	0.493	0.219	0.010	0.998	0.026	2.108	469
Jordan	0.289	0.251	0.216	0.000	0.998	0.887	3.281	151
Kazakhstan	0.400	0.380	0.213	0.036	0.994	0.638	2.865	15
Kenya	0.467	0.463	0.168	0.212	0.986	0.378	2.308	19
Korea, Republic	0.482	0.495	0.201	0.000	0.999	−0.069	2.333	1,749
Kuwait	0.370	0.363	0.217	0.002	0.993	0.299	2.243	128
Latvia	0.369	0.331	0.231	0.014	0.932	0.272	2.010	27
Lithuania	0.455	0.464	0.200	0.037	0.981	0.103	2.516	39

Table 1 | Continuation

Malaysia	0.389	0.378	0.202	0.000	0.984	0.319	2.453	656
Mexico	0.487	0.479	0.188	0.001	0.992	0.023	2.747	138
Morocco	0.502	0.519	0.216	0.004	0.945	−0.157	2.547	62
Netherlands	0.552	0.569	0.217	0.000	1.000	−0.451	2.853	206
New Zealand	0.408	0.398	0.199	0.006	0.995	0.035	2.694	28
Nigeria	0.553	0.550	0.203	0.025	0.989	−0.184	2.563	65
Norway	0.536	0.580	0.210	0.000	0.996	−0.581	2.698	290
Oman	0.426	0.417	0.222	0.023	0.949	0.213	2.038	48
Pakistan	0.533	0.566	0.204	0.031	0.933	−0.340	2.104	51
Peru	0.439	0.440	0.182	0.000	0.986	0.017	2.580	95
Philippines	0.391	0.408	0.240	0.000	1.000	0.104	2.279	183
Poland	0.465	0.465	0.205	0.000	0.998	0.033	2.467	575
Portugal	0.641	0.672	0.178	0.019	0.973	−1.018	4.199	49
Romania	0.337	0.308	0.218	0.001	0.997	0.517	2.475	127
Russia	0.465	0.450	0.242	0.000	1.000	0.107	2.095	247
Saudi Arabia	0.357	0.329	0.205	0.005	0.990	0.319	2.198	123
Serbia	0.363	0.421	0.231	0.000	0.779	−0.096	1.553	10
Singapore	0.440	0.44	0.196	0.000	1.000	0.103	2.543	529
Slovak Republic	0.334	0.333	0.188	0.003	0.967	0.536	3.767	9
Slovenia	0.462	0.442	0.195	0.045	0.943	−0.023	2.438	27
South Africa	0.484	0.474	0.190	0.002	0.994	0.274	3.170	78
Spain	0.562	0.595	0.218	0.000	0.993	−0.724	3.139	185
Sri Lanka	0.492	0.523	0.225	0.021	0.942	−0.261	2.072	37
Sweden	0.480	0.504	0.229	0.000	0.998	−0.178	2.219	666
Switzerland	0.484	0.506	0.207	0.001	0.995	−0.308	2.679	246
Thailand	0.422	0.432	0.222	0.000	0.997	0.036	2.183	576
Tunisia	0.486	0.500	0.239	0.002	0.993	−0.243	2.512	48
Turkey	0.445	0.444	0.232	0.000	0.998	0.050	2.161	324
Ukraine	0.493	0.485	0.221	0.035	0.931	0.167	2.461	20
UAE	0.377	0.370	0.214	0.004	0.933	0.406	2.602	56
UK	0.408	0.417	0.250	0.000	1.000	0.079	2.061	1,074
Vietnam	0.490	0.510	0.215	0.002	1.000	−0.157	2.187	459
Zimbabwe	0.460	0.432	0.211	0.048	0.979	0.367	2.839	18
Average/Total	0.467	0.478	0.220	0.000	1.000	−0.072	2.293	18,201

Source: Author's calculation based on the sample data set.

The financial system orientation is one of the most popular country-specific determinants in the literature. The ratio of domestic credit to private sector by banks to the GDP of a country is used to measure the development of that country's banking sector. Similarly, the ratio of stock market capitalization to the GDP is accepted as an indicator of the domestic stock market development. Furthermore, the approach used by Čihák *et al.* (2011) is employed for creating a new variable to describe the financial system orientation. It is the ratio of domestic credit to private sector by banks divided by the ratio of stock market capitalization. According to this approach, the greater the ratio the more bank-oriented the financial system.

Following La Porta *et al.* (1998), the relationship between the institutional characteristics and leverage ratios is also investigated. Spamann (2010) re-estimated the anti-director rights index presented by La Porta *et al.* (1998). Also, Djankov *et al.* (2009) devise a measure for the legal rights of creditors in 129 countries. In this study, shareholder and creditor right protection levels are measured using these two indices. In order to investigate the application of these rights, we also measure the countries' corruption levels. Following Fan *et al.* (2012), we use the Corruption Perception Index as a proxy for the degree of corruption. Lastly, inflation rate is included in order to represent the countries' overall macroeconomic situation.

A developed country dummy is included in the model. It takes a value of 1 for developed countries and a value of 0 for developing countries according to the World Bank's classification. Lastly, 10 sector dummy variables, based on 2-digit GIC sector codes and time dummies are added in order to segregate sectoral variance and the effects of time shocks.

4. Methodology

Cross-sectional and time heterogeneity are problems frequently encountered by researchers working with panel data. In some panels, an extra heterogeneity may exist because of the clustered (hierarchical) structure. When a data set has a hierarchical structure, analysing it without considering that structure may result in unreliable estimates (Bryk and Raudenbush, 2002). Multilevel linear models, which provide simultaneous analysis of within-level and across-level relationships, are employed for modelling the hierarchical data (Woltman *et al.*, 2012).

The multilevel models are discussed in the econometric literature under the title of Random Coefficients Model (RCM) beginning with Swamy (1970). A RCM can be written as

$$y_{it} = \beta_i + \sum_{k=1}^{K} \beta_{k,it} x_{k,it} + u_{it}, \tag{1}$$

$$\beta_i = \beta_0 + \upsilon_i$$

$$\beta_{kit} = \beta_k + \xi_{k,it},$$

where $\xi_{k,it}$ are the random effects, υ_i are the fixed effects and u_{it} are residuals with a zero mean and constant variance β_i is the random intercept and β_{kit} is the random coefficient. It should be noted that the fixed parts of β_i and β_{ki} are the same for all groups. A simpler

sub-class of RCM is called Random Intercept Model (RIM), where all coefficients are fixed except the intercept,

$$y_{it} = \beta_i + \sum_{k=1}^{K} \beta_k x_{k,it} + u_{it}\,, \tag{2}$$
$$\beta_i = \beta_0 + \upsilon_i\,.$$

All of the models mentioned above are called two-level structures in the multilevel analysis. The simplest multilevel model is called the Variance Components Model (VCM) (Goldstein, 2011). A two-level VCM can be specified as,

$$y_{it} = \beta_i + u_{it}\,, \tag{3}$$
$$\beta_i = \beta_0 + \upsilon_i\,.$$

In this study, we start with the VCM model and extend it to the RIM and the RCM. Our data set has as a three-level hierarchy where the time, firm and country are identifiers of the first, second and third levels, respectively. A bottom-up approach is employed for the model design (Hox, 2010).

The maximum likelihood (ML) estimator is used in the model estimation. The maximum likelihood estimation maximizes the likelihood function with either the full maximum likelihood (FML) method or the restricted maximum likelihood (REML) method. The FML is preferred over the REML when the focus of attention is on the fixed effects (West *et al.*, 2014). Since the fixed effects of capital structure determinants on leverage are investigated in this study, the FML method is more suitable for our case.

The ML methods are asymptotic; the large-sample properties of the data set affect the unbiasedness of the estimates. Coefficients and their standard error estimates will be more accurate when the sample size is increased in all levels (Hox, 2010). The sample size at the highest level is very important for the multilevel analysis (Maas and Hox, 2005). A general rule of thumb is to have at least 50 groups at this level (Bryan and Jenkins, 2016; Raudenbush and Bryk, 2002; Maas and Hox, 2005). If the number of groups at the highest level is not large enough, the statistical inferences may not be robust for unbalanced data (Raudenbush and Bryk, 2002). In this study, the highest level consists of 66 countries. However, the panel data are unbalanced. Thence, as recommended in Raudenbush and Bryk (2002) both the asymptotic standard errors and the robust standard errors are estimated and are compared as a diagnostic check. According to a simulation study conducted by Maas and Hox (2005), both the regression coefficients and variance components are not biased for a sample of 50 groups. The estimated asymptotic standard errors of the regression coefficients are also accurate. However, the standard errors of the highest-level variances are downward-biased to a small degree. In this study, the inferences are mainly limited to the fixed effects.

5. Analysis

Since panel data sets have both time series and cross-sectional dimensions, unit root properties of the variables must be investigated before the model building process. As a

rule of thumb, if T > 10 for a panel data set, the stationarity is an issue worth investigating. In this study, the time dimension is 17 years for panels with no missing observations. Panel unit-root tests can be classified as the first and second generations. The first generation of tests assumes cross-sectional independence. On the other hand, the second generation of tests can deal with the cross correlations between the panel units.

In this study, the cross-sectional dependence is tested using a CD test as described in Pesaran (2004) and Pesaran (2015). The results indicate a strong cross-sectional dependence. The multilevel analysis method can handle the cross-sectional dependency problem. However, the unbalanced structure of the data set makes it impossible to apply either the Pesaran CIPS test or any other second-generation test (Pesaran, 2007). Since the data set is highly unbalanced, imputation of the missing values is not preferred. As an inefficient and partial solution, a first-generation test (Maddala and Wu, 1999) is used to test the stationarity of the difference of observations from their time averages. The results of this test reveal no unit root property for any of the variables in the model. Thence, all the variables are used at their levels.

5.1 Variance Components Analysis

In this study, we estimate the following VCM:

$$y_{ijk} = \beta_0 + v_k + u_{jk} + e_{ijk}\,, \tag{4}$$

where y_{ijkl} is the leverage ratio at the year i of the firm j in the country k in this multilevel model without covariates. It is a linear function of the grand mean of the sample (β_0) and the three error terms. v_k is specific to the country k but constant across firms within the country k and over time. u_{jk} is specific to each firm j in the country k but constant over time. Lastly, e_{ijk} is the random error term that represents the variance of the leverage ratio over time for the firm j in the country k. It is assumed that all error terms are normally distributed with a zero mean and constant variance.

The results are shown in Table 2. Interclass correlation coefficients (ICCs) are estimated as 9%, 61% and 30% for country, firm and time levels, respectively. They show the importance of country-specific factors and prove the necessity of using a multilevel structure. Similar estimations are obtained for all sub-samples. Sub-sample results reveal two interesting findings: firstly, the country-level variability is 9% in all the sub-periods and secondly, the variability caused by the firm level increases over time. Results for the developing and developed country sub-samples are given in the last two columns. Both the country and firm effects are more important in the developed countries. Besides, leverage ratios of firms in the developing countries are more prone to change over time. The firm level accounts for more than half of the variability in all the samples. This finding reveals the importance of firm-level factors as determinants of capital structure.

Table 2 | Results of the Variance Components Model

	Full data set 2000–2016	Developing countries	Developed countries	Sub-sample 2002–2006	Sub-sample 2007–2011	Sub-sample 2012–2016
Overall (grand mean)	0.4625 (0.0087)	0.4521 (0.0110)	0.4711 (0.0129)	0.4653 (0.0099)	0.4625 (0.0089)	0.4635 (0.0091)
Variance components						
Country-specific	0.0045 (0.0009)	0.0032 (0.0009)	0.0054 (0.0014)	0.0056 (0.0011)	0.0046 (0.0009)	0.0047 (0.0009)
Firm level	0.0315 (0.0009)	0.0292 (0.0005)	0.0334 (0.0005)	0.0354 (0.0005)	0.0362 (0.0005)	0.0383 (0.0005)
Time level	0.0154 (0.0001)	0.0161 (0.0001)	0.0148 (0.0001)	0.0094 (0.0001)	0.0094 (0.0001)	0.0081 (0.0001)
Interclass Correlation Coefficients (%)						
Between countries	9	7	10	9	9	9
Between firms	61	60	62	70	72	75
Across time	30	33	28	28	19	16

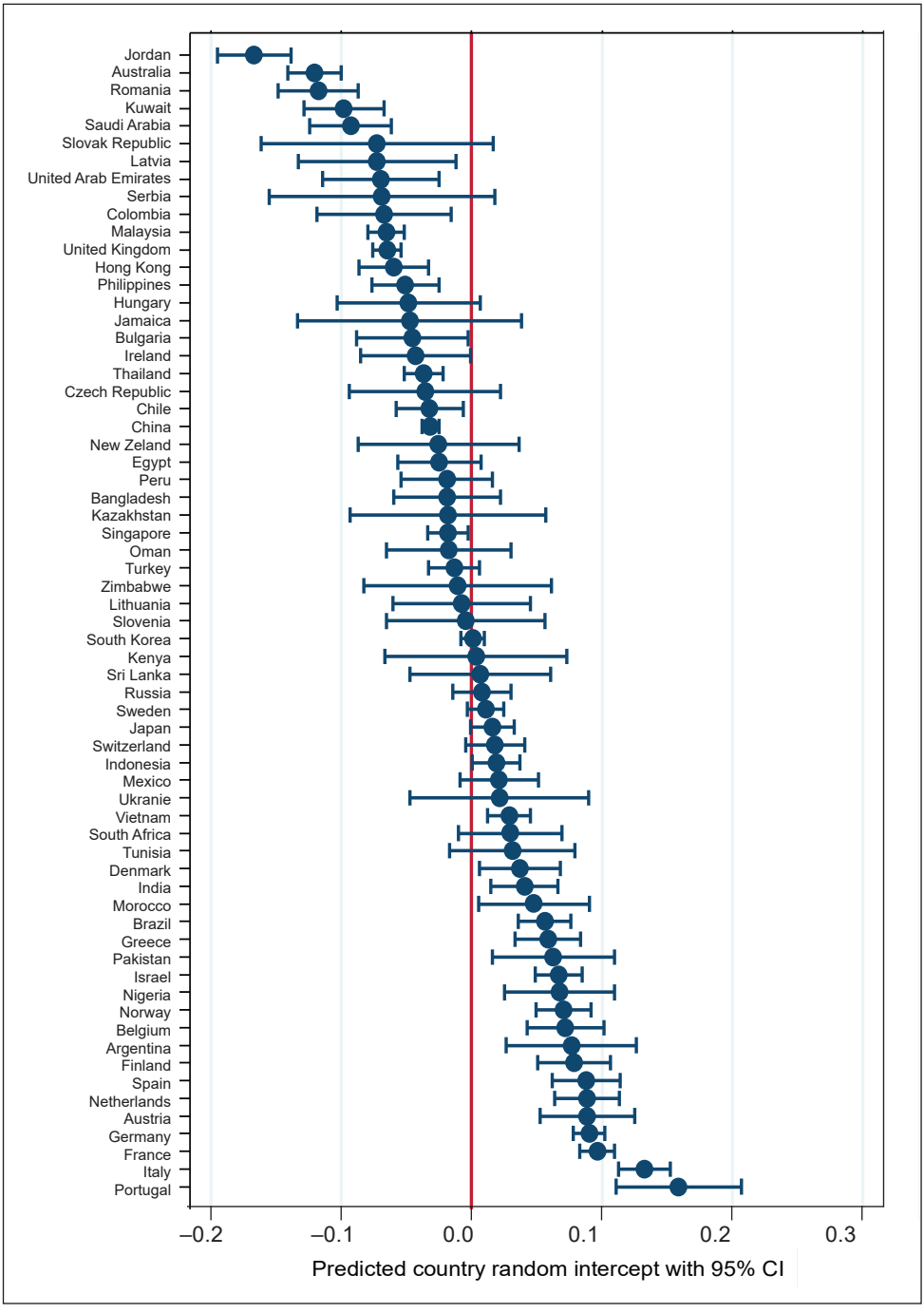
Note: Table shows the results of the variance components analysis for the full data set and all the sub-samples. The grand mean estimations of the samples are given in the first part of the table. Variance components of each hierarchical level of the data are shown in the second part. Lastly, the third part provides interclass correlation coefficients for each level. Asymptotic standard errors are presented in parentheses.

Source: Author's estimation based on the sample data set.

Figure 1 shows the divergence of the predicted country effect from the mean country effect for each country. The confidence intervals for the countries do not overlap and the lengths of confidence intervals do not vary across countries except for a few. The widths of the confidence intervals depend on the standard errors of the residual estimates, which is inversely related to the sample size. Thence, countries with fewer firms have wider ranges. The confidence intervals for 34 countries do not include zero. The leverage ratios for these countries show statistically significant differences from the overall mean of the sample.

The normal distribution of the random effects at all levels is an assumption of the linear mixed model. This assumption is necessary for the significance tests. According to the simulation study reported by Maas and Hox (2004), if the normality assumption of the highest-level error term is satisfied, then both the coefficient estimates and the standard errors are said to be reliable. A suggested method to test this assumption is to check whether there is a great difference between the magnitudes of the asymptotic and the robust (Huber/White) standard errors (Raudenbush and Bryk, 2002). A huge discrepancy between these two error estimates indicates the possibility of model misspecification and/or violation of model assumptions (Hox, 2010). Both the asymptotic and the robust (Huber/White) standard errors are estimated in order to detect any violation of the normality assumption in this study. These two error estimates are found to be very close to each other. Thence, it has been concluded that the normality assumption is valid. Only the asymptotic standard errors are reported below.

Figure 1 | Predicted Empirical Bayesian Estimates of Country Effects



Source: Author's creation based on the sample data set.

Prague Economic Papers, 2019, 28(5), 499–515, https://doi.org/10.18267/j.pep.700

5.2 Random Intercept Model

The Random Intercept Model (RIM) is obtained by including explanatory variables in the VCM model. In this model, it is assumed that the slopes of explanatory variables are constant (same for all clusters). It can be written as:

$$y_{ijk} = \beta_0 + \sum_{n=1}^{N} \beta_n x_{n,ijk} + \sum_{m=1}^{M} \delta_m z_{m,ik} + \sum_{p=1}^{P} \gamma_p w_{p,k} + \nu_k + u_{jk} + e_{ijk}\,, \tag{5}$$

where y_{ijk} is the leverage ratio in the year i of the firm j *in* the country k. $x_{n,ijk}$ is the nth firm-specific explanatory variable of the year i of the firm j in the country k. The firm-specific explanatory variables included in the model are profitability, tangibility, firm size, non-debt tax shield, and current liquidity. Two sets of country-specific predictors are used in the model. Variables in the first set change between countries and across time. $z_{m,ik}$ is the mth country-specific explanatory variable in the year i of the country k. Inflation, financial system, banking sector development and stock market development are predictors that belong to this set. Country-specific variables in the second set change between countries but they are constant across time. $w_{p,k}$ is the p-th country-specific explanatory variable of the country k. The corruption index, shareholder right protection, creditor right protection and the developed country dummy are the explanatory variables that belong to the second set. The sector and time dummies are also included in the model in order to capture the effects of the sectoral factors and the macroeconomic shocks in a given year. The model results are shown in Table 3. The first three columns of the table give the results for the full data set, developing country and developed country sub-samples, respectively. The results of the three sub-samples based on time are presented in the last three columns.

In general, the findings about direct firm effects are consistent with those of the mainstream literature. A significant and negative relationship between the leverage and the profitability can be seen in all the columns of Table 3. This inverse relation is consistent with the predictions of pecking order theory of debt (Myers and Majluf, 1984). Information asymmetry problems between managers and creditors cause firms to use debt only when retained earnings are insufficient to satisfy their financing needs.

The firm size is found to have a significant and positive relationship with the leverage ratio. This finding supports the view that large firms are less prone to suffer from the asymmetric information problems on the debt market. Since the risk premium becomes lower for these firms, they can find cheaper funding from creditors. A positive relationship between asset tangibility and leverage is also found for all the samples except those from developing countries. Again, this result is consistent with the trade-off theory. Since the fixed assets can be liquidated at their fair value in the case of a bankruptcy, creditors accept them as collaterals. Thus, firms with more tangible assets can borrow at lower costs on the debt market (Frank and Goyal, 2008). Similarly, the agency costs of debt are also lower for firms with higher asset tangibility (Rajan and Zingales, 1995; Cheng and Shiu, 2007).

Table 3 | Results of the Random Intercept Model

	Full data set 2000–2016	Developing countries	Developed countries	Sub-sample 2002–2006	Sub-sample 2007–2011	Sub-sample 2012–2016
Profitability	−0.0616*** (0.0026)	−0.0823*** (0.0070)	−0.0586*** (0.0027)	−0.1110*** (0.0061)	−0.0537*** (0.0036)	−0.0695*** (0.0037)
Tangibility	0.0128*** (0.0012)	0.0025 (0.0036)	0.0148*** (0.0012)	0.0331*** (0.0040)	0.0224*** (0.0009)	0.0570*** (0.0037)
Firm size	0.0149*** (0.0005)	0.0140*** (0.0009)	0.0159*** (0.0007)	0.0130*** (0.0008)	0.0232*** (0.0051)	0.0264*** (0.0011)
Non-debt tax shield	0.0837*** (0.0101)	0.0672 (0.0383)	0.0871*** (0.0104)	0.0524*** (0.0203)	0.1936*** (0.0312)	−0.0068 (0.0119)
Current liquidity	−0.0484*** (0.0038)	−0.0539*** (0.0072)	−0.0494*** (0.0045)	−0.0324*** (0.0073)	0.0130** (0.0064)	−0.0057 (0.0071)
Corruption index	−0.0011 (0.0009)	−0.0017 (0.0014)	−0.0013 (0.0011)	−0.0011 (0.0011)	−0.0015 (0.0012)	−0.0009 (0.0015)
Banking sector development	0.0000 (0.0000)	−0.0003** (0.0001)	0.0001 (0.0000)	−0.0001 (0.0001)	0.0001 (0.0001)	−0.0003** (0.0001)
Stock market development	0.0000** (0.0000)	0.0001 (0.0001)	−0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0001)
Shareholder right protection	−0.0140 (0.0134)	0.0155 (0.0176)	−0.0278 (0.0171)	−0.0150 (0.0150)	−0.0174 (0.0160)	−0.0275 (0.0173)
Creditor right protection	−0.0033 (0.0098)	0.0155 (0.0105)	−0.0249 (0.0142)	−0.0029 (0.0109)	−0.0013 (0.0124)	−0.0033 (0.0138)
Inflation rate	−0.0018*** (0.0002)	−0.0015*** (0.0003)	0.0000 (0.0005)	−0.0015*** (0.0004)	−0.0014 (0.0005)	0.0046*** (0.0022)
Developed country dummy	0.0843** (0.0379)	– –	– –	0.0933** (0.0474)	0.1064** (0.0458)	0.1470*** (0.0539)
Financial system	0.0108*** (0.0008)	0.0277*** (0.0024)	0.0086*** (0.0009)	0.0126*** (0.0025)	0.0035*** (0.0010)	0.0099*** (0.0025)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes
Sector effect	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.4674*** (0.0701)	0.3859*** (0.0821)	0.6422*** (0.1196)	0.4622*** (0.0828)	0.4001*** (0.0689)	0.3515*** (0.1007)
Variance components						
Country-specific	0.0044 (0.0011)	0.0022 (0.0010)	0.0044 (0.0013)	0.0051 (0.0013)	0.0043 (0.0012)	0.0061 (0.0016)
Firm level	0.0276 (0.0004)	0.0283 (0.0009)	0.0270 (0.0005)	0.0307 (0.0006)	0.0271 (0.0005)	0.0328 (0.0006)
Time level	0.0122 (0.0001)	0.0130 (0.0001)	0.0118 (0.0001)	0.0076 (0.0001)	0.0060 (0.0001)	0.0063 (0.0001)

Note: This table shows the results of the Random Intercept Model for the full data set and for all the sub--samples. The fixed coefficients can be seen in the first part of the table. The random effects are given in the second part. The asymptotic standard errors are presented within parentheses. *, ** and *** indicate significance at 5%, 1% and 0.1%, respectively.

Source: Author's estimation based on the sample data set.

Unlike some of the previous literature (Antoniou *et al.*, 2008; Venanzi *et al.,* 2014), a positive relationship between the non-debt tax shield and the leverage ratio is documented for all the samples except developing countries and the 2012–2016 sub-sample. This result indicates that the non-debt tax shield is a proxy for the solidity against the asymmetric information problems. A negative and significant relationship between the current liquidity and the leverage ratio is observed except in the 2012–2016 sub-sample. Both the developing and the developed countries show the same significant and negative effect. This result may indicate an asset-liability mismatch in the firm balance sheets.

Both the banking sector and the stock market development variables have statistically insignificant coefficients for almost all the columns of Table 3. The banking sector development is found to have a negative effect in the developing countries sample and the 2012–2016 sub-sample. A positive and significant relation with the leverage ratio and the stock market development is noticed in the full sample. However, the magnitude of the coefficients is almost zero for these variables. Thus, they do not have financial significance. On the other hand, the financial system variable has a statistically and financially significant positive coefficient for all the samples. Therefore, it can be concluded that the leverage ratios are higher in countries with more developed banking sectors compared to stock markets. This finding is not affected from the economic development level.

Two institutional variables – creditor right protection and shareholder right protection – do not have statistically significant coefficients for any of the samples. Similarly, there is no significant relationship between the corruption index and the leverage ratio.

Inflation has a significant and negative coefficient for the full sample, the developing countries' sample, and the pre-crisis and post-crisis sub-samples. However, the relationship loses its significance for the developed countries' sample.

Lastly, the developed country dummy has a statistically significant and positive coefficient for the full sample and for all the sub-samples. Firms in the developed countries prefer more debt financing compared to firms in the developing countries.

The time and the sector dummies both have meaningful coefficients. However, almost all the time dummies lose their significance in the developing country sample. Moreover, some sector dummies are also found to have statistically significant coefficients. This finding is in accordance with previous studies which found the existence of a sector effect on the leverage (Antoniou *et al.*, 2008; Kayo and Kimura, 2011).

5.3 Random Coefficient Model

Effects of the firm-specific determinants may change from country to country. In this part of the study, we analyse these indirect effects of country characteristics on the firm-specific variables. Slopes of firm-level variables are assumed to be random and influenced by country--specific variables. The Random Coefficients Model (RCM) is obtained by adding random slopes for the firm-level variables to the RIM model. The new model can be written as:

$$y_{ijkl} = \beta_0 + \sum_{n=1}^{N} \beta_n x_{n,ijk} + \sum_{m=1}^{M} \delta_m z_{m,ik} + \sum_{p=1}^{P} \gamma_p w_{p,k} + \nu_{0k} + \sum_{n=1}^{N} \nu_{1n,k} x_{n,ijk} + u_{jk} + e_{ijk}. \qquad (6)$$

Table 4 | Fixed and Random Effects of RCM Model

	Full data set 2000–2016	Developing countries	Developed countries	Sub-sample 2002–2006	Sub-sample 2007–2011	Sub-sample 2012–2016
Profitability	−0.1471*** (0.0234)	−0.2203*** (0.0457)	−0.1097*** (0.0230)	−0.1657*** (0.0210)	−0.1997*** (0.0250)	−0.1598*** (0.0230)
Tangibility	0.0388*** (0.0085)	0.0217 (0.0154)	0.0507*** (0.0092)	0.0241 (0.0135)	0.0231* (0.0112)	0.0371*** (0.0105)
Firm size	0.0282*** (0.0028)	0.0343*** (0.0051)	0.0241*** (0.0030)	0.0285*** (0.0031)	0.0322*** (0.0029)	0.0311*** (0.0028)
Non-debt tax shield	0.1868*** (0.0580)	0.0977 (0.1242)	0.2273*** (0.0598)	0.1287 (0.0890)	0.2558*** (0.0839)	0.3553*** (0.1153)
Current liquidity	0.0099 (0.0159)	0.0288 (0.0277)	−0.0043 (0.0186)	0.0326 (0.0202)	0.0505*** (0.0185)	0.0321 (0.0171)
Corruption index	−0.0008 (0.0022)	−0.0005 (0.0041)	−0.0020 (0.0024)	0.0006 (0.0025)	−0.0009 (0.0022)	0.0001 (0.0026)
Banking sector development	−0.0001 (0.0000)	−0.0002 (0.0001)	0.0000 (0.0000)	−0.0001 (0.0001)	0.0002 (0.0001)	−0.0004*** (0.0001)
Stock market development	0.0000 (0.0000)	0.0002** (0.0001)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0001)
Shareholder right protection	0.0108 (0.0313)	0.1008** (0.0492)	−0.0343 (0.0367)	−0.0082 (0.0344)	−0.0215 (0.0287)	−0.0416 (0.0314)
Creditor right protection	0.0033 (0.0233)	0.0324 (0.0304)	−0.0243 (0.0305)	−0.0403 (0.0254)	0.0064 (0.0228)	0.0032 (0.0255)
Inflation rate	0.0005* (0.0003)	0.0007** (0.0003)	0.0008 (0.0005)	0.0009* (0.0004)	−0.0008 (0.0005)	0.0048** (0.0006)
Developed country dummy	0.1323 (0.0900)	– –	– –	0.0381 (0.1077)	0.0842 (0.0835)	0.1733 (0.0963)
Financial system	0.0110*** (0.0008)	0.0268*** (0.0025)	0.0090*** (0.0009)	0.0110*** (0.0025)	0.0031*** (0.0010)	0.0065 (0.0025)
Time effect	yes	yes	yes	yes	yes	yes
Sector effect	yes	yes	yes	yes	yes	yes
Constant	0.1657 (0.1642)	−0.2588 (0.2326)	0.6234*** (0.2554)	0.2951 (0.1881)	0.2771 (0.1551)	0.2904 (0.1844)
Variance components						
Country-specific	0.0232 (0.0059)	0.0169 (0.0078)	0.0198 (0.0062)	0.0238 (0.0065)	0.0172 (0.0049)	0.0174 (0.0053)
Random effect of profitability	0.0187 (0.0055)	0.0292 (0.0125)	0.0105 (0.0037)	0.0111 (0.0038)	0.0169 (0.0054)	0.0124 (0.0040)
Random effect of tangibility	0.0024 (0.0007)	0.0030 (0.0015)	0.0016 (0.0006)	0.0054 (0.0017)	0.0034 (0.0010)	0.0026 (0.0009)
Random effect of size	0.0003 (0.0001)	0.0004 (0.0001)	0.0002 (0.0001)	0.0003 (0.0001)	0.0002 (0.0001)	0.0002 (0.0001)
Random effect of non-debt tax shield	0.0933 (0.0332)	0.1571 (0.1021)	0.0633 (0.0262)	0.2013 (0.0665)	0.1223 (0.0560)	0.2913 (0.1159)
Random effect of current liquidity	0.0083 (0.0023)	0.0098 (0.0046)	0.0068 (0.0023)	0.0112 (0.0035)	0.0090 (0.0029)	0.0065 (0.0022)
Firm level	0.0266 (0.0004)	0.0271 (0.0008)	0.0263 (0.0005)	0.0294 (0.0006)	0.0303 (0.0006)	0.0314 (0.0006)
Time level	0.0117 (0.0001)	0.0124 (0.0001)	0.0113 (0.0001)	0.0071 (0.0001)	0.0061 (0.0001)	0.0059 (0.0001)

Note: The fixed coefficients can be seen in the first part of the table. The random effects are given in the second part. The asymptotic standard errors are presented within parentheses. *, ** and *** indicates the significance at 5%, 1% and 0.1%, respectively.

Source: Author's estimation based on the sample data set.

Here, we have multiple random effects for the country level. v_{0k} is the mean country effect and $v_{1n,k}$ is the random part of the slope of the firm-level variable n for the country k. Table 4 gives the fixed and the random parameter estimates for this model.

With the random coefficients, some trivial changes in the magnitudes and significances of firm-level variables are observed. Notably, current liability loses its significance except in the 2007–2011 sub-sample. Asset tangibility and the non-debt tax shield are insignificant in the 2002–2006 sub-sample. Even though the developing country dummy is insignificant for all the columns of Table 4, the results obtained for the country-specific variables do not change to a great extent. Just like the RIM model, the time and sector dummies both have meaningful coefficients. The results of the RCM model should be taken with caution since the simulation studies in the literature have shown that the standard errors of the random effects are downward-biased when the highest-level group size is small and the data set is unbalanced (Maas and Hox, 2005).

6. Conclusion

In this study, the relative importance of the country and firm-level capital structure determinants is assessed using a multilevel modelling approach. The firm level accounts for 61% percent of the leverage variability. This finding is in accordance with the previous literature and implies the important role of firm-specific factors in capital structure decisions. On the other hand, only 9% of the total variability is explained by country-specific factors.

The international capital structure literature places a great emphasis on country-specific differences in capital structures. However, the empirical results show that publicly traded firms with similar firm-specific characteristics such as profitability, tangibility and size tend to have similar leverage ratios irrespective of the country in which they operate. Therefore, it can be argued that the emphasis should be on the firm-level determinants in future research. The country's economic development level is found to have a considerable effect on capital structure decisions. The leverage ratios are higher in the developing countries. Moreover, firms operating in countries with a more developed banking sector compared to the stock market prefer more debt financing. Also, inflation reduces the use of debt.

It should be noted that only public firms are included in the sample. Thus, the results do not reflect capital structure decisions of unlisted firms. Country-specific factors may be far more effective in their case.

References

Alves, P. F. P., Ferreira, M. A. (2011). Capital Structure and Law around the World. *Journal of Multinational Financial Management*, 21(3), 119–150, http://doi.org/10.1016/j.mulfin.2011.02.001

Antoniou, A., Guney, Y., Paudyal, K. (2008). The Determinants of Capital Structure: Capital Market-oriented Versus Bank-oriented Institutions. *Journal of Financial and Quantitative Analysis*, 43(01), 59–92, http://doi.org/10.1017/S0022109000002751

Bancel, F., Mittoo, U. R. (2004). Cross-country Determinants of Capital Structure Choice: a Survey of European Firms. *Financial Management,* 33(4), 103–132.

Belkhir, M., Maghyereh, A., Awartani, B. (2016). Institutions and Corporate Capital Structure in the MENA Region. *Emerging Markets Review, 26*, 99–129, http://doi.org/10.1016/j.ememar.2016.01.001

Booth, L., Aivazian, V., Demirguc-Kunt, A., Maksimovic, V. (2001), Capital Structures in Developing Countries. The *Journal of Finance,* 56(1), 87–130, http://doi.org/10.1111/0022-1082.00320

Bryan, M. L., Jenkins, S. P. (2016). Multilevel Modelling of Country Effects: A Cautionary Tale. *European Sociological Review*, 32(1), 3–22, https://doi.org/10.1093/esr/jcv059

Cheng, S. R., Shiu, C. Y. (2007). Investor Protection and Capital Structure: International Evidence. *Journal of Multinational Financial Management*, 17(1), 30–44, http://doi.org/10.1016/j.mulfin.2006.03.002

De Jong, A., Kabir, R., Nguyen, T. T. (2008). Capital Structure around the World: The Roles of Firm-and Country-specific Determinants. *Journal of Banking and Finance*, 32(9), 1954–1969, http://doi.org/10.1016/j.jbankfin.2007.12.034

Djankov, S., McLiesh, C., Shleifer, A. (2007). Private Credit in 129 Countries. *Journal of Financial Economics*, 84(2), 299–329, http://doi.org/10.1016/j.jfineco.2006.03.004

Fan, J. P., Titman, S., Twite, G. (2012). An International Comparison of Capital Structure and Debt Maturity Choices. *Journal of Financial and Quantitative Analysis*, 47(01), 23–56, http://doi.org/10.1017/S0022109011000597

Frank, M. Z., Goyal, V. K. (2009). Capital Structure Decisions: Which Factors are Reliably Important? *Financial Management*, 38(1), 1–37, http://doi.org/10.1111/j.1755-053X.2009.01026.x

Giannetti, M. (2003). Do Better Institutions Mitigate Agency Problems? Evidence from Corporate Finance Choices. *Journal of Financial and Quantitative Analysis*, 38(1), 185–212, http://doi.org/10.2307/4126769

Goldstein, H. (2011). *Multilevel Statistical Models.* USA: John Wiley and Sons. ISBN 9780470748657.

Hox, J. J., Moerbeek, M., van de Schoot, R. (2010). *Multilevel Analysis: Techniques and Applications.* Abingdon-on-Thames: Routledge. ISBN 978-1848728462.

Kayo, E. K., Kimura, H. (2011). Hierarchical Determinants of Capital Structure. *Journal of Banking and Finance*, 35(2), 358–371, http://doi.org/10.1016/j.jbankfin.2010.08.015

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R. W. (1998). Law and Finance. *Journal of Political Economy*, 106(6), 1113–1155, http://doi.org/10.1086/250042

Maas, C. J., Hox, J. J. (2004). The Influence of Violations of Assumptions on Multilevel Parameter Estimates and Their Standard Errors. *Computational Statistics and Data Analysis*, 46(3), 427–440, http://doi.org/10.1016/j.csda.2003.08.006

Maas, C. J., Hox, J. J. (2005). Sufficient Sample Sizes for Multilevel Modeling. *Methodology: European Journal of Research Methods for the Behavioral and Social Sciences*, 1(3), 86–92, https://doi.org/10.1027/1614-2241.1.3.86

Myers, S. C., Majluf, N. S. (1984). Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have. *Journal of Financial Economics*, 13(2), 187–221, http://doi.org/10.1016/0304-405X(84)90023-0

Öztekin, Ö. (2015). Capital Structure Decisions around the World: Which Factors are Reliably Important? *Journal of Financial and Quantitative Analysis*, 50(03), 301–323, http://doi.org/10.1017/S0022109014000660

Rajan, R. G., Zingales, L. (1995). What Do We Know About Capital Structure? Some Evidence from International Data. The *Journal of Finance*, 50(5), 1421–1460, http://doi.org/10.1111/j.1540-6261.1995.tb05184.x

Raudenbush, S. W., Bryk, A. S. (2002). *Hierarchical Linear Models: Applications and Data Analysis Methods (Vol. 1).* Sage.

Snijders, T. A. B., Bosker, R. J. (1999). *Multilevel Analysis. An Introduction to Basic and Advanced Multilevel Modeling.* London: Sage.

Spamann, H. (2010). Legal Origin, Civil Procedure, and the Quality of Contract Enforcement. *Journal of Institutional and Theoretical Economics*, 166(1), 149–165, http://doi.org/10.1628/093245610790711591

Swamy, P. A. (1970). Efficient Inference in a Random Coefficient Regression Model. *Econometrica: Journal of Econometric Society*, 38(2), 311–323, https://doi.org/10.2307/1913012

Titman, S., Wessels, R. (1988). The Determinants of Capital Structure Choice. The *Journal of Finance*, 43(1), 1–19, https://doi.org/10.1111/j.1540-6261.1988.tb02585.x

Utrero-González, N. (2007). Banking Regulation, Institutional Framework and Capital Structure: International Evidence from Sector Data. The *Quarterly Review of Economics and Finance*, 47(4), 481–506, http://doi.org/10.1016/j.qref.2006.02.006

Venanzi, D. (2017). How Country Affects the Capital Structure Choice: Literature Review and Criticism. *International Journal of Economics and Finance*, 9(4), 1, http://doi.org/10.5539/ijef.v9n4p1

Venanzi, D., Naccarato, A., Abbate, G. (2014). *Does the Country Effect Matter in the Capital Structure Decisions of European Firms?* A previous version of this paper was presented to the EFMA 2014 Annual Meeting, http://doi.org/10.2139/ssrn.2616597

Welch, I. (2011). Two Common Problems in Capital Structure Research: The Financial-debt-to-asset Ratio and Issuing Activity versus Leverage Changes. *International Review of Finance*, 11(1), 1–17, https://doi.org/10.1111/j.1468-2443.2010.01125.x

West, B. T., Welch, K. B., Galecki, A. T. (2014). *Linear Mixed Models: A Practical Guide Using Statistical Software.* London: CRC Press. ISBN 978-1-584-88480-4.

Woltman, H., Feldstain, A., MacKay, J. C., Rocchi, M. (2012). An Introduction to Hierarchical Linear Modeling. *Tutorial of Quantitative Methods in Psychology,* 8(1), 52–69, http://doi.org/10.20982/tqmp.08.1.p052