Measurement matters –

A meta-study of the determinants of corporate capital structure[*]

Markus Hang[a] (Corresponding Author)

Email: Markus.Hang@mrm.uni-augsburg.de

Jerome Geyer-Klingeberg[a]

Email: Jerome.Geyer-Klingeberg@mrm.uni-augsburg.de

Andreas W. Rathgeber[a]

Email: Andreas.Rathgeber@mrm.uni-augsburg.de

Stefan Stöckl[b]

Email: Stefan.Stoeckl@icn-groupe.fr

[a] *Author's affiliation*

Institute of Materials Resource Management
Faculty of Mathematics and Natural Sciences
University of Augsburg
Alter Postweg 101
86135 Augsburg, Germany

[b] *Author's affiliation*

Department of Finance, Audit, Accounting and Control
ICN Business School Nancy-Metz (Grande école) - CEREFIGE
3 place Edouard Branly
57070 Metz, France

2017

JEL Classifications: C83, F21, G31

For black-and-white print

[*] This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Measurement matters –

A meta-study of the determinants of corporate capital structure

Abstract

This study aggregates the mixed empirical evidence of the seven most commonly investigated determinants of corporate capital structure. We apply meta-regression analysis on a data set of 3,890 reported results, manually collected from 100 primary studies covering firm observations from 57 countries over the past 65 years. Our results reveal that – in descending order of importance – tangible assets (positive sign), market-to-book ratio (negative sign), and profitability (negative sign) are significant determinants of corporate debt level. In addition, we identify the presence of publication selection bias in academic literature. Accordingly, specific results are systematically overrepresented, as authors prefer reporting statistically significant estimates in line with theory or corresponding to previous empirical research. Significant determinants as well as publication selection bias are more pronounced for characteristics like market-based measures of capital structure or total debt measures of capital structure or for top articles from highly renowned journals, as compared to book-based measures of capital structure or long-term debt measures of capital structure or randomly selected articles including more unknown and unpublished studies. Overall, these findings highlight the need to relativize existing statistically significant results in this field and instead provide independent analyses in future for scientific progress.

Keywords: capital structure, meta-regression analysis, publication selection bias, heterogeneity

JEL Classifications: C83, F21, G31

2017

1 Introduction

Although the past 60 years of research have yielded a surge of empirical literature on the determinants of capital structure, various authors in this major discipline of corporate finance conclude that the overall picture is rather mixed (An, Li, & Yu, 2016; Schmid, 2013; Denis & McKeon, 2012; Hovakimian, 2006; Strebulaev, 2007). Over just the past five years (2012 – 2016), the number of studies has increased by more than 300 articles, each proposing its own set of core determinants (among others, Frank & Goyal, 2009; Öztekin, 2015). Such fast growth amplifies the inconclusiveness of empirical findings rather than presenting a solution.

In their seminal work, Harris and Raviv (1991) are the first to summarize and classify existing empirical evidence on the determinants of capital structure. One of their key findings refers to the large heterogeneity that characterizes previous empirical results:

> *"Comparisons suffer from the fact that these studies used different measures of the firm characteristics, different time periods, different leverage measures, and different methodologies."*
>
> (Harris & Raviv, 1991, p. 336)

As stated in their review, Harris and Raviv (1991) assume that specific study characteristics systematically affect the results of primary studies. Meta-regression analysis (MRA) is a commonly-used quantitative review technique that explicitly models the impact of these different study characteristics and thus provides a statistical tool to explain heterogeneity in existing research results. By means of MRA, previous studies successfully reveal important new insights into various fundamental questions in financial economics research (among many others, Arnold, Rathgeber, & Stöckl, 2014; Feld, Heckemeyer, & Overesch, 2013; Goerg & Strobl, 2001; Hang, Geyer-Klingeberg, Rathgeber, & Stoeckl, 2016; Havránek & Irsova, 2011; Kysucky & Norden, 2015).

In this paper, we employ MRA to synthesize empirical studies on the determinants of capital structure with the following intentions. First, we analyze the seven most commonly investigated determinants of capital structure, extending the existing work by Feld et al. (2013), who present a comprehensive meta-study on the impact of taxes on corporate debt financing. Second, MRA allows calculation of the average effect of each of the seven analyzed capital structure determinants across studies. Therein, we make use of 3,890 reported results collected from 100 representative studies, selected from a total pool of 591 relevant primary studies. Third, besides the simple aggregation of effects, we aim to explore the reasons why empirical evidence appears to be inordinately different. To study the sources of within-study and between-study heterogeneity, we include 32 different study characteristics that potentially affect the variation in reported results. These factors cover measurement differences, regional differences, data characteristics, publication characteristics, and differences in model specification.

By conducting meta-analytical techniques, this paper contributes to existing research on the determinants of corporate capital structure in several ways. First, we provide the first quantitative literature review aggregating the various determinants of capital structure. By studying heterogeneity among empirical outcomes, we aim to explore the differences across studies as emphasized by Harris and Raviv (1991). As an advantage over (traditional) qualitative reviews (among others, Nyamita, Garbharran, & Dorasamy, 2014; Pandey & Singh, 2015), meta-analysis provides a toolset for more objective and comprehensive quantitative reviews (Stanley, 2001). For example, meta-analysis allows assignment of study weights based on the reliability of reported results, summarization of all effects from primary studies within a single statistical measure, and correction of potential model misspecification in primary studies. Second, we extend the previous meta-study by Feld et al. (2013) by investigating the impact of 32 study characteristics on the seven most frequently analyzed capital structure determinants, namely tangible assets, non-debt tax shields, market-to-book ratio, firm growth, firm size, earnings volatility, and profitability. Third, compared to existing primary research, ours simultaneously analyzes all potential explanatory factors in a multiple regression framework to avoid spurious effects. Finally, we also test for the existence of publication selection bias in this field of research, which allows for inferences on the impact of existing theories and influential studies (among others, Harris & Raviv, 1991; Rajan & Zingales, 1995; Titman & Wessels, 1988) on the probability that authors select certain results for publication. Consequently, the analysis provides important indications of the reliability of certain groups of study results.

The remainder of this article is structured as follows. Section 2 describes the theoretical foundation. Section 3 presents the literature search process, the preparation of the data, and the descriptive statistics. The methodological framework of MRA is outlined in Section 4. The subsequent Section 5 reports the results of the MRA. In Section 6 we describe the results of the robustness tests. Lastly, Section 7 concludes the study.

2 Capital structure theory

Assuming a Modigliani-and-Miller world without market imperfections, the choice of capital structure should not affect the cost of capital (Modigliani & Miller, 1958). By introducing the concept of market frictions, several scholars have developed specific capital structure theories, thereby assigning meaning to the choice of capital structure. Multiple theories have been well-studied over the last decades covering three major strands (Cole, 2013). For testing, academics make use of several firm characteristics. The subsequent section presents the theoretical framework, followed by the explanation of the connected firm characteristics used in empirical research.

2.1 Theories

First, the tradeoff theory developed by Kraus and Litzenberger (1973) assumes that firms set their target leverage ratio by balancing costs of bankruptcy and tax benefits. On the one hand, the costs of bankruptcy increase with extended leverage due to the rising amount of fixed interest payments and expected costs of financial distress. On the other hand, tax benefits occur since interest payments are tax-deductible expenses (tax shield). Hence, the optimal leverage is reached when tax benefits offset the costs of bankruptcy. Consequently, firms' financing decisions are assumed to move their capital structure to an optimum.

Second, the pecking order theory by Myers (1984) suggests a hierarchical financing strategy depending on the degree of information asymmetry between managers and investors. To minimize the costs of borrowing, the source of capital with the lowest degree of information asymmetry is preferred. Generally, this procedure implies that internal funds are favored against external funds and for the latter, debt financing is favored against equity financing. Compared to the tradeoff theory, there is no optimal capital structure.

Third, the more recent market timing theory by Baker and Wurgler (2002) proposes that firms tend to issue equity in times of high market-to-book values and debt when market-to-book values are low. This means that the development of the capital structure is determined by the development of equity markets. Leverage decreases when capital is needed during bullish markets. In contrast, leverage increases when capital is needed during bearish markets. As with the pecking order theory, there is no optimal target capital structure.

This selection of theories is without any claim of comprehensiveness. The theories selected here are the most frequently represented theories in empirical literature, a fact which contributes to the feasibility of a meta-analysis. There are several additional theories, namely agency theory (Jensen & Meckling, 1976), signaling theory (Ross, 1977), or free cash flow theory (Jensen, 1986), which aim to explain the capital structure decision based on behavioral aspects.

2.2 Determinants of capital structure

In primary studies, the theoretical hypotheses are tested by certain proxy variables representing the determinants of capital structure. Typically, a linear regression model is applied to estimate the impact of the proxy variables on the corporate debt level:

$$L_{i,t} = \alpha + \beta D_{i,t} + \gamma C_{i,t} + e_{i,t}. \tag{1}$$

$L_{i,t}$ represents the leverage ratio of firm i in time t. The variables $D_{i,t}$ are assumed to determine the leverage ratio, and capture different firm characteristics. $C_{i,t}$ refers to a set of control variables, and $e_{i,t}$ denotes the error term. The vector β contains the parameters of interest, which measure the direction and strength of the impact of the determinants on the leverage ratio. These regression coefficients serve as input for our MRA.

Table 1 sums up the direction of the hypothetical influence of the corresponding proxy variables on capital structure, separately for each of the three theories. In this paper, we concentrate on the seven most frequently analyzed firm characteristics. To achieve meaningful estimates in our MRA, we only include the proxy variables for which more than 250 results are reported in the selected 100 primary studies. This limit is chosen as it exceeds 191, which is the mean number of observations in a summary of 140 different meta-analyses as reported by Nelson and Kennedy (2009).

[PLEASE INSERT TABLE 1 HERE]

When linking the proxy variables to capital structure under the tradeoff theory, one might expect a positive impact of tangible assets on leverage. Tangible assets in particular serve as collateral and achieve more stable prices in the case of liquidation (Cole 2013). The presence of non-debt related tax shields should lead to a lower leverage ratio as they represent a substitute for tax benefits arising from debt financing (Huang and Song 2006). For firm growth, the pecking-order theory assumes a positive association with leverage because investments are directly linked to cash outflows, which increase the need for additional financial resources (Frank and Goyal 2009). For market-to-book ratio, Cole (2013) proposes a negative impact on leverage. He argues that growth opportunities in terms of intangible assets lead to higher costs of financial distress, consequently lowering the portion of external financing required. As large firms are often more diversified, increasing firm size is commonly associated with lower direct bankruptcy costs (Titman and Wessels 1988). Hence, larger firms are supposed to have more debt. For firm risk measured by earnings volatility, tradeoff theory predicts a negative sign for the relation to leverage. Since income volatility induces higher expected costs of financial distress, more volatile firms should have lower leverage ratios (Frank and Goyal 2009). This is supported by the fact that more volatile firms have a lower probability to profit from tax shields. Finally, higher profitability decreases the probability of financial distress and offers additional possibilities for deduction. Both aspects speak for a positive relation between profitability and leverage under the tradeoff theory (Cole 2013).

Continuing with the pecking-order theory, tangible assets are assumed to lower the degree of information asymmetry due to ease of valuation by outsiders (Harris and Raviv 1991). Thus, leverage should be positively related to tangible assets. However, in a similar vein, equity issuances become less costly if information asymmetry decreases, potentially reducing the level of debt financing (Frank and Goyal 2009). Furthermore, firm growth supports debt issuances due to the consequently larger financing requirements, which increases the demand of debt financing (Frank and Goyal 2009). Further, there should be a negative relation between market-to-book ratio and leverage, as future growth opportunities rarely serve as collateral (Titman and Wessels 1988). Regarding firm size, pecking-order theory assumes a negative impact on leverage: as large firms provide better information to outside investors, information asymmetries are lowered and equity financing encouraged (Huang and Song 2006). Moreover, increased earnings volatility raises investment uncertainty of outsiders (Frank and Goyal 2009). Hence, more volatile firms suffer more from adverse selection due to increasing information asymmetry. For such firms, debt financing beneficially leads to relatively higher leverage ratios. Following the general idea of the pecking-order theory, retained earnings constitute the favored form of financing. This implies that more profitable firms should have lower leverage ratios (Titman and Wessels 1988).

Under the market timing theory, the market-to-book ratio serves as an indicator for the choice of capital source. When stock prices – and consequently market-to-book ratios – are high, firms are supposed to issue equity (Rajan and Zingales 1995). Thus, temporarily low leverage ratios probably occur during bullish markets.

3 Data

As a first step in our analysis, we collect data from empirical literature analyzing the determinants of corporate capital structure. The data search and the subsequent analyses comply with the established guidelines published by the Meta-Analysis of Economics Research Network

(Stanley et al., 2013). As described in Appendix A, we address all compulsory issues that are part of the guidelines concerning literature search, data preparation, and methodology as outlined hereafter.[1]

3.1 Literature search

Information about the existing results on the determinants of corporate capital structure decision is directly drawn from the respective empirical primary studies. In line with the objective of this meta-analysis, the relevant primary studies are selected by the following three content-related criteria. (1) To assure a sufficient comparability of the data set, each study should empirically analyze the determinants of corporate capital structure. (2) The dependent variable in the analysis must be a measure of the corporate capital structure. (3) As is common practice, only results for non-financial firms are included. In addition, there are three data-related criteria a study must fulfill to be integrated in our MRA. (1) The effect size measuring the relation between the determinants and capital structure must be reported in the form of regression coefficients as captured by β in Equation (1). (2) The study's sample size, or the degrees of freedom respectively, must be extractable in order to calculate the variation of the extracted effect-sizes and the study weights. (3) The study must also report country-specific results to allow an unambiguous assignment of regional variables to the specific regression coefficients.

We started our four-step literature search procedure with (1) an extensive search using the following electronic databases: ABI/INFORM Complete, Business Source Premier, EconLit, and GreenFILE. Next, we explicitly searched for unpublished literature by screening the electronic working paper database SSRN using the same search strategy as for published articles. The resulting sample of relevant studies serves as a basis for (2) a backward search in the reference lists of the studies and (3) a forward search via the "cited by"-option in Google Scholar. We also checked (4) the publication lists of authors who are involved in more than one relevant study.

[1] To ensure a sufficient quality of data extracted from the studies, we first developed a common understanding of all variables to be collected from the primary studies. Afterwards, one author extracted the data for the full sample of studies. During this data preparation process, each uncertainty was discussed among the authors until a common consensus for the discordant data point was found.

Appendix B provides detailed information about the whole search procedure together with the exact numbers of studies identified in each step.

In total, 591 studies meet the content-related criteria.[2] Appendix C shows the distribution of the publication year of the studies. The sample covers 101 unpublished studies (dissertations, working papers and conference papers), corresponding to 17.09% of the full sample. Due to the richness of available data, we decided to restrict this MRA to 50 top articles published in highly renowned journals (further referred to as "top articles") and further 50 randomly selected articles including more unknown and unpublished (further referred to as "randomly selected articles").[3] The inclusion of such a mixed set of studies is especially important in order to cover the different explanatory variables in our MRA with a sufficient number of observations. To control for potential differences in study quality, we integrate corresponding explanatory variables in our regression models. The aggregated sample of 100 studies should be an appropriate and representative compromise concerning study quality and study variability. Moreover, it should be noted that this study sample is still twice as large as the average study sample used in previous meta-analyses (Nelson & Kennedy, 2009; Doucouliagos & Stanley, 2013). A list of the 100 primary studies included in the MRA can be found in Appendix D.

Although the study sample provides results for numerous determinants, we focus on the most frequently used variables to yield statistically meaningful results. In detail, we analyze asset tangibility (TANG), non-debt tax shield (NDTS), firm growth (GROW), growth opportunities (MTB), firm size (SIZE), earnings volatility (EVOL), and profitability (PROF) in our MRA.[4] Table 2 provides an overview of the variables, the employed (quite homogeneous) definitions, as well as the number of estimates extracted from primary studies, which varies from 299 to 910. We

[2] Meta-analysis requires that the studies in the sample are statistically independent (Hunter & Schmidt, 2004). Therefore, studies from the same co-authors that build on an identical data set should be excluded in order to avoid double-counting (Stanley & Doucouliagos, 2012). In contrast, different data sets from the same authors and overlapping or equal datasets in studies from different authors are defined as independent (Doucouliagos & Ulubasoglu, 2008; Hunter & Schmidt, 2004). Overall, no study had to be excluded due to data dependencies.

[3] We use the recursive RePEc Journal Impact Factor for the valuation of the journals. This factor is chosen as it incorporates the quality of citations and comprises a wide range of economic journals (among others, Valickova, Havránek, & Horváth, 2015).

[4] At this point it should be noted that the variable abbreviations refer to the relation between capital structure and the certain determinant. For example, TANG denotes the effect between capital structure and tangible assets.

collected all reported results instead of selecting a single representative estimate from each study, following an established consensus in MRA research (among others, Valickova, Havránek, & Horváth, 2015; Doucouliagos & Stanley, 2009). We also correct for potential within-study dependencies in our methodological approach. Moreover, this procedure does not require the subjective selection of one representative estimate for each study, but allows a more detailed analysis of the within-study variation that arises from differences in the applied methodology and model specification.

[PLEASE INSERT TABLE 2 HERE]

3.2 Effect size

For effect size, we use the partial correlation coefficient (*r*), which is directly drawn from regression results reported in primary studies. In this way, we measure the intensity of the relation between capital structure and a certain determinant, while holding all other factors from the regression model constant. The partial correlation coefficient is calculated by

$$r_{ij} = \frac{t_{ij}}{\sqrt{t_{ij}^2 + df_{ij}}} \quad (2)$$

with the standard deviation

$$SE(r_{ij}) = \sqrt{\frac{(1 - r_{ij}{}^2)}{df_{ij}}}, \quad (3)$$

where t_{ij} denotes the test statistic from the *t*-test applied on the *j*-th regression slope in study *i* and *df* represents the degrees of freedom related to this test statistic (Stanley & Doucouliagos, 2012). To achieve normally distributed effect sizes, we use Fisher's z-transformation to correct for skewness in *r*. For more details on the calculation of the partial correlation *r* as well as the *z*-transformed values with the corresponding standard errors, please refer to Appendix E.

This effect size contains several advantages (Stanley & Doucouliagos, 2012). First, although the direct use of regression coefficients already has the positive characteristic of filtering out disruptive effects and to isolate the effect of interest (such as, for example, used by Belz, Hagen, & Steffens, 2016; Feld et al., 2013), it does not fulfill the requirement of comparability across studies. In contrast, the partial correlation coefficient enables us to make the effects comparable in scale and measure across the employed proxy variables. Second, compared to the zero-order correlations as frequently used in management research (among others, Bhaskar-Shrinivas, Harrison, Shaffer, & Luk, 2005; Post & Byron, 2015), the partial correlation as preferred in economics allows a detailed analysis of misspecification bias by investigating variations in estimation models and integrated control variables. Third, the use of partial correlations maximizes the sample of primary studies and effect sizes to be included in our sample. Particularly, it allows integration of multiple estimates per study as most articles report results for several regression models from different specifications or subsamples. Overall, this effect size increases the sample size, enables the analysis of within-study variation, and enhances the variability in the data set (Chaikumburg, Doucouliagos, & Scarborough, 2016).

3.3 Descriptive statistics

To give a first impression of the collected effect sizes Table 3 presents summary statistics of the partial correlation coefficients as well as arithmetic and weighted averages across the 100 primary studies. Overall, it can be seen that the different calculations of the mean effects lead to different results. Starting with the simple average partial correlation, the same weight is assigned to each effect size regardless of its precision. This approach also does not consider potential publication selection, which might heavily bias toward average effects (as outlined in the methodology section and analyzed in detail in the subsequent MRA). For the consideration of precision, meta-analysis provides two alternative calculations: a fixed effects and a random effects model. The fixed effects model assumes the effect sizes to be drawn from the same population. The effect sizes are weighted by the inverse variance, which implies that larger weights are assigned to larger studies reporting more precise estimates. Comparing the fixed effects means with the simple averages reveals remarkable deviations from the simple arithmetic mean for TANG (0.046 to 0.024), GROW (0.058 to 0.043), SIZE (0.051 to 0.021), EVOL (-0.021 to -0.031), and PROF (-0.066 to -0.030). This development shows that the effects tend to decrease when larger studies receive more weight, which might be seen as a first indication of the presence of publication selection. Hence, smaller studies especially seem to report larger results, thereby offsetting high standard errors and achieving more significant results. In contrast, random effects models additionally consider unsystematic between-study variation (heterogeneity) that leads to an individually true effect for each study. Compared to the fixed effects models, deviations of the average values can be reasoned by the integrated random effects among the underlying true effects for each effect size. Deviations are especially obvious for TANG (0.024 to 0.048), SIZE (0.021 to 0.038), EVOL (-0.031 to -0.024), and PROF (-0.030 to -0.062). To analyze the underlying forces driving these deviations across studies, we explicitly model the unobserved heterogeneity in the next step via MRA.

[PLEASE INSERT TABLE 3 HERE]

4 Meta-regression analysis

MRA is used to explain the deviations among the results reported in primary studies for a specific capital structure determinant and reveal the relevant factors that cause the heterogeneity. In a first step, we calculate the aggregated mean effects and evaluate as well as correct for publication selection for various subsamples of reported effect estimates (see for other applications of this procedure, among others, Doucouliagos & Laroche, 2009; Havránek & Irsova, 2011; Stanley, 2004). In a second step, we continue with a multiple regression analysis to explain heterogeneity among the reported effect estimates by simultaneously controlling for several study characteristics.

4.1 FAT-PET model

As usually applied in MRA, we first test for the existence of selective reporting of certain research results. In general, publication selection bias refers to the phenomenon that specific estimates are systematically underrepresented in empirical literature (Rosenthal, 1979). In other words, publication selection bias exists when researchers prefer statistically significant results (Stanley, 2005). If, for example, the majority of literature shares the same preference on the sign and significance for a certain determinant following an accepted theory, publication selection might cause an over-representation of larger and more significant effects (Card & Krueger, 1995; Doucouliagos & Stanley, 2013). One the one hand, the finding of conventionally expected results serves as a model selection test (Card & Krueger, 1995). On the other hand, reviewers and editors might favor papers that confirm the conventional view (Card & Krueger, 1995). In the presence of publication selection bias, an overall view across the available literature will be distorted. Accordingly, primary studies as well as narrative literature reviews would lead to incorrect inferences about the true effect and neither are able to meaningfully aggregate existing empirical results (Stanley, 2005). Many existing meta-analyses have already shown that publication selection bias seriously threatens the integrity of the empirical research process in different areas of research (among many others, Doucouliagos, Stanley, & Giles, 2012; Doucouliagos & Stanley, 2009; Feld & Heckemeyer, 2011; Goerg & Strobl, 2001; Rusnak, Havránek, & Horváth, 2013). Besides publication selection, model misspecification biases might also arise from certain data limitations, inappropriate estimation methods, or omitted variables (Stanley, 2001).

To test for the presence of publication selection bias, we analyze the relation between the observed effect sizes and their standard errors. This model can be described as follows:

$$r_{ij} = \beta_0 + \beta_1 SE(r_{ij}) + \varepsilon_{ij}, \quad \varepsilon_{ij} \sim N(0; SE(r_{ij})^2) \tag{4}$$

The dependent variable r_{ij} is the *i*-th partial correlation coefficient measuring the relation between capital structure and a certain determinant from the *j*-th study, $SE(r_{ij})$ is the standard error of the partial correlations, and ε_{ij} is the error term.

The *t*-test of the regression coefficient β_1 in this model quantifies publication selection bias (Egger, Smith, Schneider, & Minder, 1997). This test is commonly known as the funnel asymmetry test (FAT) (Stanley, 2008). If $\beta_1 = 0$, it can be concluded that literature does not suffer from publication selection bias as there is no association between the effect size and its precision. Hence, the probability of measuring the genuine effect increases with the precision of the estimate and as reported effect estimates are normally (symmetrically) distributed around it. If $\beta_1 \neq 0$, there would be an overrepresentation of reported results for a certain direction of the effect, indicated by a significant relation between the effect size and its precision. The intercept β_0 represents the precision effect test (PET), which quantifies the mean effect size for the relation between capital structure and the specific determinant beyond potential publication selection bias. Hereinafter, we refer to Equation 4 as FAT-PET model.

4.2 Multiple meta-regression analysis

In addition to publication selection bias, deviations in the reported results from primary studies might also be driven by measurement differences, regional differences, data characteristics, publication characteristics, or differences in model specification. In this manner, the FAT-PET model from Equation (4) can be extended to a multiple MRA by including a vector of various study characteristics:

$$r_{ij} = \beta_0 + \beta_1 SE(r_{ij}) + \sum_{k=1}^{K} \gamma_k Z_{ijk} + \epsilon_{ij}, \quad \epsilon_{ij} \sim N(0; SE(r_{ij})^2), \tag{5}$$

where Z_{ijk} denotes the set of k explanatory variables, and ϵ_{ij} is the error term. The FAT remains valid for the multiple MRA model as stated in Equation (5). The intercept β_0 still measures the mean effect size beyond potential publication selection bias, but must now be interpreted as conditional on the values for the Z vector (Stanley & Doucouliagos, 2012). In this respect, the Z vector controls for systematic variation across the effect sizes through several additional explanatory variables, thus capturing different aspects of study design.

4.3 Study characteristics

Several primary studies already show that the determinants of capital structure might be driven by time-, firm-, industry-, and country-specific factors (among others, Anwar & Sun, 2015; Fan, Titman, & Twite, 2012; Harris & Raviv, 1991; Jong, Kabir, & Nguyen, 2008; Kayo & Kimura, 2011). As the majority of primary studies examine certain firm observations, for example, a firm's specific industry and/or location during a certain period, such effects might explain a substantial part of the within- and between-study variation in existing results. Hence, besides testing the existence of publication selection bias, we control for measurement differences, regional differences, data characteristics, publication characteristics, and differences in model specification, in order to capture fixed effects among the effects sizes. The extracted variables are either directly extracted from the primary studies or derived from external databases. The variables are summarized in Table 4 including definitions and descriptive statistics.

[PLEASE INSERT TABLE 4 HERE]

4.3.1 Measurement differences

Economic literature presents and discusses several alternate methods to measure capital structure, which are assumed to have different behaviors (Harris & Raviv, 1991). In general, capital structure can be divided into market versus book leverage, as well as total versus long-term debt (among others, Cole, 2013; Feld et al., 2013; Frank & Goyal, 2009). We include two dummy variables to capture differences among variable definitions in our analyses. The variable *ML* refers to differences in the measurement of corporate capital structure. As noted by Feld et al. (2013), primary studies usually examine market leverage (among others, Bathala, Moon, & Rao, 1994; Mittoo & Zhang, 2008), book leverage (among others, Cole, 2013; Johnson, 1997), or both (among others, Berger, Ofek, & Yermack, 1997; Faulkender & Petersen, 2006) as a proxy for capital structure. Market leverage is especially characterized by its forward-looking property. Although it can be negative, book leverage might be preferred as a relatively reliable indicator for corporate financial decisions, given the high volatility of financial markets (Frank & Goyal, 2009). Although Bowman (1980) finds a large cross-sectional correlation between book and market leverage, Barclay, Morellec, and Smith (2006) see no reason for an equal behavior of the two measures. The latter conclusion is, for example, supported by Frank and Goyal (2009), whose core set of determining factors alters when changing from market to book leverage. Further, *TD* considers differences in debt maturity as the majority of studies examine long-term debt (among others, Kim & Sorensen, 1986; Shivdasani & Stefanescu, 2009), total debt (among others, Antoniou, Guney, & Paudyal, 2008; Rajan & Zingales, 1995), or both (among others, van Campenhout & van Caneghem, 2013; Erol & Tirtiroglu, 2011). Barclay and Smith (1995) state that there is a relation between the extent of information asymmetry (as, for example, recently analyzed by Laux, Lóránth, & Morrison, 2017) and the choice of debt maturity. Hence, higher asymmetries impede the use of long-term debt. Although there is an agreement that the choice of leverage measurement should be made on the basis of the analysis's objective (Rajan & Zingales, 1995), a large portion of studies on the determinants of capital structure provides results for several variable definitions (among others, Bae, Kang, & Wang, 2011; Hovakimian, Opler, & Titman, 2001; Titman

& Wessels, 1988). In these cases, it is the responsibility of the reader to assess whether certain results are reliable and which findings to follow.

4.3.2 Regional differences

Furthermore, differences in the determinants of capital structure might arise due to cross-country variations in taxation, corporate governance, development of financial markets, or legislation. In order to control for systematic regional differences (among others, Jong et al., 2008; Kayo & Kimura, 2011), we add several variables from external databases. The variables are chosen on the basis of availability of the underlying comprehensive data set. First, we control for differences in economic development. Thus, we include the country-specific (logarithm of) GDP per capita (GDP) (Frank & Goyal, 2009) as well as the growth rate in GDP per capita (GDPGROW). The former represents the development of a certain country, while the latter relates to good growth opportunities for investors (Kayo & Kimura, 2011). Following Carney, Gedajlovic, Heugens, van Essen, and van Oosterhout (2011), the variable *US* addresses the fact that a remarkable part of our sample is based on data from US firms. Moreover, differences in the determinants of corporate capital structure might also occur due to regulatory differences. Legal systems are assumed to form legal rules that can influence financial markets. Hence, civil law countries are associated with “greater government intervention in economic activity and weaker protection of private property” (La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 2000, p. 12). For these reasons, law systems drive the development of financial markets. It can also be shown that better shareholder protection induces higher company valuations (Porta, Lopez-de-Silanes, Shleifer, & Vishny, 2002). *CIVIL* distinguishes between civil law countries and differing law systems. Finally, we take potential effects into account, which are caused by the globalization of financial markets (among others, Stulz, 1999; Stulz, 2005). Therefore, we include *FDI* as a proxy for globalization (Anwar & Sun, 2015; Dreher, 2006). Among others, Alfaro, Chanda, Kalemli-Ozcan, and Sayek (2004) show that FDI significantly contributes to economic growth, while the development of financial markets plays a moderating role for the realization of these positive effects. Corresponding effects might also appear between developed and developing countries (Kayo & Kimura, 2011). *DEV* is included to measure such corresponding differences.

4.3.3 Data characteristics

Moreover, variations in taxation, legislation, and management behavior might also lead to industrial or temporal differences regarding capital structure decisions. The data characteristics are chosen in line with recent meta studies (among others, Carney et al., 2011; Feld et al., 2013; Valickova et al., 2015). *MEANYEAR* accounts for a potential temporal development in the company's capital structure decision by measuring the age of the observed firm level data (among others, Carney et al., 2011; Feld et al., 2013). *DATERANGE* indicates the time coverage of a study (among others, Horváthová, 2010; Perdiguero-García, 2013). Further, *FIRMS* refers to the comprehensiveness of the study by counting the (logarithm of) number of observed firms (among others, Valickova et al., 2015). A remarkable amount of primary studies explicitly investigate small and medium-sized enterprises (SME). Therefore, *SME* explains potential differences in capital structure decisions caused by firm size. Moreover, *CROSS* captures variations induced by cross-sectional analyses in contrast to panel data analyses (among others, Carney et al., 2011; Doucouliagos & Ulubasoglu, 2008).

4.3.4 Publication characteristics

Among the publication characteristics, we sum up differences in study quality. *CITE* measures the (logarithm of) number of citations (plus 1) and controls effects caused by differences in study quality not captured by the other explanatory variables (among others, Havránek, Horváth, Irsova, & Rusnak, 2015; Kysucky & Norden, 2015). As this factor takes study-specific quality characteristics into account and is available for each study including also unpublished works, it is preferred over the journal impact factor. To control potential differences between published and unpublished works, we include the dummy variable *WP* in our analyses (among others, Carney et al. 2011).

4.3.5 Differences in model specification

A further special capability of MRA is the explicit analysis of differences in model specification. Thereby, we capture differences in the complexity of statistical procedures. Further, we are able to investigate in detail the impact of single control variables in order to reveal misspecification bias due to ignored controls. *OLS* and *HTRG* take differences in model specification into account (among others, Feld et al., 2013; Valickova et al., 2015). *OLS* refers to simple ordinary least squares approaches compared to more sophisticated techniques like structural equation modeling (among others, Chang, Lee, & Lee, 2009; Yang, Lee, Gu, & Lee, 2010). *HTRG* indicates if a study controls for unobserved heterogeneity by fixed or random effects. To address analysis of misspecification bias in primary studies, we include fourteen dummy variables for the most frequently employed control variables (TANGDUM, NDTSDUM, GROWDUM, MTBDUM, SIZEDUM, EVOLDUM, PROFDUM, AGEDUM, LIQDUM, DIVDUM, TAXDUM, ADDUM, RDDUM, and LAGLEVDUM).

4.4 Model specification

We estimate the MRA stated in Equations (4) and (5) while taking into account the following aspects. First, we apply weighted least squares (WLS) estimations such that the equations are multiplied by the inverse of the standard errors 1/SE(r_{ij}) (precision). This weighting consequently transforms the dependent variable into a *t*-statistic. This procedure is motivated by the fact that the standard errors of the reported estimates integrated in the models as explanatory variables usually have great variation across primary studies, which leads to heteroskedasticity. Consequently, we now assign larger weights to studies reporting lower standard errors and thus obtain more precise results (Hedges & Olkin, 1985). This procedure is in line with recent MRA research (Nelson & Kennedy, 2009; Stanley & Doucouliagos, 2015).

Second, another important issue is the handling of dependencies among the effect sizes, which arises from the fact that we include multiple estimates from the same study. To consider dependencies arising from the integration of all collected effect sizes, we use the cluster-robust variance estimation as proposed by Hedges, Tipton, and Johnson (2010). It neither requires an assumption about the specific form of sampling distribution nor knowledge of the covariance structure of the effect sizes. The latter is especially important, as correlation data is not available to us.

To test robustness, we alternatively apply a mixed-effects multilevel model (Raudenbush, Cooper, & Hedges, 1994). This procedure specifically accounts for within-study data dependencies if a single study reports multiple estimates based on data from the same country. Since results from the FAT-PET model and the multiple meta-regression model do not fundamentally differ from the MRA models using cluster-robust standard errors, we do not report them in this study.

5 Results of the meta-regression analysis

Our results are based on two different specifications of the MRA model. First, we apply a hierarchical subgroup analysis using the simple FAT-PET model following Equation 4. Second, we estimate the extended multiple MRA in the form of Equation 5 to explain heterogeneity of the reported results beyond publication selection bias.

5.1 Hierarchical subgroup analysis

We start the meta-analysis by examining the aggregated mean effects while testing for publication selection bias. To obtain a first impression about the presence of publication selection bias, we apply a graphical investigation via funnel plots. Therein, the effect sizes (partial correlations r) are plotted against their precision ($1/SE(r)$). As an example, Figure 1 shows the funnel plot of the effect sizes measuring the relation between capital structure and profitability. An unbiased sample should lead to a symmetric-inverted funnel, indicating that the deviations of the single effect sizes from their mean value decrease with an increasing precision of their estimation. Figure 1 tends to reject this hypothesis, as effect sizes are systematically underrepresented on the right side of the graph. Hence, researchers tend to favor reporting negative effects for the relation between capital structure and profitability. As this finding is a first indicator of the existence of publication selection bias in the field of determinants of capital structure, we thus proceed with statistical analysis. The funnel plots for all seven analyzed determinants can be found in Appendix F.

[PLEASE INSERT FIGURE 1 HERE]

For the statistical analysis, we perform a hierarchical subgroup analysis (among others, Bhaskar-Shrinivas et al., 2005; Geyskens, Krishnan, Steenkamp, Jan-Benedict E. M., & Cunha, 2009) using the simple FAT-PET model following Equation (4), in order to measure the aggregated mean effects captured by the PET and to make statistical inferences about potential publication selection bias measured by the FAT. Following the univariate analyses by Carney et al. (2011), we build subgroups using two criteria for differences in capital structure measurement as well as study quality. The differences in capital structure measurement are analyzed by splitting the measurement of capital structure (DR) into market leverage (ML), book leverage (BL), total debt (TD), and long-term debt (LTD). For analysis of study quality, we split our sample into reported results from top articles and from randomly selected articles. Table 5 sums up the regression results for the various subgroups (subgroup number 1 to 15).

[PLEASE INSERT TABLE 5 HERE]

According to the estimated mean effects corrected for publication selection bias in form of the PET, the variables TANG (positive sign), MTB (negative sign), and PROF (negative sign) are the most determining firm characteristics that influence corporate capital structure. Across the different subgroups, a significant mean effect is observable for TANG (subgroup number 2, 7, and 10) as well as for PROF (subgroup number 2, 4, 8, and 10), and for MTB (subgroup number 2, 4, 5, 6, 8, and 10). Hence, for these three variables we confirm the findings of the seminal studies by Frank and Goyal (2009), Harris and Raviv (1991), and Rajan and Zingales (1995). A comparison of the magnitudes of these significant mean effects indicates that TANG has the strongest economic effect on leverage, followed by MTB and PROF. With a consistently positive sign, the results for TANG indicate an increasing leverage for firms that have more tangible assets. The observed statistically significant coefficients range from 0.052 through 0.074 as displayed in Table 5. This positive effect can be explained by the tradeoff theory, as tangible assets decrease the costs of financial distress due to easier valuation by outsiders (Frank & Goyal, 2009). Further, the negative sign of the MTB variable, with statistically significant coefficients between -0.028 and -0.046, indicates that those firms provided with a large amount of profitable investment opportunities should focus on equity financing (Myers, 1977), since high market-to-book ratios seem to coincide with lower leverage ratios (Wu & Yeung, 2012). Following market timing theory in terms of market misvaluation, firms exploit equity mispricing through equity issuances when market-to-book ratios are high (Frank & Goyal, 2009). Alternatively, the negative relation might be explained through persistent financing policies (Chen & Zhao, 2004), although these conclusions are not undisputed (Mahajan & Tartaroglu, 2008). Our finding for MTB might be accounted for by the dynamic tradeoff model (such as, Kayhan & Titman, 2007) as MTB also captures persistent future growth opportunities (Hovakimian, 2006). Finally, PROF with a negative sign and statistically significant coefficients ranging from -0.026 to -0.028 (please refer to Table 5) can be justified by the pecking-order theory (Myers & Majluf, 1984). More profitable firms tend to finance their projects internally, leading to a lower leverage ratio. Also, the dynamic tradeoff model supports this view by arguing that firms passively accumulate profits. Our result for profitability supports the finding by Titman and Wessels (1988), who state a significant relationship exists only for market leverage, but not for book leverage. This implies that firms do not take advantage of increased market leverage due to increased profitability by increasing debt financing, which illustrates the dominance of transaction costs. However, firms increase debt financing to the degree as book value of equity increases due to increased profitability. Overall, empirical evidence supports the view that firms seem to adjust their capital structure according to book values. This can be explained by the fact that we obtain primarily insignificant results when solely looking at book leverage as a proxy for capital structure.

Continuing with the results from the FAT, a significant publication selection bias is surprisingly striking for the above-mentioned core factors MTB (subgroup number 3 and 10) and PROF (subgroup number 2, 4, 8, and 10). This finding supports the underlying assumption that researchers tend to overstate their results to align with existing theory and/or influential empirical literature. This becomes apparent as the sign of the FAT always shows in the direction of the mean effect identified by the PET.

Differences for the PET and FAT also occur in terms of study quality. In detail, results differ between the subgroups based on top articles (subgroup number 8 to 11) and randomly selected articles (subgroup number 12 to 15). As apparent from the PET, top articles share a rather common true effect size for TANG, MTB, and PROF indicated by significant coefficients in our MRA (subgroup number 8 and 10). Hence, top articles seem to be more uniform in terms of their research design. In comparison, none of the sub-samples of randomly selected articles yields a significant mean value for any of the investigated determinants, corroborated by the fact that a huge amount of heterogeneity in the results comes from randomly selected primary studies of a relatively lower quality. Continuing with the results from FAT, significant publication selection bias tends to be slightly more severe in top articles (subgroup number 8 and 10). This finding might indicate the tendency of internationally accepted journals to require a study to be in line with accepted literature and theory, as differing results are assumed to be less reliable (Card & Krueger, 1995).

Comparing the results from PET and FAT between different measures of capital structure, our findings show remarkable deviations between market (subgroup number 4, 8, and 12) and book measures (subgroup number 5, 9, and 13) of leverage. Here, we see a clear tendency that reported results based on market leverage share a common mean effect for TANG, MTB, and PROF but they also suffer more from publication selection. The latter might especially be explained by an additional degree of freedom in the form of the market component in the market leverage ratio, which accounts for future growth opportunities of a firm. This finding allows us to judge leverage based on book values of leverage as a more reliable proxy variable for capital structure, as used by, among others, Bhagat, Bolton, and Subramanian (2011), Hovakimian (2006), Lin, Phillips, and Smith (2008), Rajan and Zingales (1995). Between total debt (subgroup number 6, 10, and 14) and long-term debt (subgroup number 7, 11, and 15) the picture seems to be analogous. Studies using total debt measures tend to report more consistent effects, thus leading to significant mean effects. Furthermore, publication selection bias tends to be more severe for total debt measures including long-term and short-term debt.

5.2 Multiple meta-regression analysis

In the following, we additionally control for systematic differences between effect sizes by extending the FAT-PET-WLS model by 32 additional explanatory factors. The results shown in Table 6 are based on Equation (5). With the chosen model specification the goodness-of-fit measure (*adj.* R^2) ranges from 0.28 to 0.79 with a remarkable mean value of 0.46. Thus, we are able to explain a substantial part of the heterogeneity of reported results from empirical primary studies. In the following, the results for the explanatory variables are discussed specifically in terms of their effect on amplifying or diminishing influence on the empirical direction of the aggregated effects for the determinants of capital structure.

[PLEASE INSERT TABLE 6 HERE]

Regarding the results displayed in Table 6, it is worth noting that the significant publication selection bias measured by SE(r_{ij}) is diminished when controlling for the additional explanatory variables. Hence, we can argue that the selection of statistical results is especially driven by the analyzed measurement differences, regional differences, data characteristics, and differences in model specification. A significant regression coefficient of SE(r_{ij}) (FAT) only remains for NDTS (β = 0.8576) and PROF (β = -0.7859).

Moreover, we again confirm significant differences among the definitions of leverage. The usage of market leverage leads to significantly different results compared to book leverage for TANG (β = 0.0378), MTB (β = -0.0263), and PROF (β = 0.0186). For TANG and MTB, the usage of a market measure amplifies the effect between capital structure and the determinant in the direction of an overall positive mean effect for TANG and negative mean effect for MTB, respectively. Hence, our findings reject the result from Bowman (1980) in the case of the determinants of capital structure, which in general assumes a highly correlated behavior between book and market values of leverage. In the same way, the usage of total debt leads to significant deviations from long-term debt for TANG (β = -0.0570), NDTS (β = 0.0530), GROW (β = 0.0839), SIZE (β = -0.0221), and PROF (β = -0.0700). This result corresponds to the findings from Barclay and Smith (1995), who propose an impact of information asymmetry on debt maturity choice. This justifies differing results for the determinants of capital structure depending on debt maturity. Remarkably, results for the variable TD show that application of a long-term debt measure (excluding short term debt) always drives the results for the determinants of capital structure in the direction of the aggregated mean effects calculated in our study, except for PROF.

Among the studied regional effects, we only find limited evidence of an impact on the determinants of capital structure. In fact, we observe a significant impact of GDPGROW on TANG (β = -0.1211) and SIZE (β = -0.0766), of the US dummy on MTB (β = -0.0312), and of the CIVIL dummy on NDTS (β = -0.0353) and SIZE (β = -0.0249). Consequently, we were not able to confirm the finding from Anwar and Sun (2015) who state that foreign presence alters leverage. Both FDI and DEV do not show any impact on the determinants of capital structure, at least at the 5% level.

We only find limited evidence for the analyzed data characteristics. The results for DATERANGE imply that studies using a longer observation period, on average, report lower effects for TANG (β = -0.027) and SIZE (β = -0.0218). The same statement can be made for an increasing number of firms (FIRMS) in terms of NDTS (β = 0.0127) and MTB (β = 0.0149). CROSS shows that cross-sectional studies tend to report a diminished effect for GROW (β = 0.1403) but an amplified effect for EVOL (β = -0.0439) and PROF (β = -0.0395).

From the publication characteristics, we learn that the impact of study quality remains for MTB and SIZE even when controlling for regional effects, data characteristics, and differences in model specification. In fact, we find a statistically significant impact of the number of citations (CITE) on the reported results in primary studies for MTB (β = -0.0098) and SIZE (β = -0.0092).

Among the methodological differences, HTRG shows that studies controlling for unobserved heterogeneity report significantly deviating results. HTRG confirms that studies integrating unobserved heterogeneity in their analysis, on average, tend to report diminished estimated effects for EVOL (β = 0.0172) and PROF (β = 0.0315). Further, the results show that inclusion of control variables is especially important when analyzing the determinants SIZE, EVOL, and PROF. In these cases, several control variables show statistically significant coefficients.

For the multiple MRA model we do not interpret the results of the intercept in terms of a PET, due to the fact that no single mean value exists anymore. Rather, the mean value would have to be interpreted with regard to the explanatory variables. Hence, a wide range of mean values would be computable, depending on the desired conditions and the resultant variable manifestations.

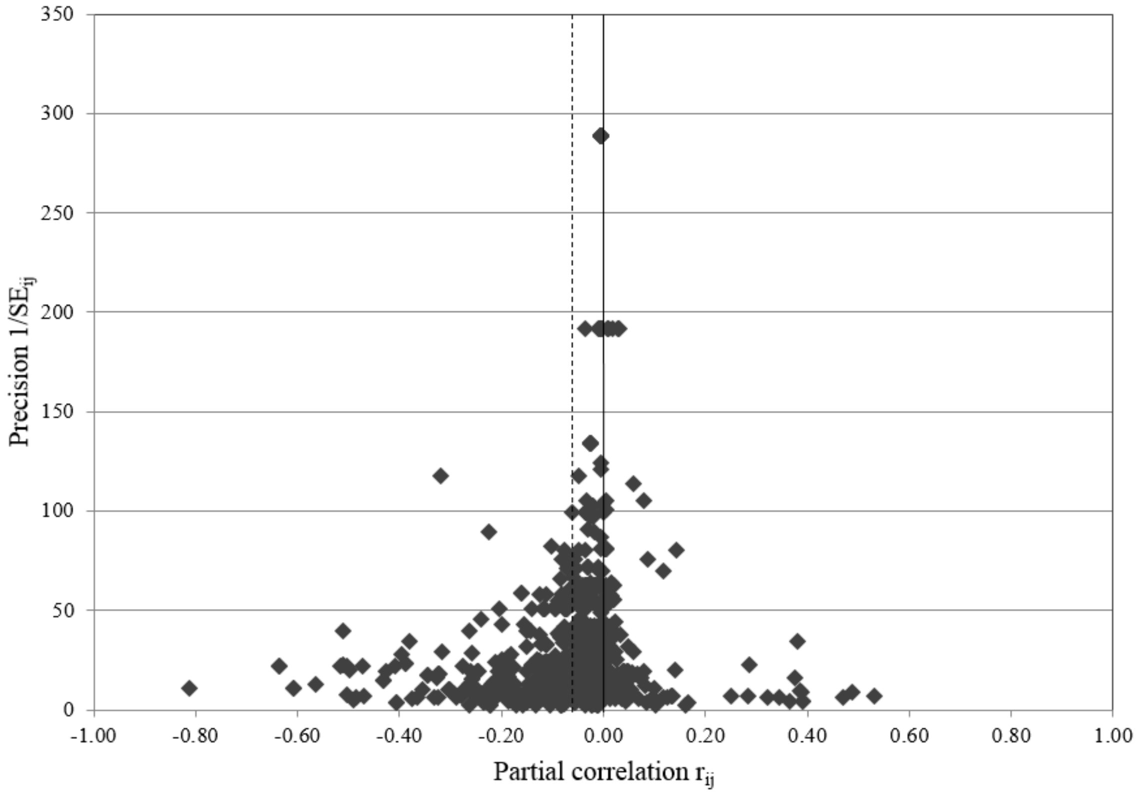
6 Conclusion

We aggregate existing mixed empirical evidence on the determinants of capital structure to explore the variation among results via MRA. Based on a sample of 3,890 reported results from 100 primary studies, our analysis allows the following five main conclusions. First, our results confirm that (in descending order) tangible assets (positive sign), market-to-book ratio (negative sign), and profitability (negative sign) significantly explain corporate capital structure. This implies three inferences: (1) Tangible assets significantly decrease the costs of financial distress due to the easier valuation by outsiders, which provides advantages to external financing. (2) Firms that are provided with a large amount of profitable investment opportunities should focus on equity financing to be able to exploit all opportunities. (3) More profitable firms should prefer internal financing for their projects in favor of a lower leverage ratio. Second, while studying heterogeneity we show that deviations from these mean effects are significantly driven by publication selection bias. Thus, specific results are systematically overrepresented, as authors prefer reporting statistically significant estimates in line with accepted theory and/or previous empirical research. Significant determinants as well as publication selection bias are more pronounced for characteristics like market-based measures of capital structure or total debt measures of capital structure or for top articles from highly renowned journals, as compared to book-based measures of capital structure or long-term debt measures of capital structure or randomly selected articles including more unknown and unpublished studies.

Overall, our findings leave some ambiguities and open issues for future research. The results for the determinants of capital structure do not seem to follow one single theory. Although each of them sounds plausible on its own, it would seem that the time has come to investigate new ideas in empirical research and recognize the constraints and tacit objectives caused by following accepted theories. Furthermore, researchers should be aware of former studies but stick to the facts and results produced by their own studies. Hence, we highly encourage researchers to provide independent analyses in order to allow further developments in the field of the determinants of capital structure. As noted by (Stanley, 2001, p. 147), we emphasize that "economic science cannot progress without independent empirical testing".

Figures

Figure 1: Funnel plot of the effect sizes measuring the relation between debt ratio (DR) and profitability (PROF)



This figure shows the funnel plot for the effect between debt ratio (DR) and profitability (PROF). The effect sizes (partial correlation coefficients) are plotted against their precision (inverse standard error). The dashed line represents the random effects mean (-0.062) as calculated in the section on descriptive statistics (Table 4).

Tables

Table 1: Determinants of corporate capital structure

Variable	**Tradeoff theory**	**Pecking-order theory**	**Market timing theory**
Asset tangibility	+	+/-	
Non-debt tax shield	-		
Firm growth	-	+	
Growth opportunities	-	-	-
Firm size	+	-	
Earnings volatility	-	+	
Profitability	+	-	

This table sums up the proxy variables used in empirical literature to explain capital structure decisions. "+", "-", and "?" indicate a positive, negative, and inconclusive impact of a certain variable on capital structure depending on the specific capital structure theory, respectively.

Table 2: Definitions of the analyzed variables

Variable	Abbreviation	Definition	Number of extracted effect sizes referring to a certain proxy variable
Measures of capital structure[1]			
Debt ratio	DR	Book value of total debt or long-term debt scaled by market or book value of the firm, market, or book value of equity respectively	1,041
Market leverage	ML	DR where equity is measured in terms of market value in the denominator	329
Book leverage	BL	DR where equity is measured in terms of book value in the denominator	712
Total debt	TD	DR where total debt is used to measure the amount of external capital in the nominator	705
Long-term debt	LTD	DR where long-term debt is used to measure the amount of external capital in the nominator	337
Determinants of capital structure[2]			
Asset tangibility	TANG	Tangible assets (scaled)	787
Non-debt tax shield	NDTS	Depreciation plus amortization (plus investment tax credits and tax-loss carryforwards) (scaled) Alternatively: earnings before interest and taxes minus tax payments (scaled)	299
Firm growth	GROW	Yearly turnover growth (scaled)	319
Growth opportunities	MTB	(Logarithm of) market value of assets (equity) to book value of assets (equity)	476
Firm size	SIZE	(Logarithm of) total assets, sales, or employees, respectively	910
Earnings volatility	EVOL	Standard deviation of earnings before interest and taxes, return on assets, respectively	308
Profitability	PROF	Earnings before interest and taxes (scaled)	791

This table lists the proxy variables reviewed in this paper. Beside variable name and abbreviation, the variable definitions used in primary studies are given in the third column. The last column shows the number of effect sizes measuring the relation between each proxy variable and debt ratio found in the sample of primary studies as used for the MRA calculations.

[1] The number of extracted effect sizes is calculated based on the number of regression equations in primary studies, where the specific DR measure is used as dependent variable, independent of the analyzed determinants.

[2] The number of extracted effect sizes is calculated based on the number of regression equations in primary studies, where the specific determinant is used as independent variable, independent of the analyzed measure of capital structure.

Table 3: Descriptive statistics

Determinant of capital structure	Number of studies	Number of effect sizes	Median *r*	Simple average *r*	Fixed effects average *r*	Random effects average *r*
TANG	81	787	0.043	0.046	0.024 (0.001)	0.048 (0.003)
NDTS	38	299	-0.006	0.002	-0.001 (0.002)	-0.001 (0.002)
GROW	39	319	0.017	0.058	0.043 (0.002)	0.045 (0.008)
MTB	40	476	-0.035	-0.039	-0.038 (0.001)	-0.038 (0.003)
SIZE	93	910	0.040	0.051	0.021 (0.001)	0.038 (0.003)
EVOL	38	308	-0.011	-0.021	-0.031 (0.002)	-0.024 (0.003)
PROF	81	791	-0.043	-0.066	-0.030 (0.001)	-0.062 (0.004)

This table lists the descriptive statistics for effect sizes measuring the relation between capital structure and a certain determinant. *r* stands for partial correlation coefficient. The standard deviation is presented in parentheses.

Table 4: Study characteristics

Variable	Description	Mean	SD
Measurement differences			
ML	= 1 if market leverage is used to calculate corporate capital structure, 0 otherwise	0.316	0.465
BL	= 1 if book leverage is used to calculate corporate capital structure, 0 otherwise	0.684	0.465
TD	= 1 if total debt is used to calculate corporate capital structure, 0 otherwise	0.677	0.468
Regional differences			
GDP	Logarithm of mean value of GDP per capita scaled by 1000 across the observed time period for the respective country[1]	2.481	1.395
GDPGROW	Mean growth rate of GDP per capita across the observed time period for the respective country[1]	0.059	0.047
US	= 1 if US firms are analyzed, 0 otherwise	0.343	0.475
CIVIL	= 1 if a country has a civil law system, 0 otherwise[2]	0.414	0.493
FDI	Logarithm of mean value of foreign direct investment (FDI) across the observed time period for the respective country[1]	0.550	0.981
DEV	= 1 if a country is classified as a developing country, 0 otherwise[3]	0.264	0.441
Data characteristics			
MEANYEAR	Logarithm of mean observation year of firm data used in a primary study less 1950	3.842	0.221
DATERANGE	Logarithm of number of observed years	2.119	0.859
FIRMS	Logarithm of number of observed firms	6.239	1.817
SME	= 1 if only small and medium sized enterprises are analyzed, 0 otherwise	0.141	0.348
CROSS	= 1 if cross-sectional data are analyzed, 0 otherwise	0.811	0.391
Publication characteristics			
CITE	Logarithm of number of citations plus 1 on Google Scholar as of April 27, 2016	4.026	1.956
WP	= 1 if the respective study is not published in a scientific journal yet, 0 otherwise	0.060	0.238
Differences in model specification			
OLS	= 1 if the study applies a simple ordinary least squares regression, 0 otherwise	0.455	0.498
HTRG	= 1 if the study controls for unobserved heterogeneity in the statistical approach through fixed or random effects, 0 otherwise	0.115	0.320
TANGDUM	= 1 if the study controls for tangible assets in the regression analysis, 0 otherwise	0.714	0.452
NDTSDUM	= 1 if the study controls for non-debt tax shield in the regression analysis, 0 otherwise	0.280	0.449
GROWDUM	= 1 if the study controls for firm growth in the regression analysis, 0 otherwise	0.344	0.475
MTBDUM	= 1 if the study controls for growth opportunities of a firm in the regression analysis, 0 otherwise	0.375	0.484
SIZEDUM	= 1 if the study controls for firm size in the regression analysis, 0 otherwise	0.839	0.368
EVOLDUM	= 1 if the study controls for earnings volatility in the regression analysis, 0 otherwise	0.293	0.455
PROFDUM	= 1 if the study controls for profitability in the regression analysis, 0 otherwise	0.729	0.445
AGEDUM	= 1 if the study controls for firm age in the regression analysis, 0 otherwise	0.214	0.410
LIQDUM	= 1 if the study controls for liquidity in the regression analysis, 0 otherwise	0.214	0.410
DIVDUM	= 1 if the study controls for dividend yield in the regression analysis, 0 otherwise	0.097	0.296
TAXDUM	= 1 if the study controls for corporate tax rate in the regression analysis, 0 otherwise	0.152	0.359
ADDUM	= 1 if the study controls for advertising intensity in the regression analysis, 0 otherwise	0.074	0.262
RDDUM	= 1 if the study controls for research and development intensity in the regression analysis, 0 otherwise	0.138	0.345
LAGLEVDUM	= 1 if the study includes a lagged variable of leverage in the regression analysis, 0 otherwise	0.129	0.335

This table presents the explanatory variables employed in the MRA. Beside the abbreviation of the variable name, a short description is given in the second column. The last two columns show the mean value and the sample standard deviation (SD) for the particular variable. The data are calculated based on the sample of 100 studies.

[1] The data are drawn from the World Bank: http://data.worldbank.org/

[2] The data are drawn from The World Factbook: https://www.cia.gov/library/publications/the-world-factbook/fields/2100.html

[3] Data for this classification is taken from the Organization for Economic Co-operation and Development (OECD): https://www.oecd.org/dac/stats/documentupload/DAC List of ODA Recipients 2014 final.pdf.

Table 5: Results of the FAT-PET models

Subsample according to study quality	All articles		Top articles		Randomly selected articles		All articles							
Subsample according to capital structure measure	DR		DR		DR		ML		BL		TD		LTD	
Subgroup number	**1**		**2**		**3**		**4**		**5**		**6**		**7**	
Regression coefficient	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**
TANG	0.111 (0.330)	0.038 (0.027)	0.119 (0.383)	**0.053**** (0.018)	0.231 (0.239)	0.001 (0.011)	0.173 (0.425)	0.070* (0.024)	0.102 (0.334)	0.017 (0.026)	-0.067 (0.385)	0.035 (0.032)	0.162 (0.343)	**0.074**** (0.024)
NDTS	0.133 (0.236)	-0.006 (0.01)	-0.674* (0.225)	0.018 (0.01)	0.425 (0.246)	-0.026 (0.009)	-0.385 (0.241)	0.010 (0.008)	0.230 (0.239)	-0.009 (0.009)	0.497 (0.281)	-0.011 (0.010)	-0.045 (0.163)	-0.028 (0.013)
GROW	0.459 (0.794)	0.016 (0.054)	-0.3151 (0.351)	-0.021 (0.023)	0.822 (1.132)	0.023 (0.074)	-0.571 (0.539)	-0.016 (0.018)	0.704 (1.034)	0.023 (0.071)	0.590 (1.052)	0.009 (0.061)	0.135 (0.346)	0.030 (0.049)
MTB	-0.007 (0.110)	-0.039* (0.006)	-0.184 (0.127)	**-0.037***** (0.007)	**0.962**** (0.169)	**-0.046*** (0.015)	-0.263 (0.156)	**-0.044**** (0.009)	0.189 (0.193)	**-0.030**** (0.009)	-0.149 (0.251)	**-0.038**** (0.008)	0.127 (0.213)	-0.030 (0.013)
SIZE	0.518* (0.165)	0.016 (0.013)	0.520 (0.371)	0.015 (0.034)	0.512 (0.422)	0.017 (0.018)	0.841 (0.444)	0.012 (0.031)	0.373 (0.141)	0.017 (0.010)	0.546 (0.194)	0.011 (0.014)	0.245 (0.188)	0.047* (0.019)
EVOL	0.138 (0.251)	-0.032 (0.021)	0.186 (0.370)	-0.037 (0.030)	-0.015 (0.283)	-0.014 (0.017)	0.423 (0.534)	-0.054 (0.039)	-0.063 (0.273)	-0.014 (0.023)	0.243 (0.331)	-0.034 (0.028)	-0.114 (0.305)	-0.023 (0.014)
PROF	-0.438 (0.189)	-0.037 (0.012)	**-0.483**** (0.185)	**-0.028**** (0.008)	-0.341 (0.386)	-0.054 (0.038)	**-0.474**** (0.161)	**-0.026**** (0.008)	-0.415 (0.247)	-0.044 (0.019)	-0.587 (0.219)	-0.035 (0.012)	-0.200 (0.186)	-0.035 (0.022)

Table 5: continued

Subsample according to study quality	Top articles								Randomly selected articles							
Subsample according to capital structure measure	ML		BL		TD		LTD		ML		BL		TD		LTD	
Subgroup number	**8**		**9**		**10**		**11**		**12**		**13**		**14**		**15**	
Regression coefficient	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**	**FAT ($\widehat{\beta_1}$)**	**PET ($\widehat{\beta_0}$)**
TANG	0.196 (0.440)	0.068* (0.025)	-0.012 (0.464)	0.037 (0.024)	-0.017 (0.452)	**0.052**** (0.021)	0.204 (0.728)	0.074 (0.038)	-1.406 (12.718)	0.157 (0.075)	0.232 (0.232)	-0.007 (0.007)	0.008 (0.396)	-0.011 (0.015)	0.126 (0.459)	0.073 (0.032)
NDTS	-0.700 (0.387)	0.018 (0.016)	-0.627 (0.352)	0.018 (0.017)	-0.124 (0.156)	0.009 (0.007)	-1.931 (0.419)	0.060 (0.021)	-0.112 (0.222)	0.008 (0.016)	0.490 (0.280)	-0.032 (0.010)	0.917 (0.386)	-0.041 (0.018)	-0.025 (0.210)	-0.019 (0.035)
GROW	-0.498 (0.472)	-0.024 (0.015)	0.169 (1.636)	-0.031 (0.102)	-0.294 (0.364)	-0.022 (0.025)	**-4.335***** (0.000)	**0.214***** (0.000)	-27.197 (13.235)	0.074 (0.051)	0.782 (11.122)	0.032 (0.073)	12.118 (1.764)	0.012 (0.105)	0.170 (0.332)	0.032 (0.047)
MTB	-0.361* (0.128)	**-0.043**** (0.009)	-0.008 (0.258)	-0.028* (0.010)	**-0.476**** (0.146)	**-0.034***** (0.008)	0.104 (0.285)	-0.031 (0.018)	14.042 (0.992)	-0.076 (0.062)	0.451 (0.175)	0.005 (0.009)	**10.168**** (0.191)	-0.054 (0.026)	**17.031**** (0.117)	-0.060 (0.040)
SIZE	0.843 (0.444)	0.006 (0.031)	0.139 (0.410)	0.026 (0.030)	0.505 (0.335)	0.012 (0.024)	0.385 (0.181)	0.037 (0.020)	-0.287 (0.733)	0.122 (0.054)	0.506 (0.407)	0.011 (0.015)	0.594 (0.515)	0.009 (0.018)	0.048 (0.373)	0.063 (0.046)
EVOL	0.580 (0.607)	-0.067 (0.041)	-0.481 (0.502)	-0.003 (0.024)	0.162 (0.368)	-0.037 (0.032)	0.533 (0.415)	-0.048 (0.018)	-0.691 (0.479)	0.017 (0.014)	0.104 (0.297)	-0.024 (0.021)	0.094 (0.488)	-0.004 (0.034)	-0.161 (0.372)	-0.023 (0.018)
PROF	**-0.459**** (0.160)	**-0.026**** (0.008)	-0.524 (0.330)	-0.029* (0.011)	**-0.708**** (0.213)	**-0.026**** (0.008)	-0.135 (0.238)	-0.018 (0.025)	-0.785 (0.424)	-0.009 (0.036)	-0.336 (0.438)	-0.056 (0.043)	-0.405 (0.578)	-0.052 (0.046)	-0.194 (0.266)	-0.061 (0.04)

The table sums up the regression coefficients from the FAT-PET-WLS model using weighted least squares estimation as described in Equation (4):

$$r_{ij} = \beta_0 + \beta_1 SE(r_{ij}) + \varepsilon_{ij}, \quad \varepsilon_{ij} \sim N(0; SE(r_{ij})^2)$$

The *t*-test of the regression coefficient β_1 in this model serves as a funnel asymmetry test (FAT) to detect publication selection bias. The intercept β_0 quantifies the mean effect size for the relation between capital structure and a certain determinant beyond potential publication selection bias in the form of a precision effect test (PET). In each regression model, the dependent variable is the effect size (partial correlation *r*) measuring the relation between a certain measure of capital structure (DR, ML, BL, TD, or LTD) and a certain determinant (TANG, NDTS, GROW, MTB, SIZE, EVOL, or PROF). The model considers data dependencies at the study level by cluster-robust errors and uses the inverse standard errors as weights. The standard deviations are displayed in parentheses.

Statistically significant values are displayed in bold: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Results of the multiple MRA

	Determinant	TANG	NDTS	GROW	MTB	SIZE	EVOL	PROF
	Emp. sign	+	-	-	-	+	-	-
	Intercept	0.3426	**-0.1796*** **	**-0.3743** **	-0.0969	0.3529*	-0.0211	-0.1422
		(1.53)	(-3.47)	(-2.48)	(-0.61)	(1.90)	(-0.13)	(-0.54)
FAT	**SE(r_{ij})**	0.2776	**0.8576****	1.1085	0.4037	0.2277	0.0372	**-0.7859*****
		(1.25)	(2.23)	(1.26)	(0.95)	(1.09)	(0.22)	(-3.59)
1	**ML**	**0.0378*****	-0.0061	-0.0367	**-0.0263****	0.0093	0.0031	**0.0186****
		(2.74)	(-1.19)	(-1.42)	(-2.34)	(1.19)	(0.32)	(2.04)
	TD	**-0.0570****	**0.0530*****	**0.0839*****	-0.0209	**-0.0221****	0.0098	**-0.0700****
		(-2.45)	(3.38)	(3.70)	(-1.51)	(-2.21)	(0.61)	(-2.05)
2	**GDP**	0.0011	0.0100*	0.0120	-0.0008	-0.0048	-0.0004	-0.0077
		(0.24)	(1.72)	(1.44)	(-0.16)	(-1.17)	(-0.10)	(-1.20)
	GDPGROW	**-0.1211****	0.0086	m	-0.0079	**0.0766*****	m	-0.0080
		(-2.08)	(0.31)		(-0.37)	(3.85)		(-0.15)
	US	-0.0036	0.0031	-0.0024	**-0.0312****	0.0002	-0.0024	0.0291
		(-0.24)	(0.35)	(-0.07)	(-2.32)	(0.01)	(-0.26)	(1.33)
	CIVIL	-0.0166	**-0.0353****	0.0075	-0.0132	**0.0249****	0.0173	-0.0117
		(-0.91)	(-2.27)	(0.19)	(-0.78)	(2.11)	(1.07)	(-0.81)
	FDI	-0.0099	-0.0028	-0.0158*	-0.0055	0.0007	0.0004	0.0041
		(-1.56)	(-0.72)	(-1.96)	(-1.33)	(0.14)	(0.09)	(0.58)
	DEV	-0.0091	0.0120	-0.0187	-0.0132	0.0036	0.0025	-0.0074
		(-1.23)	(1.15)	(-1.17)	(-1.68)	(0.45)	(0.75)	(-1.31)
3	**MEANYEAR**	-0.0630	m	m	0.0024	-0.0590	-0.0063	0.0433
		(-1.21)			(0.09)	(-1.44)	(-0.15)	(0.78)
	DATERANGE	-0.0277*	-0.0064	0.0063	0.0078	**-0.0218****	0.0030	0.0093
		(-1.82)	(-0.62)	(0.23)	(1.66)	(-2.18)	(0.34)	(1.05)
	FIRMS	m	**0.0127*****	-0.0000	**0.0149****	m	0.0006	m
			(2.81)	(-0.00)	(2.19)		(0.23)	
	SME	0.0014	-0.0095	0.0069	-0.0416	-0.0013	0.0174	-0.0091
		(0.19)	(-0.65)	(0.35)	(-1.43)	(-0.30)	(1.14)	(-1.19)
	CROSS	0.0165	0.0053	**0.1403****	0.0104	0.0177	**-0.0439*****	**-0.0395****
		(0.98)	(0.33)	(2.68)	(0.66)	(1.33)	(-2.80)	(-2.12)
4	**WP**	m	-0.0158	-0.0020	m	0.0166	-0.0165	m
			(-0.53)	(-0.04)		(0.59)	(-0.85)	
	CITE	0.0063	m	-0.0016	**-0.0098*****	**-0.0092*****	m	0.0066*
		(1.63)		(-0.12)	(-3.71)	(-3.16)		(1.96)
5	**OLS**	**0.0278****	-0.0042	0.0342	0.0174	-0.0206	0.0041*	0.0099
		(2.13)	(-1.03)	(0.92)	(1.34)	(-1.41)	(1.89)	(0.93)
	HTRG	-0.0108	0.0193	-0.0126	0.0286*	0.0269*	**0.0172*****	**0.0315****
		(-0.74)	(1.52)	(-0.70)	(1.77)	(1.66)	(2.75)	(2.61)
	TANGDUM		0.0002	0.0339	-0.0172	-0.0382*	-0.0141	-0.0078
			(0.02)	(1.19)	(-0.52)	(-1.71)	(-1.22)	(-0.33)
	NDTSDUM	-0.0067		-0.0496	-0.0344*	**0.0336*****	**0.0157****	0.0238
		(-0.40)		(-1.64)	(-1.69)	(2.74)	(2.15)	(1.49)
	GROWDUM	-0.0034	0.0195		0.0479*	0.0241	**0.0488****	**-0.1049*****
		(-0.14)	(0.77)		(1.76)	(1.64)	(2.26)	(-3.00)
	MTBDUM	0.0454*	0.0313	-0.0750		**0.0662****	**0.0407****	-0.0187
		(1.83)	(1.63)	(-1.41)		(2.50)	(2.71)	(-0.95)
	SIZEDUM	-0.0245	-0.0197	0.0983*	m		0.0172	-0.0002
		(-0.98)	(-0.93)	(1.96)			(0.79)	(-0.01)
	EVOLDUM	0.0019	0.0087	-0.0020	0.0015	**0.0381****		-0.0075
		(0.17)	(0.77)	(-0.07)	(0.09)	(2.31)		(-0.82)
	PROFDUM	-0.0061	m	**0.0947****	0.0181	0.0052	-0.0073	
		(-0.24)		(2.18)	(0.48)	(0.29)	(-0.33)	
	AGEDUM	-0.0235	m	0.0252	-0.0057	**-0.0757*****	**-0.0335****	0.0209
		(-1.13)		(0.64)	(-0.25)	(-5.27)	(-2.37)	(1.03)
	LIQDUM	0.0183	0.0156	**-0.1131*****	0.0758	**-0.0342****	-0.0244	**0.0888****
		(1.24)	(0.62)	(-2.72)	(1.14)	(-2.13)	(-1.01)	(2.41)
	DIVDUM	**-0.0504****	0.0070	0.0866	0.0006	-0.0136	0.0124	-0.0293*
		(-2.18)	(0.23)	(1.00)	(0.03)	(-1.06)	(0.50)	(-1.94)
	TAXDUM	-0.0047	0.0134	-0.0416	-0.0869	-0.0475*	0.0045	**0.0602*****
		(-0.25)	(0.76)	(-1.14)	(-1.67)	(-1.91)	(0.35)	(2.65)
	ADDUM	-0.0019	-0.0210	m	0.0274	-0.0164	m	-0.0048
		(-0.07)	(-1.39)		(0.98)	(-0.68)		(-0.15)
	RDDUM	-0.0109	-0.0036	**0.1463*****	-0.0111	**-0.0343*****	**-0.0364*****	-0.0156
		(-0.47)	(-0.18)	(3.10)	(-0.58)	(-2.74)	(-2.74)	(-0.71)
	LAGLEVDUM	-0.0050	-0.0277	0.0344	0.0486	-0.0001	-0.0026	0.0183
		(-0.38)	(-1.54)	(1.01)	(1.64)	(-0.01)	(-0.33)	(1.07)
	Adj. R^2	0.55	0.28	0.46	0.34	0.43	0.79	0.40

Observations	774	299	311	472	895	298	785

This table presents the results of the extended MRA model with cluster-robust errors as described in Equation (5):

$$r_{ij} = \beta_0 + \beta_1 SE(r_{ij}) + \sum_{k=1}^{K} \gamma_k Z_{ijk} + \epsilon_{ij}, \quad \epsilon_{ij} \sim N(0; SE(r_{ij})^2)$$

In addition to the funnel asymmetry test (FAT) by $SE(r_{ij})$, extension of the regression model by several study characteristics in the form of the additional *Z*-vector allows a more detailed analysis of the heterogeneity of the dependent variable. In each regression, the dependent variable is the effect size (partial correlation *r*) measuring the relation between capital structure and a certain determinant (TANG, NDTS, GROW, MTB, SIZE, EVOL, or PROF). In addition to measurement differences and the funnel asymmetry test (FAT), the regression models include several study characteristics, which control for (1) measurement differences, (2) regional differences, (3) data characteristics, (4) publication characteristics, and (5) differences in model specification. The corresponding explanatory variables are separated by horizontal lines. *t*-statistics are reported in parentheses.

Statistically significant values are displayed in bold: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

[m] The variable was dropped for multicollinearity reasons (VIF > 20).

References

Alfaro, L., Chanda, A., Kalemli-Ozcan, S., & Sayek, S. (2004). FDI and economic growth: the role of local financial markets. *Journal of International Economics, 64*(1), 89–112.

An, Z., Li, D., & Yu, J. (2016). Earnings management, capital structure, and the role of institutional environments. *Journal of Banking and Finance, 68,* 131–152.

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*(1), 59–92.

Anwar, S., & Sun, S. (2015). Can the presence of foreign investment affect the capital structure of domestic firms? *The Journal of Corporate Finance, 30,* 32–43.

Arnold, M. M., Rathgeber, A. W., & Stöckl, S. (2014). Determinants of corporate hedging: A (statistical) meta-analysis. *The Quarterly Review of Economics and Finance, 54*(4), 443–458.

Bae, K.-H., Kang, J.-K., & Wang, J. (2011). Employee treatment and firm leverage: A test of the stakeholder theory of capital structure. *Journal of Financial Economics, 100*(1), 130–153.

Baker, M., & Wurgler, J. (2002). Market timing and capital structure. *The Journal of Finance, 57*(1), 1–32.

Barclay, M. J., Morellec, E., & Smith, C. W. (2006). On the debt capacity of growth options. *Journal of Business, 79,* 37–59.

Barclay, M. J., & Smith, C. W. (1995). The maturity structure of corporate debt. *The Journal of Finance, 50*(2), 609–631.

Bathala, C. T., Moon, K. P., & Rao, R. P. (1994). Managerial ownership, debt policy, and the impact of institutional holdings: An agency perspective. *Financial Management, 23*(3), 38–50.

Belz, T., Hagen, D., & Steffens, C. (2016). R&D intensity and the effective tax rate: A meta-regression analysis. *Journal of Economic Surveys,*

Berger, P. G., Ofek, E., & Yermack, D. L. (1997). Managerial entrenchment and capital structure decisions. *The Journal of Finance, 52*(4), 1411–1438.

Bhagat, S., Bolton, B., & Subramanian, A. (2011). Manager characteristics and capital structure: Theory and evidence. *Journal of Financial and Quantitative Analysis, 46*(6), 1581–1627.

Bhaskar-Shrinivas, P., Harrison, D. A., Shaffer, M. A., & Luk, D. M. (2005). Input-based and time-based models of international adjustment: Meta-analytic evidence and theoretical extensions. *Academy of Management Journal, 48*(2), 257–281.

Bowman, R. G. (1980). The importance of a market-value measurement of debt in assessing leverage. *Journal of Accounting Research, 18,* 242–254.

Card, D., & Krueger, A. B. (1995). Time-series minimum-wage studies: a meta-analysis. *The American Economic Review, 85*(2), 238–243.

Carney, M., Gedajlovic, E. R., Heugens, P. P. M. A. R., van Essen, M., & van Oosterhout, H. (2011). Business group affiliation, performance, context, and strategy: A meta-analysis. *Academy of Management Journal, 54*(3), 437–460.

Chaikumburg, M., Doucouliagos, C., & Scarborough, H. (2016). The economic value of wetlands in developing countries: A meta-regression analysis. *Ecological Economics, 124,* 164–174.

Chang, C., Lee, A. C., & Lee, C. F. (2009). Determinants of capital structure choice: A structural equation modeling approach. *The Quarterly Review of Economics and Finance, 49*(2), 197–213.

Chen, L., & Zhao, X. S. (2004). Understanding the role of the market-to-book ratio in corporate financing decisions. *Available at SSRN 538944,*

Cole, R. A. (2013). What do we know about the capital structure of privately held US firms? Evidence from the surveys of small business finance. *Financial Management, 42*(4), 777–813.

Denis, D. J., & McKeon, S. B. (2012). Debt Financing and Financial Flexibility Evidence from Proactive Leverage Increases. *Review of Financial Studies, 25*(6), 1897–1929.

Doucouliagos, C., & Stanley, T. D. (2013). Are all economic facts greatly exaggerated?: Theory competition and selectivity. *Journal of Economic Surveys, 27*(2), 316–339.

Doucouliagos, C., Stanley, T. D., & Giles, M. (2012). Are estimates of the value of a statistical life exaggerated? *Journal of Health Economics, 31*(1), 197–206.

Doucouliagos, H., & Laroche, P. (2009). Unions and Profits: A Meta-Regression Analysis1. *Industrial Relations: A Journal of Economy and Society, 48*(1), 146–184.

Doucouliagos, H., & Stanley, T. D. (2009). Publication selection bias in minimum-wage research?: A meta-regression analysis. *BJIR: An International Journal of Employment Relations*, *47*(2), 406–428.

Doucouliagos, H., & Ulubasoglu, M. (2008). Democracy and economic growth: A meta-analysis. *American Journal of Political Science, 52*(1), 61–83.

Dreher, A. (2006). Does globalization affect growth?: Evidence from a new index of globalization. *Applied Economics, 38*(10), 1091–1110.

Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ: The British Medical Journal, 315*(7109), 629–634.

Erol, I., & Tirtiroglu, D. (2011). Concentrated ownership, no dividend payout requirement and capital structure of REITs: Evidence from Turkey. *The Journal of Real Estate Finance and Economics, 43*(1-2), 174–204.

Fan, J. P. H., Titman, S., & Twite, G. (2012). An international comparison of capital structure and debt maturity choices. *Journal of Financial and Quantitative Analysis*, *47*(1), 23–56.

Faulkender, M., & Petersen, M. A. (2006). Does the source of capital affect capital structure? *Review of Financial Studies, 19*(1), 45–79.

Feld, L. P., & Heckemeyer, J. H. (2011). Fdi And Taxation: A Meta-Study. *Journal of Economic Surveys, 25*(2), 233–272.

Feld, L. P., Heckemeyer, J. H., & Overesch, M. (2013). Capital structure choice and company taxation: A meta-study. *Journal of Banking and Finance, 37*(8), 2850–2866.

Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? *Financial Management, 38*(1), 1–37.

Geyskens, I., Krishnan, R., Steenkamp, Jan-Benedict E. M., & Cunha, P. V. (2009). A review and evaluation of meta-analysis practices in management research. *Journal of Management*, *35*(2), 393–419.

Goerg, H., & Strobl, E. (2001). Multinational companies and productivity spillovers: A meta-analysis. *The Economic Journal: The Journal of the Royal Economic Society*, *111*, 723–739.

Hang, M., Geyer-Klingeberg, J., Rathgeber, A., & Stoeckl, S. (2016). Economic Development Matters: A Meta-Regression Analysis on the Relation between Environmental Management and Financial Performance. *Journal of Industrial Ecology, Forthcoming*. Retrieved from https://ssrn.com/abstract=2879330

Harris, M., & Raviv, A. (1991). The theory of capital structure. *The Journal of Finance*, *46*(1), 297–355.

Havránek, T., Horváth, R., Irsova, Z., & Rusnak, M. (2015). Cross-country heterogeneity in intertemporal substitution. *Journal of International Economics, 96*(1), 100–118.

Havránek, T., & Irsova, Z. (2011). Estimating vertical spillovers from FDI: Why results vary and what the true effect is. *Journal of International Economics*, *85*(2), 234–244.

Hedges, L. V., & Olkin, I. (1985). *Statistical methods for meta-analysis*. Orlando, Fla.: Acad. Pr.

Hedges, L. V., Tipton, E., & Johnson, M. C. (2010). Robust variance estimation in meta-regression with dependent effect size estimates. *Research Synthesis Methods*, *1*(1), 39–65.

Horváthová, E. (2010). Does environmental performance affect financial performance?: A meta-analysis. *Ecological Economics*, *70*(1), 52–59.

Hovakimian, A. (2006). Are Observed Capital Structures Determined by Equity Market Timing? *Journal of Financial and Quantitative Analysis*, *41*(1), 221–243.

Hovakimian, A., Opler, T., & Titman, S. (2001). The debt-equity choice. *Journal of Financial and Quantitative Analysis*, *36*(1), 1–24.

Hunter, J. E., & Schmidt, F. L. (2004). *Methods of meta-analysis: Correcting error and bias in research findings* (2nd ed.). Thousand Oaks, Calif: Sage.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance and takeovers. *The American Economic Review*, *67*(2), 323–329.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics, 3*(4), 305–360.

Johnson, S. A. (1997). An empirical analysis of the determinants of corporate debt ownership structure. *Journal of Financial and Quantitative Analysis*, *32*(01), 47–69.

Jong, A. d., 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.

Kayhan, A., & Titman, S. (2007). Firms' histories and their capital structures. *Journal of Financial Economics*, *83*(1), 1–32.

Kayo, E. K., & Kimura, H. (2011). Hierarchical determinants of capital structure. *Journal of Banking and Finance*, *35*(2), 358–371.

Kim, W.-s., & Sorensen, E. H. (1986). Evidence on the impact of the agency costs of debt on corporate debt policy. *Journal of Financial and Quantitative Analysis, 21*(2), 131–144.

Kraus, A., & Litzenberger, R. H. (1973). A state-preference model of optimal financial leverage. *The Journal of Finance, 28*(4), 911–922.

Kysucky, V., & Norden, L. (2015). The benefits of relationship lending in a cross-country context: A meta-analysis. *Management Science, 62*(1), 90–110.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. (2000). Investor protection and corporate governance. *Journal of Financial Economics, 58*(1), 3–27.

Laux, C., Lóránth, G., & Morrison, A. (2017). The adverse effect of information on governance and leverage. *Management Science, in press*.

Lin, C.-m., Phillips, R. D., & Smith, S. D. (2008). Hedging, financing, and investment decisions: Theory and empirical tests. *Journal of Banking and Finance, 32*(8), 1566–1582.

Mahajan, A., & Tartaroglu, S. (2008). Equity market timing and capital structure: International evidence. *Journal of Banking and Finance, 32*(5), 754–766.

Mittoo, U. R., & Zhang, Z. (2008). The capital structure of multinational corporations: Canadian versus US evidence. *The Journal of Corporate Finance: Contracting, Governance and Organization, 14*(5), 706–720.

Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review, 48*, 261–297.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics, 5*(2), 147–175.

Myers, S. C. (1984). The capital structure puzzle. *The Journal of Finance, 39*(3), 574–592.

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.

Nelson, J. P., & Kennedy, P. E. (2009). The use (and abuse) of meta-analysis in environmental and natural resource economics: An assessment. *Environmental and Resource Economics, 42*(3), 345–377.

Nyamita, M. O., Garbharran, H. L., & Dorasamy, N. (2014). Factors influencing debt financing within State-owned corporations in Kenya. *Journal of Economics and Behavioral Studies, 6*(11), 884–905.

Öztekin, Ö. (2015). Capital structure decisions around the world: Which factors are reliably important? *Journal of Financial and Quantitative Analysis, 50*(3), 301–323.

Pandey, A., & Singh, M. (2015). Capital structure determinants: A literature review. *AJAAF: African Journal of Accounting, Auditing and Finance, 4*(2), 163–176.

Perdiguero-García, J. (2013). Symmetric or asymmetric oil prices? A meta-analysis approach. *Energy Policy, 57*, 389–397.

Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. (2002). Investor protection and corporate valuation. *The Journal of Finance, 57*(3), 1147–1170.

Post, C., & Byron, K. (2015). Women on boards and firm financial performance: A meta-analysis. *Academy of Management Journal, 58*(5), 1546–1571.

Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure?: Some evidence from international data. *The Journal of Finance*, *45*(1), 31–48.

Raudenbush, S. W., Cooper, H., & Hedges, L. V. (1994). Random effects models. *The handbook of research synthesis,* 301–321.

Rosenthal, R. (1979). The file drawer problem and tolerance for null results. *Psychological Bulletin, 86*(3), 638–641.

Ross, S. A. (1977). The determination of financial structure: the incentive-signalling approach. *The Bell Journal of Economics, 8*(1), 23–40.

Rusnak, M., Havránek, T., & Horváth, R. (2013). How to solve the price puzzle?: A meta-analysis. *Journal of International Economics*, *45*(1), 37–70.

Schmid, T. (2013). Control considerations, creditor monitoring, and the capital structure of family firms. *Journal of Banking and Finance, 37*(2), 257–272.

Shivdasani, A., & Stefanescu, I. (2009). How do pensions affect corporate capital structure decisions? *Review of Financial Studies*, *23*(3), 1287–1323.

Stanley, T. D. (2001). Wheat from chaff: Meta-analysis as quantitative literature review. *Journal of Economic Perspectives*, *15*(3), 131–150.

Stanley, T. D. (2004). Does unemployment hysteresis falsify the natural rate hypothesis?: A meta-regression analysis. *Journal of Economic Surveys*, *18*(4), 589–612.

Stanley, T. D. (2005). Beyond publication bias. *Journal of Economic Surveys, 19*(3), 309–345.

Stanley, T. D. (2008). Meta-regression methods for detecting and estimating empirical effects in the presence of publication selection. *Oxford Bulletin of Economics and Statistics, 70*(1), 103–127.

Stanley, T. D., & Doucouliagos, H. (2012). *Meta-regression analysis in economics and business* (Online-Ausg). New York: Routledge.

Stanley, T. D., & Doucouliagos, H. (2015). Neither fixed nor random: Weighted least squares meta-analysis. *Statistics in Medicine, 34*(13), 2116–2127.

Stanley, T. D., Doucouliagos, H., Giles, M., Heckemeyer, J. H., Johnston, R. J., Laroche, P., . . . Pugh, G. (2013). Meta-analysis of economics research reporting guidelines. *Journal of Economic Surveys*, *27*(2), 390–394.

Strebulaev, I. S. (2007). Do tests of capital structure theory mean what they say? *The Journal of Finance*, *62*(4), 1747–1787.

Stulz, R. M. (1999). Golbalization, corporate finance, and the cost of capital. *Journal of Applied Corporate Finance*, *12*(3), 8–25.

Stulz, R. M. (2005). The limits of financial globalization. *The Journal of Finance*, *60*(4), 1595–1638.

Titman, S., & Wessels, R. (1988). The determinants of capital structure choice. *The Journal of Finance*, *43*(1), 1–19.

Valickova, P., Havránek, T., & Horváth, R. (2015). Financial development and economic growth: A meta-analysis. *Journal of Economic Surveys*, *29*(3), 506–526.

van Campenhout, G., & van Caneghem, T. (2013). How did the notional interest deduction affect Belgian SMEs' capital structure? *Small Business Economics*, *40*(2), 351–373.

Wu, X., & Yeung, C. K. A. (2012). Firm growth type and capital structure persistence. *Journal of Banking and Finance*, *36*(12), 3427–3443.

Yang, C.-C., Lee, C.-f., Gu, Y.-x., & Lee, Y.-w. (2010). Co-determination of capital structure and stock returns: A LISREL approach ; an empirical test of Taiwan stock markets. *The Quarterly Review of Economics and Finance*, *50*(2), 222–233.

Measurement matters –

A meta-study of the determinants of corporate capital structure

APPENDICES

Appendix A: Reporting guidelines for meta-regression research

	Guidelines by Stanley et al. (2013)	This study
Research question		
1	Clear statement of the specific economic theories, hypotheses, or effects studied	The relevant theoretical background for the determinants of corporate capital structure is stated in section 2, followed by the theory of the analyzed moderating effects in section 4.4.
2	Precise definition of how effects are measured (the 'effect size') and explicit description of how measured effects are comparable	Section 3.2 includes the discussion and derivation of the partial correlation coefficients used as effect sizes in this study. Appendix E shows the relevant formulas for their calculation. Table 2 sums up the aggregated definitions of the variables of interest. Moreover, Section 4.4.1 explicitly refers to differences in variable definitions, captured as explanatory variables in order to make the effect sizes even more comparable.
Research literature searching, compilation and coding		
3	Full report of how the research literature was searched	Section 3.1 presents the search for literature and Appendix B shows the full details of the database search including the exact databases and further sources, employed keywords, and the date of the search.
4	Full disclosure of the rules for study (or effect size) inclusion/exclusion	Section 3.1 discusses the full set of inclusion criteria. An overview of the sample and its characteristics is given in Appendix C and Appendix D.
5	Statement addressing who searched, read and coded the research literature	At the beginning of Section 3, we discuss the procedure for the coding of the data.
6	Complete list of the information coded for each study or estimate	Table 4 gives an overview of all explanatory variables that have been coded. These variables also comprise the different dimension of explanatory variables suggested in the guidelines.
MRA modeling issues		
7	Descriptive statistics of the variables that are coded (means and standard deviations) and graph(s) displaying the effect sizes	Table 4 presents the means and standard deviations of the explanatory variables. A funnel plot of the effect size estimates is shown in Appendix F. As an example, the funnel plot for the effect between capital structure and profitability is described in the results section in detail as displayed in Figure 1.
8	Fully reported multiple MRA, along with the exact strategy used to simplify it (e.g., general-to-specific)	Section 5 and Table 5 refer to our baseline FAT-PET-WLS models. The results table contains all relevant estimation models with a description of the model specifications, goodness-of-fit statistics, and sample sizes. The results for the extended multiple models are further displayed in Table 7.
9	Investigation of publication, selection, and misspecification biases	Table 5 through Table 7 include the funnel asymmetry test for publication bias. The extended regression models controls for publication selection as well as several sources of misspecification bias (e.g., inclusion of important control variables like firm size).
10	Methods to accommodate heteroscedasticity and within-study dependence	The FAT-PET-WLS models in Table 5, Table 6 respectively, are based on cluster-robust standard errors, weighted least squares (WLS) multilevel models respectively. The results for the extended multiple MRA in Table 7 are again based on cluster-robust standard errors.
11	Results from MRA model specification tests, robustness checks or sensitivity analyses	Table 6 presents the results from the robustness test. This means an alternative specification of the within-study dependencies in the form of a multilevel model.

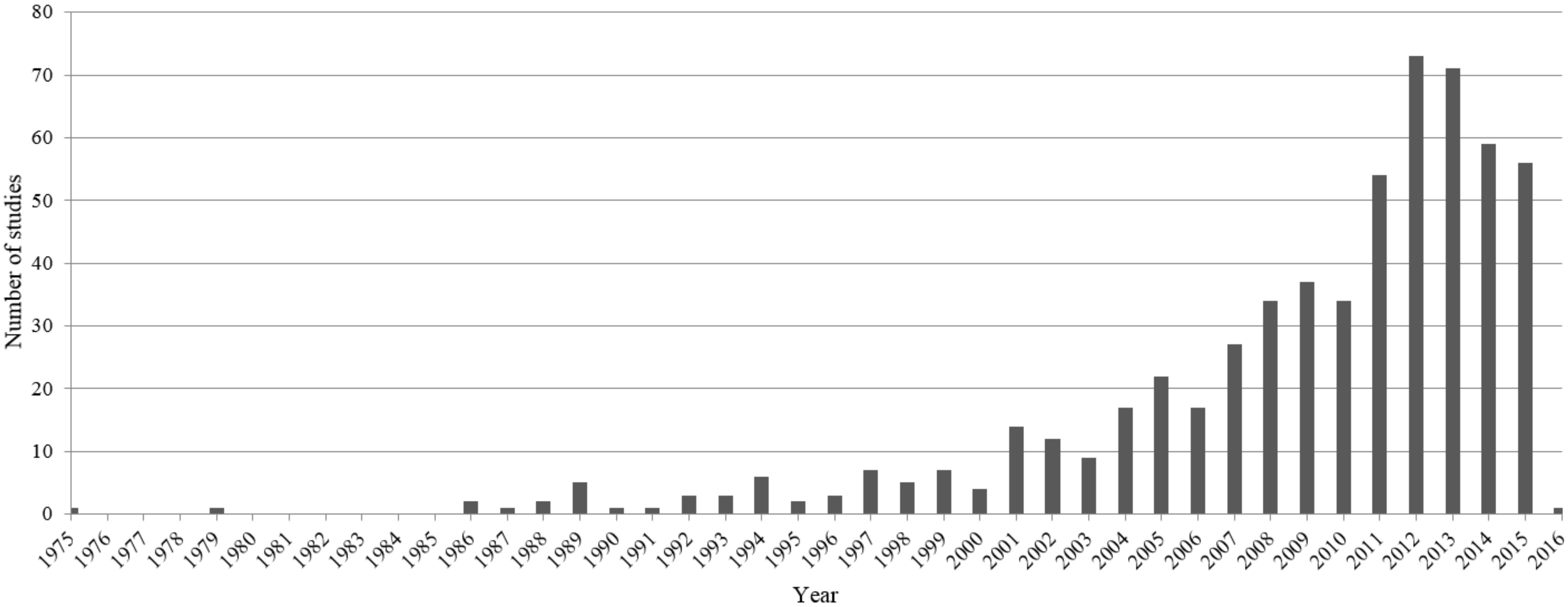
This table shows the reporting guidelines by Stanley et al. (2013) in the first column and the fulfillment of each requirement in the paper at hand in the second column.

Appendix B: Overview of the literature search process in electronic databases

Database	ABI/Inform Complete (via ProQuest) per November 19, 2015	Business Source Premier, EconLit, GreenFILE (via EBSCOhost) per November 19, 2015	SSRN (via ProQuest) per November 19, 2015
Search command	TI((capital structure OR Leverage OR Financing) AND (deter* OR affect* OR predict* OR factor* OR sample* OR evidence OR result* OR data OR investigat* OR test* OR empiric* OR survey* OR examine*))	ttl((capital structure OR Leverage OR Financing) AND (deter* OR affect* OR predict* OR factor* OR sample* OR evidence OR result* OR data OR investigat* OR test* OR empiric* OR survey* OR examine*))	TI((capital structure OR Leverage OR Financing) AND (deter* OR affect* OR predict* OR factor* OR sample* OR evidence OR result* OR data OR investigat* OR test* OR empiric* OR survey* OR examine*))
Search options	Language: English Date range: until November 19, 2015 Peer reviewed only		Language: English Date range: until November 19, 2015 Document type: Working paper
Search results	868	856	298
Number of studies after the title check	363	249	82
Relevant after content check	**242**	**181**	**51**
	Number of relevant studies from backward search	Number of relevant studies from forward search	Number of relevant studies from authors' publication lists
	145	**141**	**0**
Total number of relevant studies without duplicates	**591**		

The table presents the details of the literature search procedure started on November 19, 2015. Beneath the names of the electronic databases, the individual search command as well as the search options are listed. Afterwards, the numbers of search results are noted together with the numbers of remaining studies after checking the title in a first iteration and the content check in a second iteration. Based on the relevant studies, a backward search, a forward search, a data request for unavailable data, as well as a check of author's publication lists (for authors who wrote more than one relevant study) are performed. The corresponding numbers are given below. The last row shows the total number of primary studies that are integrated in the analysis of the study at hand.

Appendix C: Temporal distribution (publication year) of the 591 relevant primary studies



Appendix D: Overview of the final primary study sample for the MRA
(reference list available on request)

#	Author(s) (Year)	Published	Number of observed firms	Observation period	Observed countries
Top articles					
1	Antoniou et al. 2008	Y	4854	1987-2000	France, Germany, Japan, UK, US
2	Anwar and Sun 2015	Y	20515	2000-2007	China
3	Bae et al. 2012	Y	10562	2003-2007	US
4	Barclay et al. 2003	Y	5765	1980-1999	US
5	Bathala et al. 1994	Y	516	1988-1988	US
6	Berger et al. 1997	Y	452	1984-1991	US
7	Bhagat et al. 2011	Y	1101	1993-2007	US
8	Bharath et al. 2008	Y	2575	1973-2002	US
9	Bock and von Guericke 2013	Y	48	2010-2010	Germany
10	Caglayan and Rashid 2013	Y	5436	1999-2008	UK
11	Cole 2013	Y	3841	1987-2003	US
12	Cook and Tang 2010	Y	2493	1976-2005	US
13	Crutchley and Hansen 1989	Y	603	1981-1985	US
14	De Jong et al. 2007	Y	11845	1997-2001	Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Croatia, Denmark, Finland, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Italy, Japan, Korea, Malaysia, Mexico, Netherlands, New Zealand, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Singapore, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, UK, US, Indonesia
15	Driffield et al. 2007	Y	452	1994-1998	Indonesia, Korea, Malaysia, Thailand
16	Erol and Tirtiroglu 2011	Y	13	1997-2007	Turkey
17	Fan et al. 2012	Y	36767	1991-2006	Australia, Austria, Belgium, Brazil, Canada, Switzerland, Chile, China, Germany, Denmark, Spain, Finland, France, UK, Greece, Hong Kong, Indonesia, India, Ireland, Israel, Italy, Japan, Korea, Mexico, Malaysia, Netherlands, Norway, New Zealand, Pakistan, Peru, Philippines, Portugal, Singapore, Sweden, Thailand, Turkey, Taiwan, US, South Africa, Australia, Austria, Belgium, Brazil, Canada, Switzerland, Chile, China, Germany, Denmark, Spain, Finland, France, UK, Greece, Hong Kong, Indonesia, India, Ireland, Israel, Italy, Japan, Korea, Mexico, Malaysia, Netherlands, Norway, New Zealand, Pakistan, Peru, Philippines, Portugal, Singapore, Sweden, Thailand, Turkey, Taiwan, US, South Africa
18	Faulkender and Peterson 2005	Y	4219	1986-2000	US
19	Frank and Goyal 2009	Y	4644	1950-2003	US
20	Friend and Lang 1988	Y	984	1979-1983	US
21	Gaud et al. 2005	Y	104	1991-2000	Switzerland
22	Giambona et al. 2007	Y	57	1997-2003	US
23	Gilson 1997	Y	108	1980-1989	US
24	Graham 1999	Y	10100	1973-1994	US
25	Harford et al. 2008	Y	1188	1976-2005	US
26	Harrison et al. 2011	Y	127	1990-2008	US
27	Hirota 1998	Y	500	1977-1992	Japan
28	Hovakimian 2006	Y	2813	1983-2002	US
29	Hovakimian et al. 2001	Y	2073	1979-2000	US
30	Hovakimian et al. 2004	Y	736	1982-2000	US

31	Huang and Ritter 2009	Y	3376	1969-2001	US
32	Huyghebaert and Van de Gucht 2007	Y	244	1992-1992	Belgium
33	Jensen et al. 1992	Y	565	1982-1987	US
34	Johnson 1997	Y	847	1989-1989	US
35	Kale et al. 1991	Y	238	1984-1985	US
36	Kim and Sorensen 1986	Y	156	1978-1980	US
37	Lasfer 1995	Y	88	1972-1983	UK
38	Lemmon et al. 2008	Y	5791	1965-2003	US
39	Lin and Flannery 2013	Y	3051	1998-2009	US
40	Lin et al. 2008	Y	494	1992-1996	US
41	Mittoo and Zhang 2008	Y	965	1998-2002	Canada, US
42	Ovtchinnikov 2008	Y	4224	1966-2006	US
43	Petacchi 2015	Y	5285	1996-2004	US
44	Rajan and Zingales 1995	Y	4557	1987-1991	Canada, France, Germany, Italy, Japan, UK, US
45	Roberts and Sufi 2009	Y	4425	1996-2005	US
46	Schmid 2013	Y	695	1995-2009	Germany
47	Shivdasani and Stefanescu 2010	Y	1309	1991-2003	US
48	Taub 1975	Y	89	1960-1969	US
49	Titman and Wessels 1988	Y	469	1974-1982	US
50	Xu 2012	Y	3938	1989-2004	US
Randomly selected articles					
1	Abor 2008	N	230	1998-2003	Ghana
2	Abor and Biekpe 2007	Y	160	1998-2003	Ghana
3	Akhtara and Oliver 2005	N	360	1994-2003	Japan
4	An 2012	Y	45681	2002-2008	China
5	Bartoloni 2013	Y	2591	1996-2003	Italy
6	Bhaduri 2002	Y	363	1989-1995	India
7	Bhole and Jitendra 2004	Y	330	1984-2000	India
8	Campenhout and Caneghem 2013	Y	614	1998-2007	Belgium
9	Chen and Chen 2011	Y	647	2005-2009	Taiwan
10	Chen et al. 2013	Y	1481	2011-2011	China
11	Chhapra and Asim 2012	N	90	2005-2010	Pakistan
12	Chkir and Cosset 2001	Y	71	1987-1991	US
13	Crutchley et al. 1999	Y	812	1987-1993	US
14	Dang 2013	Y	635	1980-2007	France, Germany, UK
15	Daskalakis and Thanou 2010	N	1018	2003-2007	Greece
16	Gill et al. 2009	Y	300	2004-2005	US
17	Gottardo and Moisello 2013	Y	3006	2001-2010	Italy
18	Hassan et al. 2012	N	90	2005-2010	Malaysia
19	Hussain et al. 2015	Y	45	2003-2012	Malaysia
20	Jamal et al. 2013	Y	69	2007-2011	Malaysia
21	Kant 2014	N	48	2004-2010	Netherlands
22	Kara and Erdur 2015	Y	48	2006-2014	Turkey
23	Khrawish and Khraiwesh 2010	Y	30	2001-2005	Jordan
24	Kumar and Bodla 2014	Y	430	1991-2007	India
25	Kuoki and Said 2012	Y	244	1997-2007	France
26	La Rocca et al. 2010	Y	9515	2000-2000	Italy
27	Li et al. 2009	N	83414	2000-2004	China
28	Li et al. 2011	Y	8000	2002-2002	China

29	Lopéz-Garcia and Sánchez 2007	Y	858	1997-2004	Spain
30	Mittoo and Zhang 2010	Y	339	1990-2003	Canada, US
31	Olakunle and Jones 2014	Y	216	1997-2007	Nigeria
32	Ozkan 2001	Y	390	1987-1996	UK
33	Palacín-Sánchez et al. 2013	Y	13838	2004-2007	Spain
34	Qureshi et al. 2011	Y	22	1988-2006	Pakistan
35	Rezaei and Habashi 2012	Y	127	2006-2010	Iran
36	Salawu and Agboola 2008	Y	33	1990-2004	Nigeria
37	Sangeetha and Sivathaasan 2013	Y	50	2002-2006	Sri Lanka
38	Schoubben and van Hulle 2004	N	587	1992-2002	Belgium
39	Seelanatha 2010	Y	752	1999-2005	China
40	Serrasqueiro et al. 2014	Y	659	1996-2007	Germany, France, Italy, Netherlands, Portugal, Spain, UK, US
41	Serrasquiero et al. 2012	Y	854	1999-2005	Portugal
42	Tian et al. 2015	Y	1485	1999-2011	China
43	Tong and Green 2005	Y	44	2002-2003	China
44	Ukaegbu and Oino 2013	Y	2268	2004-2008	Nigeria
45	Vo and Nguyen 2014	Y	81	2007-2012	Vietnam
46	Wellalage and Locke 2013	Y	40	2003-2010	New Zealand
47	Westgaard et al. 2008	Y	308	1998-2006	UK
48	Wu et al. 2013	Y	340	1990-1999	Netherlands
49	Yarram 2013	Y	465	2004-2010	Australia
50	Yusuf et al. 2015	Y	57	2006-2011	Jordan

This table shows study characteristics for the underlying sample of primary studies analyzed in the MRA. In the second column, "Y" stands for published literature. Gray literature, such as dissertations, working and conference papers are marked by "N". The third column shows the number of firms analyzed in the respective study. If not directly presented, the number of firms is calculated from the number of observations. If a study uses different subsamples, the sample size corresponds to the mean number of firms. Column four and five name the time coverage of the analysis and the observed countries, respectively.

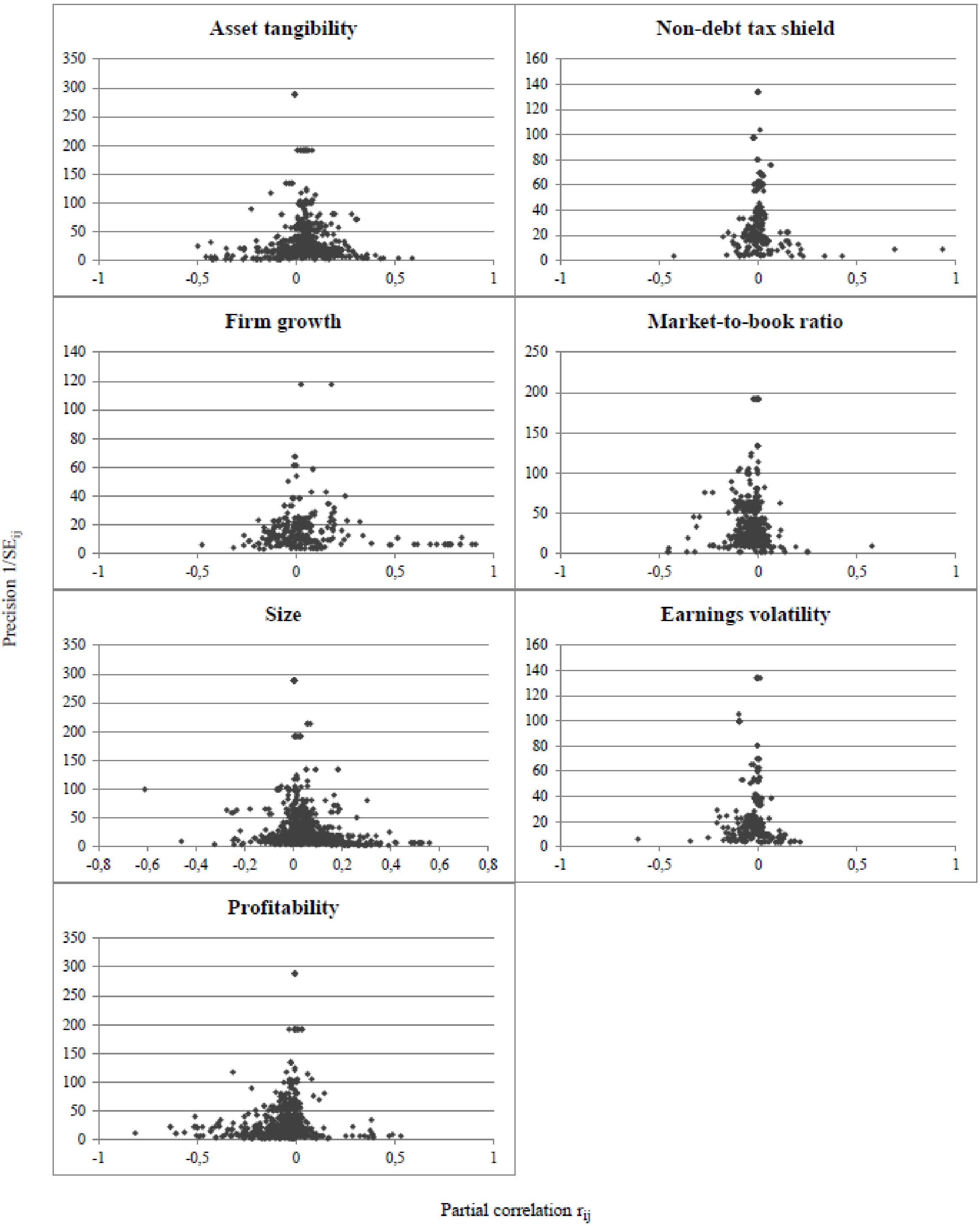
Appendix E: Formulas for the calculation of effect sizes

Effect size	Partial correlation r		Fisher's z-transformed correlations	
	r	SE(r)	z	SE(z)
Formula	$r = \frac{t}{\sqrt{t^2 + df}}$	$SE(r) = \sqrt{\frac{(1 - r^2)}{df}}$	$\mathrm{z} = \frac{1}{2}\ln\left(\frac{1 + r}{1 - r}\right)$	$\mathrm{SE(z)} = \frac{1}{\sqrt{n - 3}}$

This table presents the formulas for the calculation of the effect sizes and the corresponding standard errors (SE). Beside the effect sizes (partial correlation r and Fisher's z), t denotes the test statistic from the t-test applied on the regression slopes measuring the relation between capital structure and a certain determinant, df represents the degrees of freedom related to this test statistic, and n stands for the sample size of the respective sample used in the regression of the primary study.

If the level of significance is only given by asterisks, the corresponding upper limits are used as p-value (*** = 0.01, ** = 0.05 and so on). For results without an asterisk, p = 0.5 is used following the recommendation by Stanley and Doucouliagos (2012). This procedure leads to a consistently conservative coding, while introducing a measurement error.

Appendix F: Funnel plots



The figure presents the funnel plots for the analyzed effect sizes measuring the relationship between corporate capital structure and a certain determinant. In the absence of publication selection, the funnels should be symmetrically distributed around the most precise estimates.