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On the Capital Structure of Foreign Subsidiaries: Evidence from a Panel Data Quantile Regression Model

Abstract

This paper studies how variations in tax rates and profitability affect the (unconditional) quantiles of the distribution of the leverage of European foreign owned subsidiaries in the presence of unobserved company characteristics, possibly correlated with their observable dimensions. To achieve our goal, we suggest how to apply Firpo et al. (2009) approach to the estimation of unconditional quantile partial effects in a model with correlated random effects. The results show that the impact of taxes and profitability on subsidiaries' financial choices varies across different quantiles of the (skewed) distribution of leverage. In particular, when the leverage ratio is low enough, an increase in a subsidiary's tax rate stimulates its borrowing. When however, the leverage ratio is high enough, taxes do not matter. We also find that the parent company's tax rate has a positive impact on a subsidiary's leverage ratio only if its starting leverage ratio is low enough. Finally, profitability (proxied by ROA) has either a negative or null impact, depending on the leverage ratio and the tax rate used (namely, statutory or effective marginal tax rates).

JEL-Codes: C230, C210, G320, H250.

Keywords: panel data, quantile regression, corporate finance.

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1 Introduction

The empirical corporate finance literature has recently recognized that the determinants of companies' choices may vary according to their own financial structure. The use of conditional quantile regression (CQR) models to investigate such heterogeneity has become common and has produced interesting results for companies in the United States, as well as in European and developing countries (e.g. Fattouh et al. (2005, 2008); Arshanapalli and Nelson (2014); Aviral and Raveesh (2015); Chay et al. (2015); Gu et al. (2015)). The use of CQR is effective in making apparent the heterogeneity of responses, for example, to tax incentives. However, such estimated effects are conditional on specific values of other control variables (e.g., company size) and therefore they do not have a relevant policy interpretation. Indeed, the policy maker is in most cases concerned with the effects of an innovation on the unconditional distribution of the target variable. For example, it may be interested in studying the effects of a variation in the tax rate on the distribution of corporate indebtedness of the entire target population. In standard regression analysis, which studies the conditional expectation of the outcome variable, the conditional partial effect averages up to its unconditional counterpart. When quantile regression is used, this relation holds only if the conditional effect of a variable does not depend on the value of other variables (either observable or not). In all other cases, Firpo et al. (2009) show that using CQR estimates to calculate the effects on the unconditional distribution is often impractical. As a manageable alternative in the case of cross-sectional data, they suggest to adopt an *unconditional* quantile regression (UQR) approach.

In this paper, we use panel data and quantile regressions to investigate the determinants of foreign subsidiaries' leverage. Our empirical strategy relies on quantile regression techniques for panel data aimed at estimating the effects on the unconditional and conditional distribution of the outcome variable. The use of panel data allows us to control for heterogeneity due to both observable and unobservable company specific factors. Referring to quantile regression enables us to assess systematically if the impact of profitability and taxation is homogeneous across different levels of indebtedness. The presence of unobserved heterogeneity, possibly correlated with some observable characteristics, makes the estimation of the parameters a non trivial problem. We face this challenge by extending the unconditional quantile regression estimator by Firpo et al. (2009) to panel data, dealing with the presence of (possibly correlated) unobserved heterogeneity in the Chamberlain-Mundlak vein (Chamberlain, 1984), and also using a fixed effects estimator for the conditional quantile regression (Powell, 2016).

To do so, we exploit the data for a sample of European subsidiary companies held by a foreign owner, whose financial decisions may be affected by both their domestic tax rate and the parent company's one. The use of this sample has two main advantages. Firstly, it allows us to compare our findings with those obtained by the growing literature on multinational companies' capital structure (see, e.g., Feld L.P., 2013). Secondly, the noticeable heterogeneity of tax rates across country is a major source of variability for the tax incentives to debt, and allows a sharper identification of their effects on the capital structure.

Our results show that the response of capital structure to taxes and profitability varies across different quantiles of the (skewed) distribution of the leverage. More specifically, the impact of profitability on the leverage ratio is either negative or nil depending on the firms' leverage. For what concerns tax incentives, the use of the quantile regression approach points out that changes in taxation are quite heterogeneous. As will be shown, subsidiaries' tax rates have a positive impact on debt finance only if the leverage ratio is low enough. On the other hand, parent companies' tax rates have either a positive or a null impact, depending on the starting leverage. In sum, we can say that there is room for debt shifting if leverage is low enough. Otherwise, this effect vanishes.

The structure of this article is as follows. Section 2 discusses the relevant literature dealing with the effects of taxation and profitability on a firm's capital structure. Section 3 focuses on the existing techniques based on quantile regressions and proposes a strategy to estimate the unconditional quantile effects in the presence of correlated random components. Section 4 discusses some preliminary evidence on the capital structure of our sample of European foreign subsidiaries. In Section 5 we use this dataset to estimate the effects of both the subsidiary's and parent company's tax rates on a subsidiary's leverage ratio, as well as the impact of profitability on leverage. As expected, the subsidiary's tax rate has a positive impact on leverage. The parent company's tax rate has a positive impact when a static specification is used. Finally, the effect of profit is either negative or nil. Section 6 provides a summary of our results.

2 Capital structure, profitability and corporate taxation: relevant literature

There is an ample empirical debate about which of the two main theories (*Pecking Order* and *Trade-Off*) is a better predictor of firms' financial choices. According to the *Pecking Order Theory* firms prefer debt to equity because the former source of finance has lower information costs associated than the latter (see Myers, 1984 and Myers, 1993). This means that the higher the profit the less the firm borrows. Moreover, taxation does not play a crucial role. According to the *Trade-Off Theory*, a firm is expected to choose the optimal leverage by trading off the costs and tax benefits of debt finance.[1]

[1] The effect of profitability on a firm's leverage is a key element to deal with the well-known diatribe between the *Pecking Order* and the *Trade-Off* theories. The *Pecking Order Theory* is based on the existence of a hierarchy between alternative financing sources due to adverse selection issues. According to this theory, firms prefer internal (i.e., retained earnings) to external finance. When however outside funds are necessary, firms prefer debt to equity

Long and Malitz (1985) use cross-sectional data from Compustat to validate the prediction of *Pecking Order Theory* that firms prefer internal funds to the capital market. In the same vein, the negative relationship between profitability and leverage finds "some support" from the results of Titman and Wessels (1988), Rajan and Zingales (1995), for companies from the G-7 countries, and Booth et al. (2001) for companies from developing countries. Fama and French (2002) exploit the longitudinal nature of their data to study who wins the horse race. In doing so, they estimate a negative relationship between profit and leverage, that is "*one scar on the trade-off model*". Tax economists have mainly looked at the capital structure from a slightly different perspective, i.e., by focusing on the financial decisions of multinational companies (MNCs). In particular, they have studied the MNCs' ability to shift debt from high- to low-tax jurisdictions. A complete review of the literature is beyond the scope of this article, but to our aims, it is relevant to highlight the heterogeneity of the research strategies adopted by the scholars. The approach typically looks at the differential between the subsidiary's and the parent company's tax rate (τ_S and τ_P, respectively)

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because the former has lower information costs than the latter (see Myers (1984) and Myers (1993)). According to the *Pecking Order Theory* therefore, the higher the profit (and thus, the ability to self-finance a business activity) the less a firm is expected to borrow. Although the original *Pecking-order* theory does not consider taxation, the estimation of a positive tax effect on leverage does not contradict it. The reason is simple: a tax rate increase reduces the after-tax profit and therefore the ability to self-finance a firm's business activity. In line with the *Pecking Order Theory*, therefore, a tax rate increase might oblige a firm to increase borrowing.

The static *Trade-Off Theory* states that firms are expected to choose their capital structure by trading off the costs and benefits of debt finance (see, e.g., Graham et al. (2013)). While debt costs are mainly due to the dead-weight losses caused by default, benefits are closely linked to tax savings due to the deductibility of interest expenses (see, e.g., Fischer et al. (1989) and Leland (1994)). According to this framework, a tax rate increase raises the tax saving due to interest deductibility. Since the tax benefit of borrowing rises, the *Trade-Off Theory* predicts that, for a given expected marginal cost (of default), it is optimal to increase the leverage ratio.

We can say that both theories therefore deliver the same prediction about the link between business taxation and leverage: namely, the higher the tax rate, the higher the optimal debt ratio. However, they have have diverging views about the relationship between profitability and leverage. According to the *Pecking Order Theory*, an increase in profit allows a firm to increase self finance and thus reduce borrowing. This means that there is a negative relationship between profitability and leverage. According to the *Trade-Off Theory* however, an increase in profitability reduces the probability of default for a given tax rate. Since the expected marginal cost of default drops, a firm finds it optimal to increase the leverage ratio. The relationship is therefore positive. If we look at the empirical results we can see that, in most cases, there is a negative relationship between profitability and leverage, supporting the *Pecking Order Theory* against the static *Trade-Off Theory*. More recently, both the *Pecking Order* and the *Trade-Off Theory* have been supported by dynamic models. A review of this literature is of course beyond the scope of this article. However, it is worth mentioning Abel (2018) who shows that, when borrowing constraints are not binding, the Trade-off Theory holds, although profitability has a negative effect on the leverage ratio.

as the main determinant of debt shifting within a multinational group: scholars expect that τ_S stimulates the subsidiary's leverage and that the opposite is true when τ_P rises.[2] The empirical literature started with studies on US and Canadian companies, with paper such as Collins and Shackelford (1992) and Froot and Hines Jr (1995) who used consolidated financial accounting data from Compustat and showed that taxation affect firms' financial activities. Using the data from large companies, Altshuler and Mintz (1996) studied the impact of changes to interest allocation rules in the 1986 tax reform. Desai et al. (2004) exploited confidential company data and found that a 10% increase of the tax rate is associated with 2.8% rise of the debt ratio of the affiliates and that internal debt is particularly sensitive. The research on European companies started later. For instance, Ramb and Weichenrieder (2005) showed that the tax rates of the parent companies have no statistically significant effect on their subsidiaries' leverage, whereas Overesch and Wamser (2010) studied the effects of parent companies' tax rates on their own capital structure. Moreover, using the effective cross-border tax rates Huizinga et al. (2008) estimated a negative impact of parent company taxation. As shown by Miniaci et al. (2014) however, the effects of a change in parent company tax rate are much more complex, because taxes affect both a MNC's borrowing decision and the distribution of debt among its entities. Accordingly, the meta-analysis of the empirical literature on corporate capital structure by Feld et al. (2013) emphasized the complexity of tax effects at a multinational level. Based on 48 studies, they estimate a marginal tax effect on the debt ratio of about 0.27, that is, the debt-to-assets ratio rises by 2.7% if the marginal tax rate increases by 10%. When however they focus on the capital structure of foreign subsidiaries, taxation has a more complex impact, as the tax sensitivity of inter-company debt financing is particularly strong. Overall, their meta-analysis does not support the idea that the international tax system affects the financing decisions of multinational firms. These results show that there is room for further research aimed at focusing on firms' heterogeneity.

It is worth noting that many empirical works, in both the corporate finance and taxation literature, rely on panel data sets with a large number of companies and a short time period. Typically, they use linear models and only seldom account for the presence of unobserved individual heterogeneity, possibly correlated with some of the covariates. Moreover, they rarely pay attention to the fact that the effects of changes in tax rates and/or profitability on the debt ratios may differ across companies, e.g., depending on the initial ratio. There are some noticeable exceptions, mainly Lem-

[2]To explain this point, let us use a simple numerical example where that $\tau_S = 20\%$ and $\tau_P = 40\%$. In this case, the multinational group might shift debt from one country to another. In particular, if the subsidiary and the parent company sign a loan contract where the former is the lender and the latter is the debtor, paying the interest. A tax saving may occur, if interest expenses are deductible. Indeed, the subsidiary taxes the active interest at a rate of 20%, while the parent company faces a deduction. Assuming that the interest payment is equal to 10 Euros, the group's net benefit is equal to 10 times the tax rate differential (τ_S -τ_P).

mon et al. (2008) and Baker and Wurgler (2002). As regards the tax literature, Fattouh et al. (2008) also apply conditional quantile regression methods to study the choice of leverage ratio made by UK listed companies. They find that the estimated effect of explanatory variables differs at different quantiles of the distribution. Moreover, the effect of a variable may change sign between low leveraged and high leveraged firms. Gu et al. (2015) resort to a quantile regression (QR) approach as a robustness check in their study of the taxation in international banking, without fully deal with the longitudinal nature of the data. Like standard linear regression models, the consistency of the estimated parameters, and hence the reliability of the policy prescriptions, heavily depends on the likelihood of the assumption adopted about the existing relation between observable and non observable heterogeneity of the companies. The existing literature either neglects the existence of time-invariant company-specific unobserved heterogeneity, or (implicitly) assumes it is uncorrelated with the observed characteristics of the company. These are quite crucial assumptions, since leverage may also depend on unobservable time-invariant and firm-specific components. In principle, the existence of such an unobserved component can invalidate results and should therefore be accounted for, nevertheless, scholars often ignore this issue (e.g. Chay et al., 2015). The only noticeable exception is, to the best of our knowledge, Ferrarini et al. (2017) who study the leverage of the Chinese listed companies using the fixed effect conditional quantile regression suggested by Powell (2016). It is worth noting that all the published papers use conditional QR models. This may undermine the policy implications of the estimated results, since it would be hard to extend the empirical findings to a heterogeneous population. For this reason, we propose a strategy to apply the unconditional quantile regression models to the case of panel data (with possibly correlated random effects) and compare the conditional and the unconditional effects on leverage due to tax changes. We will show that the policy implications depart from those consolidated in the literature.

3 Quantile regression: overview

Quantile Regression (QR) was first proposed by Koenker and Bassett Jr (1978), who generalized Boscovich's idea of using the regression to the median to estimate the conditional quantiles of a response variable Y_{it}, given a vector of regressors $\mathbf{X}_{it}$ (see Koenker and Bassett, 1985). Along with expectile regression (see Newey and Powell, 1987), QR is an alternative to mean regression methods and is particularly useful when the independent variables have potentially varying effects at different points of the conditional distribution of the response variable, $Y_{it}|\mathbf{X}_{it}$. QR models can be used to characterize the entire conditional distribution $y|\mathbf{x}$, they are relatively simple to estimate, and they are robust to the presence of outliers. Thus, they find useful applications whenever the object of interest is the entire conditional distribution of the outcome variable, in medicine (i.e. to study extreme low infant birthweight, e.g. Abrevaya and Dahl, 2008), in finance (to estimate the

Value-at-Risk, e.g. Engle and Manganelli, 2004), in labour economics (e.g. Firpo et al., 2009) and in corporate finance (e.g., Fattouh et al., 2008).

As in the standard conditional mean regression framework, when panel data are available QR models have to deal with the presence of unobserved time-invariant heterogeneity. Assume the data generating process (DGP) is

$$Y_{it} = h\left(\mathbf{X}_{it}, \alpha_i, \mathbf{u}_{it}\right) = \alpha_i + \mathbf{X}_{it}'\beta\left(\mathbf{u}_{it}\right) \tag{1}$$

$$\mathbf{u}_{it}|\mathbf{X}_{it}, \alpha_i \sim U\left(0,1\right) \tag{2}$$

where the time-invariant unobserved component α_i enters the model linearly; is potentially correlated with the observable characteristics $\mathbf{X}_{it}$; and, conditional on $\mathbf{X}_{it}$ and α_i, the idiosincratic random term $\mathbf{u}_{it}$ is *iid* uniform. Under these assumptions, the (structural) conditional quantile function is:

$$CQ\left(\tau, x, \alpha\right) = Q_\tau\left(Y_{it}|\mathbf{X}_{it} = x_{it}, \alpha_i = \alpha_i\right) = \alpha_i + x_{it}'\beta\left(\tau\right) \tag{3}$$

To estimate $\beta\left(\tau\right)$, Koenker (2004) and Lamarche (2010) propose a ℓ_1 Penalized Quantile Regression estimator, where a penalty parameter λ is used to shrink the vector of additive individual effects α_i. Koenker (2004) leaves the question of how to tune λ unanswered, whereas Lamarche (2010) suggests to select it in order to minimize the asymptotic variance of the fixed-effects estimator. The ordinary (cross sectional) QR estimator fully shrinks this components towards zero; at the opposite, the fixed effects estimator performs no shrinkage (thus potentially incurring in the curse of dimensionality), while the PQR shrink the unobserved heterogeneity component according to the penalty parameter λ. Lamarche (2010) shows that the Penalized QR estimator is unbiased, robust, and attains the minimum variance in the class of QR estimator for longitudinal data. For comparison, the ordinary QR estimator, the fixed-effect QR estimator and the PQR estimator correspond to the OLS, LS dummy variable, and penalized LS in the regression to the mean framework. Canay (2011) proposes a simple two-step approach: in the first stage, an estimate of the individual effect (say α_i) is obtained as by-product of the LS within-group fixed effects estimator of Y on the covariates X; in the second stage, a standard QR method is used for the regression of the modified version of the outcome variable $\hat{y}_{it} \equiv y_{it} - \hat{\alpha}_i$ on the covariates of interest. Notice that these estimation strategies of the conditional quantile function with additive fixed effects allow a researcher to characterize the conditional distribution $\left(Y_{it} - \alpha_i\right)|\mathbf{X}_{it}$, rather than $Y_{it}|\mathbf{X}_{it}$. The more the time invariant component α is relevant, the less the information on $\left(Y_{it} - \alpha_i\right)|\mathbf{X}_{it}$ is informative on $Y_{it}|\mathbf{X}_{it}$.

Alternative approaches are proposed by Abrevaya and Dahl (2008); Bache et al. (2013); Geraci and Bottai (2007) and Geraci and Bottai (2014); Arellano and Bonhomme (2016). They consider extensions of the Correlated Random Effects (CRE) model proposed in Chamberlain (1982) and Chamberlain (1984) to the conditional quantile regression framework. Chamberlain controls for dependence between the set of (possibly endogenous) covariates $\mathbf{X}$ and the unobserved heterogeneity term α, by assuming that their relation can be approximated by a linear (in parameters) model. In doing so, they overcome the limitation of the pure random-effects models, which assume the unobserved heterogeneity to be uncorrelated with all the covariates.

The proposed extensions to the QR require neither linearity of the relation between $\mathbf{X}$ and α,nor the additivity of the heterogeneity term as in (1). Similarly, Powell (2016), in the spirit of Chernozhukov and Hansen (2005), considers the more general case

$$Y_{it} = h\left(\mathbf{X}_{it}, \mathbf{v}_{it}\right) = \mathbf{X}_{it}'\beta\left(\mathbf{v}_{it}\right) \tag{4}$$

$$\mathbf{v}_{it}|\mathbf{X}_i \sim \mathbf{v}_{is}|\mathbf{X}_i \tag{5}$$

$$CQ\left(\tau, x\right) = Q_\tau\left(Y_{it}|\mathbf{X}_{it} = x_{it}\right) = x_{it}'\beta\left(\tau\right) \tag{6}$$

where $\mathbf{v}_{it} = f\left(\alpha_i, \mathbf{u}_{it}\right)$ for some unknown function f,and $\mathbf{X}_i' = \left(\mathbf{X}_{i1}', \ldots, \mathbf{X}_T'\right)$. Here the βs are identified (and estimated) thanks to the within group variation (that is, relying on $\mathbf{X}_{it} - \bar{\mathbf{X}}_i$). The estimated parameters refer to the conditional distribution of the outcome variable, $Y_{it}|\mathbf{X}_{it}$, and can be interpreted as in the cross-sectional QR.

The *conditional quantile regression* (CQR) discussed so far recovers the partial effect of a change in the covariates on a specific quantile of the conditional distribution of Y given X. Notice that

$$CQ\left(\tau, x\right) = Q_\tau\left(Y_{it}|\mathbf{X}_{it} = x_{it}\right) = h\left(x_{it}, Q_\tau\left(\mathbf{v}_{it}\right)\right)$$
$$Q\left(\tau\right) = Q_\tau\left(Y_{it}\right) = Q_\tau\left(h\left(\mathbf{X}_{it}, \mathbf{v}_{it}\right)\right) = q_\tau$$

and

$$Q\left(\tau\right) \neq E_X\left[CQ\left(\tau, x\right)\right],$$

that is, unlike conditional means, conditional quantiles do not average up to their unconditional population.

Following Firpo et al. (2009), we define the conditional and unconditional quantile partial effects ($CQPE$ and $UQPE$) as

$$CQPE(\tau,x) = \frac{\partial h(x_{it}, Q_\tau(\mathbf{v}_{it}))}{\partial x}$$
$$UQPE(\tau) = \frac{\partial Q_\tau(h(\mathbf{X}_{it}, \mathbf{v}_{it}))}{\partial x},$$

respectively. From a policy perspective, $UQPE$ is the main object of interest (see, e.g., in Borah and Basu, 2013), Some of the conditional QR models discussed above allow us to recover the unconditional partial effects, although these procedures require quite cumbersome computations (as Machado and Mata, 2005).

In the cross sectional case, Firpo et al. (2009) suggest an unconditional quantile regression (UQR) model to approximate the $UQPE$. They base their estimation procedure on the concept of the re-centered influence function (RIF). The influence function $IF(Y;\nu(F_Y))$ of a distributional statistic $\nu(F_Y)$ accounts for the influence of individual observations on that distributional statistic. If the statistics of interest is the τ-th quantile, q_τ, the influence function is:

$$IF(Y;q_\tau) = \frac{\tau - \mathbf{1}\{Y \leq q_\tau\}}{f_Y(q_\tau)}.$$

Its re-centered version is defined as $RIF(Y;q_\tau) = q_\tau + IF(Y;q_\tau)$. The expectation of the $RIF(Y;q_\tau)$ conditional on the explanatory variables X defines the RIF regression model, that is:

$$E[RIF(Y;q_\tau)|\mathbf{X}] = m_\tau(\mathbf{X}).$$

As $E[m_\tau(\mathbf{X})] = q_\tau$, then the RIF regression model can be interpreted as a form of UQR model, and the $UQPE$ can be estimated as changes of $m_\tau(\mathbf{X})$.[3] Firpo et al. (2009) propose a two-step procedure to estimate the UQR model. For any given τ, the first step is to estimate the RIF of

[3]For a comparison, in case of the mean, $\mu = \nu(F_Y)$, the RIF is simply the outcome variable Y, $RIF(Y;\mu) = \mu + (Y - \mu) = Y$.

the τ-th quantile of Y, where q_τ is estimated using the sample analog of the unconditional τ-th quantile, while the density $f_Y(q_\tau)$ at point q_τ is estimated using kernel methods. The second step is to run an OLS regression of the estimated $\widehat{RIF}(Y_i;\hat{q}_\tau) = \hat{q}_\tau + \frac{\tau - \mathbf{1}\{Y_i \leq \hat{q}_\tau\}}{\hat{f}_Y(\hat{q}_\tau)}$ on the observed covariates X_i. The RIF regression model $E[RIF(Y;q_\tau)|\mathbf{X}] = \mathbf{X}'\beta(\tau)$ is a form of unconditional quantile regression for the τ-th quantile, which assumes that the re-centered influence function is linear in the covariates $\mathbf{X}$. The suggested procedure requires not only $h(\mathbf{X},\mathbf{v})$ to be monotonically increasing in $\mathbf{v}$ (a standard assumption in quantile models), but also independency between $\mathbf{v}$ and $\mathbf{X}$. In the case of panel data, where $\mathbf{v}_{it} = f(\alpha_i, \mathbf{u}_{it})$, we consider the case of correlated random effects, postulating $E[\mathbf{v}_{it}|\mathbf{X}_i] = \bar{\mathbf{X}}_i'\gamma$ and $\varepsilon_{it} = \mathbf{v}_{it} - \bar{\mathbf{X}}_i'\gamma \perp \mathbf{X}_i$ and

$$E[RIF(Y_{it};q_\tau)|\mathbf{X}_i] = m_\tau\left(\mathbf{X}_{it}, \bar{\mathbf{X}}_i\right). \tag{7}$$

In order to account for within-panel correlation, we compute panel-clustered standard errors via bootstrapping.[4]

In the empirical analysis, we consider both a linear conditional quantile regression model in presence of non additive fixed effects (Powell, 2016) to estimate $CQPE(\tau,x)$, and a linear version of the UQR model (7).

4 Data and preliminary evidence

Let us investigate the role of profitability and tax incentives as determinants of capital structure of foreign owned companies. With respect to other companies, the tax effects on foreign owned subsidiaries vary both over time and cross-nationally according to the fiscal residence of their owners. Data on financial statements are collected from Orbis (by Bureau van Dijk), which provides standardized annual balance sheet and profit & loss items for millions companies around the world as well as information on their legal form and ownership structure. We have selected companies satisfying at least one of the following criteria: i) more than 15 employees; ii) operating revenue of at least 1 million euro; iii) total assets of at least 2 million euro. We have focused on European limited companies and limited liability companies[5] whose ultimate owner in August 2018

[4]The key assumption here is not the linearity of $E[\mathbf{v}_{it}|\mathbf{X}_i]$ with respect to the individual means $\bar{\mathbf{X}}_i$,which can easily be relaxed, but rather the strict exogeneity assumption of the covariates with respect to the idiosyncratic random component $\mathbf{u}_{it}$.With this respect, the assumption resembles the strict exogeneity hypothesis of the linear within-group fixed effects estimator for panel data.

[5]From Orbis Internet Guide: *Limited Companies: companies whose capital is divided into shares which can be offered to the general public and whose members are only liable for its debts to the extent of any amount unpaid on*

was a company resident abroad in a known country and was neither an individual nor a family. We excluded all the companies operating in the financial and insurance services (NACE code K), in public administration and defense (NACE code O), and the activities of households as employer (NACE code T) and of extraterritorial organizations (code U).

We define the ultimate owner as the company which directly or indirectly holds at least 50% of a subsidiary's shares. We set a high share of ownership because a parent company with a lower level of (direct or indirect) ownership may not be able to determine the debt policy of its subsidiary. After dropping observations with unrealistic account data and few outliers (top and bottom 0.05% of the relevant ratios), we have obtained a sample of 71,535 subsidiaries controlled by foreign companies, with all the necessary unconsolidated accounts data covering years from 2009 to 2017 (average number of years=5.8, see Table I).

Company data have been matched with information on statutory tax rates and Effective Marginal Tax Rates (EMTRs) provided by the Oxford University Centre for Business Taxation.[6]

In Table II we show the average subsidiary statutory tax rate τ_s and the average parent statutory tax rate τ_p by subsidiary country. For instance, this table shows that the 1,181 Austrian subsidiaries in our sample face an average statutory tax rate of 25%, while the average statutory tax rate of their foreign ultimate owners is 21.99%. On average, the differential between subsidiary and parent companies' tax rates is -1.32% (i.e., 23.81%-25.13%, see last row). When we use the EMTRs, the number of subsidiaries in the sample reduces, because of lack of information for Bosnia and Herzegovina and Serbia (see Table II). With the EMTR, the tax rate differential is about -2.79%. Moreover, for 41.1% (37.3%) of subsidiaries, the statutory (effective marginal) tax rate is higher than their ultimate owner's one: this may suggest that parent companies strategically locate their subsidiaries in low-tax countries (see, e.g. Devereux and Maffini, 2007 and references in Herger N., 2016).

Table II shows the distribution of subsidiaries in each host country according to the home country of their parent companies, based on the full sample of companies. This gives a clear picture of the weight of each *home* (parent) - *host* (subsidiary) country tax differential. For example, 37.51% of Austrian foreign-owned subsidiaries are held by German companies. Moreover, we can see that: i) about 1/5 of the subsidiaries are owned by a US global ultimate owner; ii) about 28% is owned by either a German, British or French company. Therefore, the within-Europe and the US-European countries tax differentials are by far the most relevant ones and will play a major role in

their shares; Limited Liability Companies: companies whose capital is divided into shares which cannot be offered to the general public. The liability of its members is limited to the amount of their shares.

[6]See, http://eureka.sbs.ox.ac.uk/4635/. Data available at https://ora.ox.ac.uk/objects/uuid:81f28d9a-fe6e-445b-8d34-a641b573d986.

Subsidiary			Statutory tax rate				Effective marginal tax rate			
Country name	N	$\bar{T}$	$\bar{\tau}_s$	$\bar{\tau}_p$	$\bar{\tau}_s - \bar{\tau}_p$	$\tau_s > \tau_p$	$\bar{\tau}_s$	$\bar{\tau}_p$	$\bar{\tau}_s - \bar{\tau}_p$	$\tau_s > \tau_p$
Austria	1181	4.7	0.2500	0.2199	0.0301	59.9%	0.1312	0.1696	-0.0384	20.4%
Belgium	3477	6.1	0.3300	0.2612	0.0688	64.8%	0.1390	0.1638	-0.0248	35.2%
Bosnia and Herz.	172	4.8	0.1000	0.2099	-0.1099	2.6%				
Bulgaria	893	6.5	0.1000	0.2362	-0.1362	8.7%	0.0283	0.1447	-0.1164	4.4%
Croatia	597	6.5	0.2000	0.2250	-0.0250	33.3%	0.0780	0.1356	-0.0576	13.7%
Czechia	3357	5.9	0.1900	0.2318	-0.0418	31.3%	0.0832	0.1603	-0.0771	16.7%
Denmark	779	2.8	0.2256	0.2458	-0.0202	38.1%	0.1452	0.1692	-0.0241	34.9%
Estonia	554	6.2	0.2059	0.2361	-0.0301	18.6%	0.3173	0.1552	0.1621	99.9%
Finland	1224	6.4	0.2145	0.2489	-0.0344	16.5%	0.1398	0.1666	-0.0268	23.8%
France	8051	5.9	0.3333	0.2526	0.0807	78.0%	0.1915	0.1629	0.0286	62.1%
Germany	5180	5.2	0.1500	0.2697	-0.1197	8.8%	0.1817	0.1690	0.0126	48.0%
Greece	581	5.9	0.2566	0.2567	-0.0001	47.1%	0.1273	0.1629	-0.0356	26.5%
Hungary	993	6.3	0.1772	0.2381	-0.0609	25.1%	0.1169	0.1592	-0.0423	19.1%
Iceland	25	4.4	0.1985	0.2300	-0.0315	23.5%	0.1193	0.1751	-0.0558	9.9%
Ireland	718	5.4	0.1250	0.2804	-0.1554	3.2%	0.0771	0.1984	-0.1212	4.2%
Italy	5487	6.4	0.2714	0.2495	0.0219	57.5%	-0.0595	0.1744	-0.2340	4.0%
Luxembourg	231	5.0	0.2197	0.2638	-0.0441	29.1%	0.1132	0.1707	-0.0574	15.4%
Netherlands	1039	4.4	0.2500	0.2719	-0.0219	33.4%	0.0815	0.1888	-0.1073	9.2%
Norway	1646	6.4	0.2673	0.2402	0.0272	76.9%	0.2041	0.1593	0.0448	79.4%
Poland	3655	5.6	0.1900	0.2387	-0.0487	28.1%	0.1073	0.1583	-0.0509	18.6%
Portugal	2035	6.4	0.2299	0.2643	-0.0344	22.7%	0.1500	0.1876	-0.0377	25.6%
Romania	2454	4.7	0.1600	0.2434	-0.0834	20.8%	0.0624	0.1310	-0.0686	11.8%
Russian Fed.	4736	4.9	0.2000	0.2288	-0.0288	30.3%	0.0789	0.1512	-0.0723	11.5%
Serbia	758	6.1	0.1362	0.2252	-0.0890	8.4%				
Slovakia	1808	6.4	0.2131	0.2300	-0.0170	39.8%	0.1133	0.1436	-0.0302	29.3%
Slovenia	442	6.1	0.1756	0.2298	-0.0542	28.1%	0.0943	0.1396	-0.0453	23.1%
Spain	5558	5.9	0.2869	0.2536	0.0333	61.3%	0.2828	0.1643	0.1184	99.3%
Sweden	3361	6.0	0.2326	0.2501	-0.0175	36.6%	0.1388	0.1734	-0.0346	23.9%
Turkey	6	5.5	0.2000	0.2352	-0.0352	41.9%	0.0873	0.2018	-0.1146	0.0%
Ukraine	1296	6.3	0.1922	0.2307	-0.0385	19.1%	0.0927	0.1364	-0.0437	35.2%
United Kingdom	9241	5.8	0.2349	0.2784	-0.0435	26.1%	0.2005	0.1856	0.0149	41.2%
Total	71535	5.8	0.2381	0.2513	-0.0132	41.1%	0.1377	0.1656	-0.0279	37.3%

Table I: Number of subsidiaries (N), average number of years available per subsidiary $(\bar{T})$, average tax rates of the subsidiaries $(\bar{\tau}_S)$ and their parents $(\bar{\tau}_P)$, percent of subsidiaries with $\tau_S > \tau_P$. Statistics were computed for the full sample, with statutory tax rates (left panel), and for the sample with effective marginal tax rates (right panel).

	DEU	FRA	GBR	USA	Other EU	Other OECD	Rest of the world
Austria	37.51	8.55	6.6	14.73	16.43	13.97	2.2
Belgium	9.98	16.05	7.13	19.07	34.43	11.33	2.01
Bosnia and Herz.	18.45	0	5.95	5.95	39.29	14.88	15.48
Bulgaria	13.1	6.16	7.05	12.54	37.4	20.94	2.8
Croatia	14.12	4.37	7.06	9.24	35.46	26.89	2.86
Czechia	23.38	5.96	6.05	13.08	27.7	21.51	2.32
Denmark	10.91	4.62	11.42	21.44	30.94	18.61	2.05
Estonia	6.68	2.89	6.86	7.94	61.91	13	0.72
Finland	7.52	4.17	6.78	15.69	48.45	15.52	1.88
France	11.81	0	10.86	21.56	39.5	14.11	2.16
Germany	0	9.75	8.78	23.36	29.4	24.46	4.25
Greece	11.53	9.47	13.25	20.31	30.98	13.6	0.86
Hungary	18.93	7.45	10.37	14.7	24.07	21.75	2.72
Iceland	16	0	20	12	28	24	0
Ireland	5.57	5.71	22.42	41.23	12.67	10.17	2.23
Italy	12.78	9.62	9.8	20.81	24.91	18.41	3.66
Luxembourg	17.32	16.02	11.26	17.75	22.51	12.55	2.6
Netherlands	11.45	6.54	10.78	32.63	17.52	17.42	3.66
Norway	6.44	3.28	11.54	11.73	57.53	8.44	1.03
Poland	21.75	8.4	7.33	12.01	35.13	13.35	2.02
Portugal	8.99	14.4	10.37	12.63	43	9.19	1.43
Romania	14.06	8.48	6.28	9.49	43.6	16.01	2.08
Russian Fed.	17.66	4.22	9.76	12.51	31.5	21.02	3.34
Serbia	10.95	4.09	5.15	11.35	39.58	19.79	9.1
Slovakia	16.54	6.31	5.64	9.62	38.38	21.52	1.99
Slovenia	20.59	3.39	6.11	11.99	26.47	27.15	4.3
Spain	14.81	12.45	11.28	17.51	27.31	13.82	2.82
Sweden	9.76	4.88	12.85	16.22	30.41	23.98	1.9
Turkey	33.33	0	33.33	33.33	0	0	0
Ukraine	4.4	4.24	16.51	7.64	41.59	15.82	9.8
United Kingdom	8.47	7.85	0	39.22	23.64	16.68	4.14
Total	12.39	7.28	8.29	19.79	32.12	17.11	3.01

Table II: Percentage of subsidiaries in the *Subsidiary Country* (rows) by parent company's country of residence (columns). Statistics computed for the full sample.

our regression analysis.

The empirical literature on tax-motivated debt finance uses book data rather than mark-to-market values. We also follow this approach due to the characteristics of the dataset. Book and mark-to-market values are likely to be close only for listed companies, due to the application of international accounting principles (IAS/IFRS). As for non-listed companies (that is, the large majority of the companies in the sample) however, accounting principles could allow us to reckon historical rather than fair values. In this case, the book value of one item may differ from its fair value. In line with most research (e.g. Desai et al. (2008)), leverage is given by the ratio between debt (long- and short-term liabilities) and total assets. The return on assets (ROA) is the ratio between earnings before interest payments and taxes (EBIT) and total assets. We also consider the constituents of the $Z-score$ (see Altman et al. (2000)) to control for the default risk: the ratio between working capital and total assets and the variation of the shareholders funds over total assets.

Table III shows the median values of the main balance sheet items and ratios, conditional on the residence country. Since the population of firms is typically composed of many small-medium size companies and a few large ones, we have preferred to use median values to summarize the characteristics of our sample. The median value of operating revenues is quite homogeneous across countries, between 8 and 11 millions Euro. Table III also shows the heterogeneity of the average national PPP per capita GDP growth rates experienced by the European countries during the sample period, ranging from the -0.7% of the Greek firms to the +6.5% of the Turkish enterprises. Also, the ROA shows high variability in the sample: it ranges from a median of 3% for Greece to 11.6% for Turkey. Moreover, the overall median ROA is positive (5.7%), although, on average, about 23% of subsidiaries were making losses in the previous year.

5 Regression analysis

We consider two quantile regression analysis: the conditional quantile regression (CQR) with non additive fixed effects suggested by Powell (2016) and the unconditional quantile regression (UQR) with correlated random effects, which extend Firpo et al. (2009) framework to panel data. The former allows us to estimate the conditional quantile partial effects (CQPE), the latter delivers an approximation of the unconditional quantile partial effects (UQPE).

For the CQR, we consider:

	Leverage	Turnover	ROA	$\frac{\text{Fixed assets}}{\text{Total assets}}$	$\frac{\text{Working capital}}{\text{Total assets}}$	$\frac{\Delta\text{Shareholders' funds}}{\text{Total assets}}$	$EBIT < 0$	GDP grow
Austria	66.3%	10.41	6.1%	21.8%	28.5%	1.4%	19.7%	2.8%
Belgium	62.7%	9.86	4.6%	17.0%	16.1%	1.4%	21.9%	2.5%
Bosnia and Herz.	63.9%	8.91	3.4%	44.6%	14.7%	1.1%	30.9%	4.6%
Bulgaria	54.1%	8.48	6.1%	32.0%	14.9%	2.1%	23.6%	4.5%
Croatia	63.4%	8.62	4.7%	25.6%	32.0%	1.4%	25.8%	4.0%
Czechia	48.2%	9.11	7.6%	24.5%	18.9%	2.5%	15.5%	4.0%
Denmark	59.1%	10.79	6.0%	24.3%	16.0%	2.3%	20.2%	1.8%
Estonia	41.0%	8.52	6.8%	25.0%	31.5%	4.8%	19.7%	5.5%
Finland	60.8%	9.53	7.9%	14.5%	20.6%	1.8%	20.6%	2.1%
France	65.0%	9.63	4.5%	20.3%	18.3%	1.6%	27.3%	2.4%
Germany	68.6%	10.78	6.1%	22.8%	20.9%	0.0%	22.3%	3.7%
Greece	70.0%	9.42	3.0%	13.2%	25.8%	0.3%	32.8%	-0.7%
Hungary	61.1%	9.78	5.8%	26.4%	18.2%	2.1%	21.0%	4.0%
Iceland	50.0%	9.83	9.1%	40.9%	11.7%	5.0%	14.8%	5.2%
Ireland	58.6%	9.93	5.8%	10.7%	12.1%	3.2%	20.4%	9.5%
Italy	70.4%	9.63	4.3%	17.8%	22.6%	1.4%	23.8%	1.8%
Luxembourg	57.7%	9.80	5.4%	15.7%	13.6%	1.6%	18.5%	3.1%
Netherlands	56.5%	10.81	5.1%	21.9%	50.7%	2.1%	17.2%	2.1%
Norway	72.2%	9.48	8.3%	14.2%	21.8%	0.4%	22.4%	0.6%
Poland	52.3%	9.32	7.7%	31.4%	24.0%	2.5%	17.4%	4.5%
Portugal	64.2%	8.89	5.0%	22.7%	34.6%	1.4%	23.3%	2.4%
Romania	61.3%	8.74	6.2%	29.9%	38.3%	2.2%	21.8%	5.1%
Russian Fed.	65.6%	8.67	8.3%	14.5%	13.0%	1.1%	23.4%	1.8%
Serbia	60.9%	8.41	5.8%	31.7%	16.1%	1.8%	25.2%	3.2%
Slovakia	62.1%	8.64	6.5%	23.1%	17.4%	1.8%	19.7%	3.6%
Slovenia	55.4%	9.06	5.1%	34.7%	14.4%	2.2%	20.2%	3.1%
Spain	61.0%	9.48	4.4%	26.7%	30.5%	1.7%	25.2%	2.3%
Sweden	61.6%	9.59	6.7%	15.3%	22.3%	1.1%	24.9%	2.7%
Turkey	47.9%	10.97	11.6%	14.7%	48.2%	3.7%	6.7%	6.5%
Ukraine	67.4%	7.99	4.5%	19.0%	12.8%	0.9%	34.2%	1.8%
United Kingdom	59.6%	9.99	6.1%	13.0%	17.0%	2.8%	22.2%	2.9%
Total	62.5%	9.57	5.7%	20.1%	21.1%	1.6%	23.0%	2.9%

Table III: Median values of leverage, turnover, ROA, fixed to total assets ratio; percentage of subsidiaries recording a negative EBIT in the past year, average PPP real per capita GDP growth rate. Statistics computed for the full sample.

$$CQ\left(\tau,\mathbf{F}_{it-1},\mathbf{T}_{it},g_{it}\right)=Q_{\tau}\left(\ln L_{it}|\mathbf{F}_{it-1},\mathbf{T}_{it},g_{it}\right)=\gamma_{s}\left(\tau\right)\tau_{s,it}+\gamma_{p}\left(\tau\right)\tau_{p,it}+\mathbf{F}_{it-1}^{\prime}\beta\left(\tau\right)+g_{it}\delta\left(\tau\right)+\mathbf{T}_{it}^{\prime}\kappa\left(\tau\right) \quad (8)$$

where L_{it} is the leverage of company i at time t, τ_s and τ_p are the subsidiary and parent company tax rates, respectively, g_{it} is the subsidiary country's GDP growth rate, used to control for country specific business cycles; $\mathbf{T}_{it}$ contains time dummy variables, and F_{it-1} is a set of lagged covariates including: ROA, the logarithm of the operating revenues, the constituents of the Z-score index, the ratio between fixed assets over total assets, and a dummy variable - which equals one - if at time $t-1$ the subsidiary had a negative EBIT. We use lagged financial statements because the leverage at time t (L_{it}) is expected to be planned at least one year in advance, based on the information available at time $t-1$. Notice that being a fixed effects model, all the time invariant characteristics are implicitly taken into consideration.

For the UQR, we consider:

$$E\left[RIF\left(\ln L_{it};q_{\tau}\right)|F_{i},\mathbf{T}_{it},g_{it},\Psi_{i}\right]=\gamma_{s}\left(\tau\right)\tau_{s,it}+\gamma_{p}\left(\tau\right)\tau_{p,it}+\mathbf{F}_{it-1}^{\prime}\beta\left(\tau\right)+g_{it}\delta\left(\tau\right)+\mathbf{T}_{it}^{\prime}\kappa\left(\tau\right)+\bar{\mathbf{F}}_{i}\bar{\beta}\left(\tau\right) \quad (9)$$

where $\mathbf{F}_i=\left(\mathbf{F}_{i1},...,\mathbf{F}_{iT}\right)$, $\bar{\mathbf{F}}_i$ is the vector of the individual means of the variables included in $\mathbf{F}_i$.

Figure 1 shows the distribution of leverage on our sample firms. As can be seen, the large majority of them shows a leverage less than 100%. However, a non-negligible number of operating firms shows a leverage ratio which is higher than 100%: this means that the value of equity may be negative. From a methodological point of view, there are various reasons that could affect the evaluation of equity. The main accounting systems (IAS/IFRS or US GAAP) provide for a separate component of equity associated with the cash flow hedge accounting (cash flow hedge reserve) and the reduction of equity due to own shares. Moreover, companies that use project finance and that, at the same time, have entered into derivative contracts must record negative reserves (if this is the case) in the balance sheet. However, this does not mean that they are close to default.

In order to present the results, we plot the estimated conditional and unconditional quantile partial effects for the tax rates (τ_p, τ_s) and the profitability index (ROA), together with their 95% confidence intervals, for the 10th, 15th, ..., 90th quantiles. For sake of brevity, the results for all the covariates are presented in appendix. We estimate equations (8) and (9) first using the statutory tax

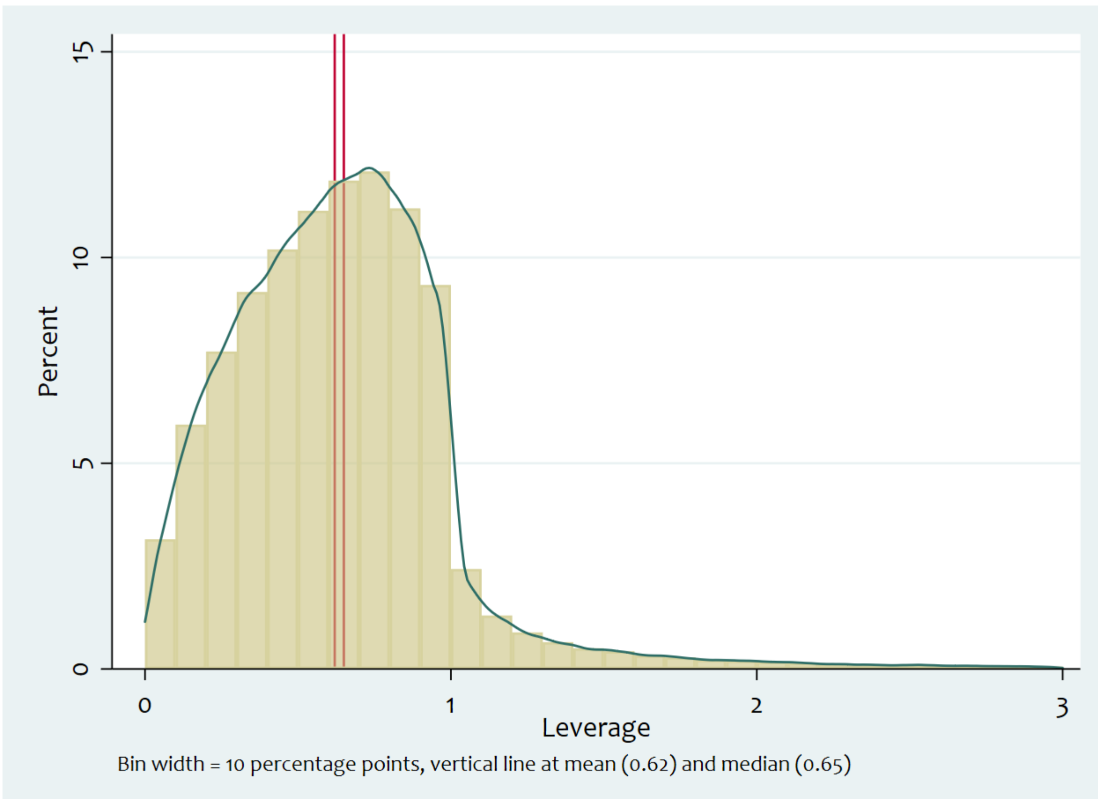

Figure 1: The distribution of firms' leverage.

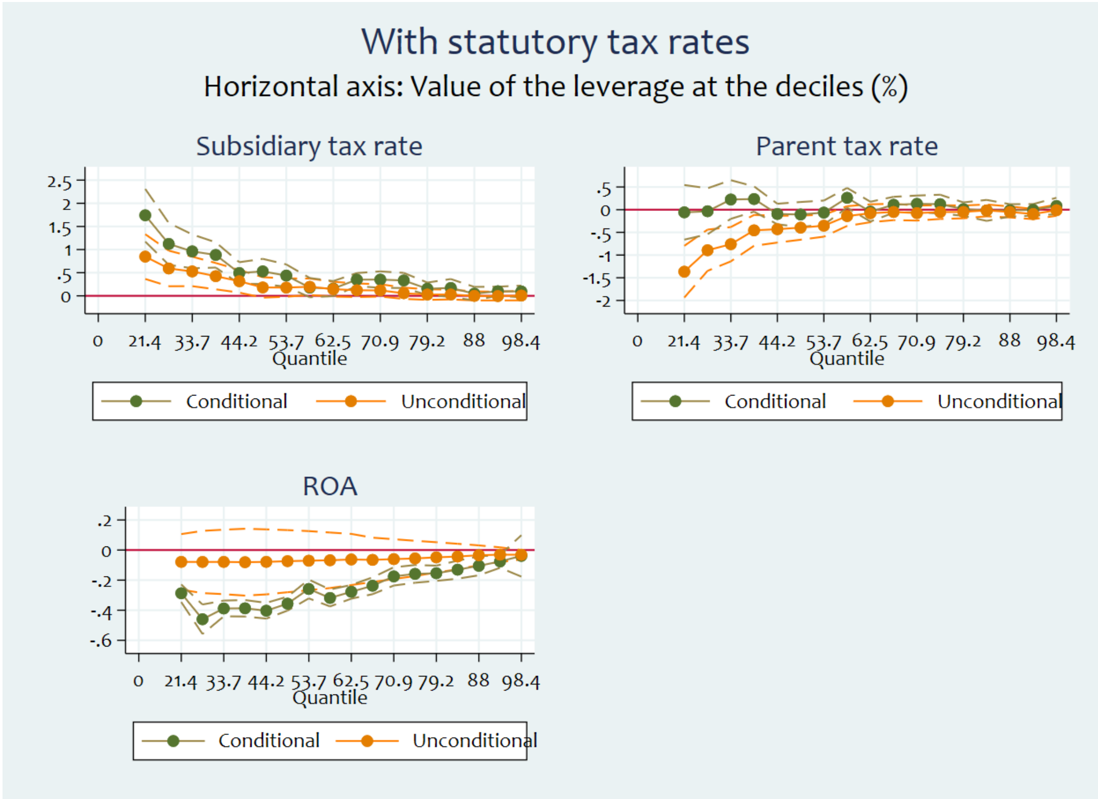

Figure 2: Estimated conditional and unconditional quantile partial effects for subsidiary company statutory tax rate; parent company statutory tax Rate, and ROA. The shaded area are the 95% confidence bands.

rates (Figure 2), then using the effective marginal tax rates (Figure 3).

In Figure 2 we see that the estimated conditional (CQPE) and unconditional partial effects (UQPE) of the subsidiary statutory tax rate on the leverage distribution are positive (and statistically different from zero) for the first quantiles. A 1 percentage point increase in τ_s would move upward by 2% the 10th quantile of the conditional distribution of L_{it} (conditional on the observed values of the covariates and the unobserved fixed effects) and by about 1% its unconditional distribution. However, starting from the median, the CQPE and UQPE of the subsidiary tax rate are both negligible. In our view, this tax effect vanishes when firms become credit constrained and lose their financial flexibility. As regards the statutory subsidiary tax rate, the estimated CQPE and UQPE provide almost equivalent results. This is not the case for the parent tax rate. According to the estimated UQPE, changes in the parent tax rate decrease the quantiles below the median of the unconditional leverage distribution, that is, the least leveraged subsidiaries further reduce their leverage if their parent tax rate increases. Again, for higher quantiles the UQPE is nil. For the CQPE instead, changes in the parents' tax rates are irrelevant for all the quantiles of the conditional

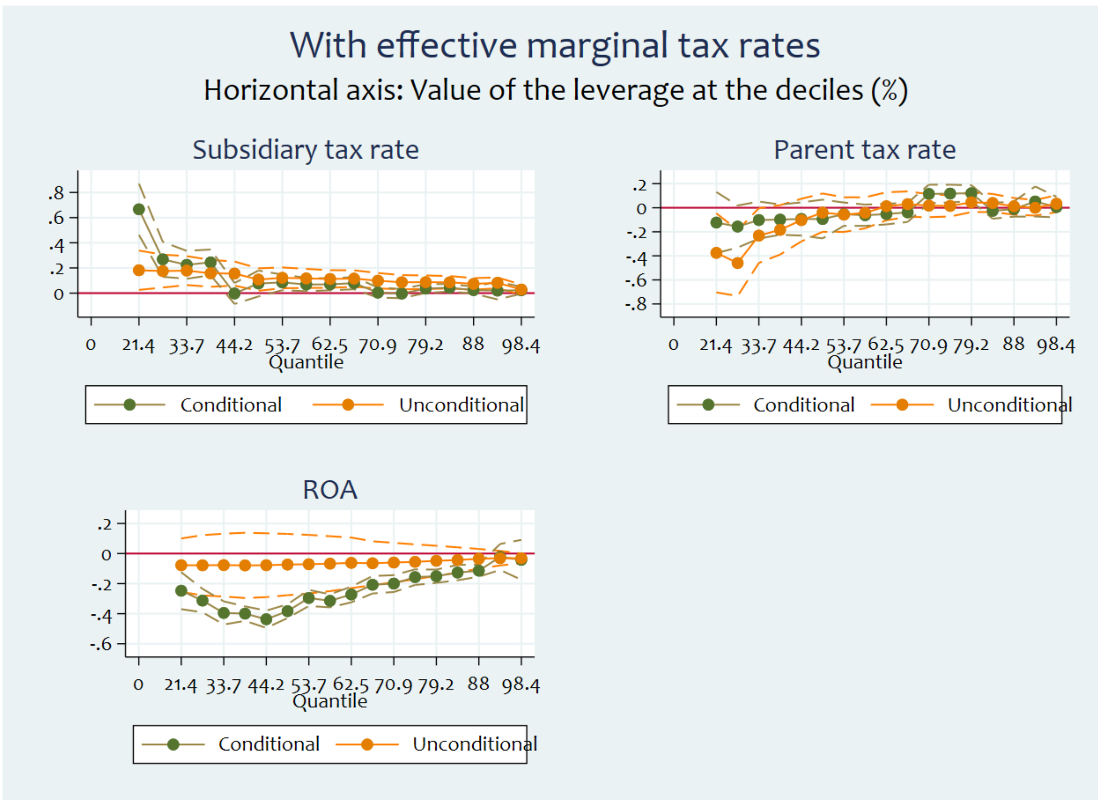

Figure 3: Estimated conditional and unconditional quantile partial effects for subsidiary company marginal effective tax rate; parent company marginal effective tax Rate, and ROA. The shaded area are the 95% confidence bands.

distribution. CQPE and UQPE differ from each other also for the profitability of the companies: looking at the unconditional distribution of the leverage, the UQPE of the ROA are small and never statistically different from zero; the CQPE are instead negative and decreasing in absolute value when moving from the left to the right tail of the conditional distribution. Looking at the results for the effective marginal tax rates (Figure 3), the insights are qualitatively the same, although the effects of the changes in the EMTR are smaller in values.As regards the effects of ROA, we can see that its impact on leverage is negative under the CQPE, until the 8th/9th decile. If leverage is high enough, its impact is nil. When however we look at the UQPE results, the impact is not statistically significant.

6 Conclusion

This article has applied a quantile regression analysis for panel data to investigate the determinants of the capital structure of a sample of European foreign-owned subsidiaries. We have proposed an extension of Firpo et al. (2009) approach for the estimation of unconditional quantile partial effects to the case of panel data with correlated unit-specific random intercepts and compared it with an estimate of the conditional quantile partial effects from a non-additive fixed effects quantile regression model (see Powell (2016)). By accounting for such unobserved heterogeneity, we have shown that both taxation and profitability have an heterogeneous impact on a subsidiary's capital structure and that looking at the effects on the unconditional rather than on the conditional distribution makes a difference.

In particular, it is always the case that low-levered firms are expected to increase borrowing when their statutory or effective marginal tax rate rises. At the same time, taxation has a minor impact on high-levered subsidiaries. This may be due to the fact that, if leverage is high enough, firms face some borrowing constraint and cannot fully exploit the tax benefits of debt finance. We also show that the parent company tax rate has a negative impact on left tail of the unconditional leverage distribution of the subsidiaries. Again, it has little effect on the most leveraged companies.

Finally, we have also shown that profitability (measured as ROA) has little impact on the unconditional distribution of the leverage. This does not imply that the subsidiaries do not vary their leverage with their profitability: indeed the effects on the conditional distribution (i.e. the CQPE) are negative, with the lowest quantiles decreasing the most. All in all, the results of the conditional quantile regressions show the heterogeneity of both tax and profit impacts. Namely, profitability and taxes matter only if leverage is low enough.

References

Abel, A. B. (2018). Optimal debt and profitability in the tradeoff theory. *Journal of Finance 73*(1), 95–143.

Abrevaya, J. and C. M. Dahl (2008). The effects of birth inputs on birthweight: Evidence from quantile estimation on panel data. *Journal of Business & Economic Statistics 26*(4), 379–397.

Altman, E. I. et al. (2000). Predicting financial distress of companies: revisiting the z-score and zeta models. *Stern School of Business, New York University*, 9–12.

Altshuler, R. and J. M. Mintz (1996). Us interest-allocation rules: Effects and policy. In *The Taxation of Multinational Corporations*, pp. 3–31. Springer.

Arellano, M. and S. Bonhomme (2016, jun). Nonlinear panel data estimation via quantile regressions. *The Econometrics Journal 19*(3), C61–C94.

Arshanapalli, B. and W. Nelson (2014). Using quantile regressions to examine the capital structure decision of us firms. *The International Journal of Business and Finance Research 8*(5), 1–8.

Aviral, K. T. and K. Raveesh (2015). Determinants of capital structure: A quantile regression analysis. *Studies in Business and Economics 10*(1), 16–34.

Bache, S. H. M., C. M. Dahl, and J. T. Kristensen (2013). Headlights on tobacco road to low birthweight outcomes. *Empirical Economics 44*(3), 1593–1633.

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

Booth, L., V. Aivazian, A. Demirguc-Kunt, and V. Maksimovic (2001). Capital structures in developing countries. *Journal of Finance 56*(1), 87–130.

Borah, B. J. and A. Basu (2013). Highlighting differences between conditional and unconditional quantile regression approaches through an application to assess medication adherence. *Health economics 22*(9), 1052–1070.

Canay, I. A. (2011). A simple approach to quantile regression for panel data. *The Econometrics Journal 14*(3), 368–386.

Chamberlain, G. (1982). Multivariate regression models for panel data. *Journal of Econometrics 18*(1), 5–46.

Chamberlain, G. (1984). Panel data. *Handbook of econometrics 2*, 1247–1318.

Chay, J., S. H. Park, S. Kim, and J. Suh (2015). Financing hierarchy: Evidence from quantile regression. *Journal of Corporate Finance 33*, 147–163.

Chernozhukov, V. and C. Hansen (2005). An iv model of quantile treatment effects. *Econometrica 73*(1), 245–261.

Collins, J. H. and D. A. Shackelford (1992). Foreign tax credit limitations and preferred stock issuances. *Journal of Accounting Research*, 103–124.

Desai, M. A., C. F. Foley, and J. R. Hines (2004). A multinational perspective on capital structure choice and internal capital markets. *Journal of Finance 59*(6), 2451–2487.

Desai, M. A., C. F. Foley, and J. R. Hines (2008). Capital structure with risky foreign investment. *Journal of Financial Economics 88*(3), 534–553.

Devereux, M. P. and G. Maffini (2007). The impact of taxation on the location of capital, firms and profit: A survey of empirical evidence.

Engle, R. F. and S. Manganelli (2004). Caviar: Conditional autoregressive value at risk by regression quantiles. *Journal of Business & Economic Statistics 22*(4), 367–381.

Fama, E. F. and K. R. French (2002). Testing trade-off and pecking order predictions about dividends and debt. *Review of Financial Studies 15*(1), 1–33.

Fattouh, B., L. Harris, and P. Scaramozzino (2008). Non-linearity in the determinants of capital structure: Evidence from uk firms. *Empirical Economics 34*(3), 417–438.

Fattouh, B., P. Scaramozzino, and L. Harris (2005). Capital structure in south korea: A quantile regression approach. *Journal of Development Economics 76*(1), 231–250.

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

Feld L.P., J.H. Heckemeyer, M. O. (2013). Capital structure choice and company taxation. *Journal of Banking and Finance 37*, 2850–2866.

Ferrarini, B., M. Hinojales, and P. Scaramozzino (2017). Leverage and capital structure determinants of chinese listed companies. Technical Report n. 509, Asian Development Bank.

Firpo, S., N. M. Fortin, and T. Lemieux (2009). Unconditional quantile regressions. *Econometrica 77*(3), 953–973.

Fischer, E. O., R. Heinkel, and J. Zechner (1989). Dynamic capital structure choice: Theory and tests. *Journal of Finance 44*(1), 19–40.

Froot, K. A. and J. R. Hines Jr (1995). Interest allocation rules, financing patterns, and the operations of us multinationals. In *The Effects of Taxation on Multinational Corporations*, pp. 277–312. University of Chicago Press.

Geraci, M. and M. Bottai (2007). Quantile regression for longitudinal data using the asymmetric laplace distribution. *Biostatistics 8*(1), 140–154.

Geraci, M. and M. Bottai (2014). Linear quantile mixed models. *Statistics and computing 24*(3), 461–479.

Graham, J. R., M. Hanlon, T. Shevlin, and N. Shroff (2013). Incentives for tax planning and avoidance: Evidence from the field. *The Accounting Review 89*(3), 991–1023.

Gu, G. W., R. de Mooij, and T. Poghosyan (2015). Taxation and leverage in international banking. *International Tax and Public Finance 22*(2), 177–200.

Herger N., C. Kotsogiannis, S. M. (2016). Multiple taxes and alternative forms of fdi: Evidence from cross-border acquisitions. *International Tax and Public Finance 23*, 82–113.

Huizinga, H., L. Laeven, and G. Nicodeme (2008). Capital structure and international debt shifting. *Journal of Financial Economics 88*(1), 80–118.

Koenker, R. (2004). Quantile regression for longitudinal data. *Journal of Multivariate Analysis 91*(1), 74–89.

Koenker, R. and G. Bassett (1985). On boscovich's estimator. *The Annals of Statistics*, 1625–1628.

Koenker, R. and G. Bassett Jr (1978). Regression quantiles. *Econometrica: journal of the Econometric Society*, 33–50.

Lamarche, C. (2010). Robust penalized quantile regression estimation for panel data. *Journal of Econometrics 157*(2), 396–408.

Leland, H. E. (1994). Corporate debt value, bond covenants, and optimal capital structure. *Journal of Finance 49*(4), 1213–1252.

Lemmon, M. L., M. R. Roberts, and J. F. Zender (2008). Back to the beginning: Persistence and the cross-section of corporate capital structure. *Journal of Finance 63*(4), 1575–1608.

Long, M. S. and I. B. Malitz (1985). Investment patterns and financial leverage. In *Corporate Capital Structures in the United States*, pp. 325–352. University of Chicago Press.

Machado, J. A. F. and J. Mata (2005). Counterfactual decomposition of changes in wage distributions using quantile regression. *Journal of Applied Econometrics 20*(4), 445–465.

Miniaci, R., M. L. Parisi, and P. Panteghini (2014). Debt shifting in europe. *International Tax and Public Finance 21*(3), 397–435.

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

Myers, S. C. (1993). Still searching for optimal capital structure. *Journal of Applied Corporate Finance 6*(1), 4–14.

Newey, W. K. and J. L. Powell (1987). Asymmetric least squares estimation and testing. *Econometrica: Journal of the Econometric Society*, 819–847.

Powell, D. (2016). Quantile regression with nonadditive fixed effects.

Rajan, R. G. and L. Zingales (1995). What do we know about capital structure? some evidence from international data. *Journal of Finance 50*(5), 1421–1460.

Ramb, F. and A. J. Weichenrieder (2005). Taxes and the financial structure of german inward fdi. *Review of World Economics 141*(4), 670–692.

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