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(Working Papers)

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# DOES CORPORATE TAXATION AFFECT CROSS-COUNTRY FIRM LEVERAGE?

by Antonio De Socio* and Valentina Nigro*

**Abstract**

We evaluate the relation between firm leverage and taxation of corporate income using a dataset of mostly unlisted European corporations, highly representative of medium-sized and large firms. We use a correlated random effect approach in order to take into account unobserved heterogeneity and to assess the contribution of cross-sectional variation of the regressors. We also apply quantile regressions to evaluate a possible differential impact of taxation on leverage across firms. Our results suggest that corporate income taxation is positively related to leverage and explains part of the cross-country variability, showing a stronger effect for less levered firms. In accordance with the theory of the debt tax shield, the relation between debt and taxation is stronger for highly profitable firms. These findings are robust to the inclusion of different measures of the financial development and characteristics of the legal system of the country where firms are located.

**JEL Classification**: G32, H32.
**Keywords**: leverage, corporate taxation, financial structure.

**Contents**



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## 1. Introduction[1]

Firms require financial resources for ordinary business activities and in order to invest. Their financial structure reflects their characteristics, but it is also influenced by institutional and macroeconomic factors such as taxation, bankruptcy law and creditor protection, and the size and structure of the financial system. This paper evaluates the cross-country relation between firm leverage and taxation of corporate income controlling for the differences in legal and financial systems and in firm characteristics.

The existence and the magnitude of a tax effect on firm leverage have been investigated by an extensive body of applied corporate finance literature focusing on the simplifying assumptions underlying the irrelevance proposition of Modigliani and Miller (1958), namely the role of taxation, the cost of bankruptcy, agency problems and asymmetric information. The results of these studies are inconclusive. They vary depending on two key empirical issues. The first is the nature of the indicator measuring the impact of taxation. The second issue concerns the characteristics of the firms included in the sample. For instance, using data of listed as opposed to unlisted firms can lead to very different findings, because listed firms can raise capital more easily thanks to less severe agency problems and asymmetric information.

Among the papers that study cross-country differences in leverage of listed firms, Rajan and Zingales (1995) consider companies of the G-7 countries and find that whether taxation is linked to leverage or not is highly sensitive to assumptions about the marginal investor tax rate (e.g. if the investor is tax-exempt or is taxed at the top rate). de Jong et al. (2008) use the effective tax rate (defined as taxes paid over pre-tax income) and find no relation between taxation and debt measures in a sample of companies from 42 countries. Fan et al. (2012) study the impact of institutional factors on leverage of firms from 39 countries and show that taxation, measured using Miller index (which considers the personal tax on interest and dividend along with the corporate tax rate), has a positive effect on leverage in developed countries but not in emerging economies.

Other studies investigate the relation between debt level and country-specific characteristics for unlisted corporations using European data from Amadeus database. In general, they find that the traditional corporate finance theory developed for application to large listed firms also holds for smaller companies. Giannetti (2003) finds that taxation, measured with the non-debt tax shield (i.e. depreciation of assets, investment tax credits and R&D expenses) has no impact on leverage. Two other papers use a sample of manufacturing firms to specifically evaluate the role of taxation on leverage. Bartholdy and Mateus (2008) show that the statutory corporate tax rate is positively related to a measure of leverage which indirectly excludes trade payables. Pfaffermayr et al. (2008) focus on the impact of age on the relation between leverage and the statutory corporate tax rate, showing that the debt tax shield is more important for older companies. Although the two last papers find evidence of a positive relation between corporate taxation and leverage, both do not consider the role of the financial markets and the latter also does not examine the effect of the legal system.

In this paper we evaluate the impact of corporate income taxation on firms' financial structure, building on previous literature that used Amadeus database and expanding it along different lines: the sample of firms, the measure of leverage, the country- and firm-level controls and the estimation methods.

[1] The authors are grateful to Giorgio Albareto, Giuseppe Cappelletti, Cinzia Chini, Giorgio Gobbi, Paolo Finaldi Russo, Silvia Magri, Enrico Sette, Stefania Zotteri, and two anonymous referees. All remaining errors are ours. The views expressed are those of the author and do not necessarily reflect those of the Bank of Italy.

First, we use data of firms from European countries during the period 2004-07, not restricted to the manufacturing sector; thanks also to the increase in the number of corporations in the archive since 2004, our analysis is highly representative of larger firms in most of the countries we consider. The measure of leverage includes only financial debt and directly excludes other liabilities like trade payables, which mainly depend on business transactions and not on the effect of corporate income taxation (e. g. Welch, 2011). We also use a simple but reliable measure of taxation, the statutory corporate tax rate, which only considers taxation from the firm's point of view; we avoid using the personal tax rate, which depends on the category and the income of the investor.

Secondly, we include other variables to control for country-level characteristics such as legal system and degree of development of financial markets, introducing financial account data to measure the latter. Firm individual features are also taken into account; in particular, since we are interested in financial debt only, we check for the effect of net working capital, which in some countries requires a significant amount of funding.

Finally, we analyse the data under different estimation methods in order to focus on different aspects of the relation between leverage and taxation. In particular, to consider the unobserved heterogeneity and its correlation with the regressors, we rely on the correlated random effect (CRE) approach, which allows us also to estimate the coefficients of time-invariant variables. And to analyse a possible differential impact of taxation along the firm's position in the leverage distribution, we also use quantile regressions.

Our findings suggest that taxation is positively related to leverage and explains part of the cross-country variability. The effect is stronger for less levered corporations, which presumably have more incentive to increase their debt. Finally, the debt tax shield is more effective for highly profitable firms, in accordance with corporate finance theory.

In Section 2 we review the role played by taxation and institutional characteristics, along with the effect of firm-level variables on leverage. In Section 3 we describe the data sources and our variables. The estimation methods and the results of the empirical analysis are presented in Section 4. We assess the finding in Section 5 and draw our main conclusions in Section 6.

## 2. Relation between leverage and taxation, institutional and firm characteristics

In this section we review the main variables that are related to leverage according to corporate finance theory. First, we examine some proxies of debt and non-debt tax shield, since taxation is the focus of our paper. Then we review the role played by institutional features, divided into legal and financial variables; they are relevant because they affect agency costs and asymmetric information. Finally, we briefly describe the relation between firm-level characteristics and leverage.

### *2.1 Debt and non-debt tax shield*

The influence of taxation on financial structure stems from the possibility for firms to deduct some costs from taxable income: interest expense, thus obtaining a debt tax shield; depreciation and similar expenses, offering a non-debt tax shield (NDTS; DeAngelo and Masulis, 1980). In particular, debt is positively correlated with the marginal corporate tax rate and the ratio of personal taxation of equity income to interest income, and negatively with non-debt tax shield, existing interest rate deductions and the probability of future losses (Graham, 2006).

There are several variables that measure the effect of taxation on financial structure and each of them has some limitations.[2]

A first measure is the *effective tax* paid by firms. Two main methods of using it can be identified (Nicodème, 2001). The backward-looking method measures the weight of tax over past corporate income and takes into account the effects of the business cycle, while the forward-looking

[2] An alternative way to measure the impact of taxation on debt is through the effects of financial reforms.

approach is based on simulated corporate income and considers all tax rules (King and Fullerton, 1984; Devereux and Griffith, 1998). A relate issue is the endogeneity of taxation status: the more a firm uses the debt tax shield, the smaller its tax base and the lower its tax rate. A possible solution to this problem is a forward-looking estimation of income before interest deduction (Graham et al., 1998; Alworth and Arachi, 2001; Bartholdy and Mateus, 2011).

The previous measures include all the advantages of tax shield, so it is not possible to distinguish the role of debt tax shield. A first measure that considers tax advantages alone is the *marginal tax rate* paid on an additional unit of income. It also covers the case of negative profits, where a tax credit arises and the marginal rate is zero. A direct estimation of the marginal tax rate considers tax carrybacks and carryforwards, requiring a long time series of firm data and the forecast of future income. However, an analysis developed in Graham (1996) shows that a simpler approach is possible; some proxies are the statutory corporate tax rate, a dichotomous variable or a trichotomous variable. The statutory tax rate is a simple and reliable measure referring to a specific country. Its main drawback may be its limited variation over time. The dichotomous variable is equal to the statutory tax rate if the taxable income is positive and zero otherwise. The trichotomous variable is equal to: a) 0 if taxable income is negative and there are net operating losses in any period of the time span considered; b) half the statutory tax rate if taxable income is negative or there are net operating losses in any period; c) the statutory tax rate otherwise.

An alternative approach considers an investor's choice between an investment in equity or bonds. In a classical tax system dividends are taxed twice, at both the corporate and the personal tax rate, while interest is only taxed at personal rate. This tax advantage of debt is counterbalanced by the higher interest rate a firm has to pay to investors who are interested in the net return on bonds or equity (Miller, 1977). In most of the empirical literature, *Miller index* is used to take into account different countries' tax rates, including the corporate and personal taxation of dividends and interest payments.[3] However, this synthetic indicator has some shortcomings. First, it depends on which tax rate is applied, since some investors are tax exempt, while others pay the marginal rate. Second, it is based on the idea of an investor who chooses between bonds and share, thereby excluding the possibility of loans, the main source of finance for firms in Europe and the United States. This line of reasoning can be extended to other financial intermediaries: pension funds or insurance companies could well prefer to invest mainly in bonds. Moreover, this approach rules out capital increases through retained earnings, although cash flow is a very important source of funding for firms. Alternatively, Miller index implies that retained earnings are discounted in capital gains and that the taxation of capital gains and dividends is the same.[4]

A final proxy of tax advantages that is often used in the literature is the *non-debt tax shield*. Its drawback is that it may be positively related to profitability and investment, so that if a profitable firm with a high tax rate invests more and also borrows more, this can result in a positive relation

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[3] Monacelli et al. (2001) develop a model with a synthetic tax rate including all these rates.

[4] To better evaluate these facts we derive the arbitrage rule from which the Miller index is obtained, but excluding some simplifying assumptions. Consider the three ways in which a firm can finance its assets – debt, equity and internal funds – and suppose it distributes a fraction $p$ of its profits while *(1-p)* are reinvested. Then the following equivalences must hold:

$$p(1-\tau_c^d)(1-\alpha\tau_d)\pi = p(1-\tau_i)i \qquad \text{(a)}$$

$$(1-p)(1-\tau_c^{nd})(1-\beta\tau_{cg})\pi = (1-p)(1-\tau_i)i \qquad \text{(b)}$$

in which the tax rates are $\tau_c^{\,d}$ and $\tau_c^{\,nd}$ (statutory corporate tax rate on distributed and undistributed earnings), $\tau_i$ (personal tax rate on interest), $\tau_d$ (marginal personal tax rate on dividends), and $\tau_{cg}$ (marginal personal tax rate on capital gains); $i$ is the return on debt, $\pi$ is the return on equity; $\alpha(\beta)$ is the percentage of dividends (capital gains) subject to taxation.
The sum of (a) and (b) yields:

$$\frac{i}{\pi} = \frac{p + (1-p)(1-\tau_c^{nd})(1-\beta\tau_{cg})}{\dfrac{p(1-\tau_i)}{(1-\tau_c^{nd})(1-\alpha\tau_d)} + (1-p)(1-\tau_i)}$$

The Miller index implies that $\alpha = 1$ and $p = 1$ (or that $\tau_c^{\,d} = \tau_c^{\,nd}$, $\tau_d = \tau_{cg}$, and $\alpha = \beta$).

between the NDTS and debt. MacKie-Mason (1990) addresses this problem, interacting the NDTS with an ad hoc near tax exhaustion variable, and finds a negative relation.

The variable we use in our analysis is the statutory tax rate (as in Bartholdy and Mateus, 2008, and Pfaffermayr et al., 2008). It takes the point of view of a firm, so we do not have to deal with the Miller index' problems of measuring personal taxation. Also, it does not change with taxable income, thereby avoiding the endogeneity problems arising from the effective tax rate. Finally, it does not require estimation of future income to derive the marginal tax rate. In order to deal with its limited variation over time in the empirical analysis, we use a non-standard econometric technique, described in Section 4.

### *2.2 Legal and financial system*

The legal system is one of the main factors that reduce conflicts of interests among the different actors involved in a firm: managers, employees, shareholders and external investors. La Porta et al. (1998) report that greater use of short-term debt is more likely if the *legal system* is not developed and the enforcement of rules is not strict: this type of debt reduces the discretion of managers or majority shareholders. *Bankruptcy law* affects the relationships between a firm and its creditors more directly in case of financial distress (Djankov et al., 2008). In fact, there is a trade-off between preserving the ongoing business of profitable firms and protecting creditors, the latter proxied by swift exercise of their rights. Consequently, the stronger the protection of creditors, ensured by a rapid bankruptcy process, the higher might be firms' leverage. Another relevant variable is the *level of corruption* of a country, which is linked to the effectiveness of law enforcement by the courts (Djankov et al., 2003). The possibility of expropriation of external financers by managers or public officials implies that a higher level of short-term debt is likely, the more a country is perceived as corrupt.

Other variables used in the previous empirical literature relate to the role of *financial markets.* The main distinction here is between bank-based and market-based financial systems. The variables usually considered are bank loans to the private sector and bond or equity market capitalization as a percentage of GDP. The idea is that the presence of a larger banking system is likely to be related to higher leverage and more short-term debt. Also, a closer relationship between firms and banks, a proxy for which could be the number of banks a firm typically borrows from, would reduce agency problems, thus increasing debt (e. g. Petersen and Rajan, 1994). A more developed bond market could be an alternative to the banking system and should permit more long-term debt. Leverage is also influenced by the development of the equity market, which facilitates the issue of shares. It should be noted that the relation between bank- or market-based financial systems and leverage is not unambiguous: bank loans might be more expensive than market alternatives because interest rates may cover banks' monitoring costs (Diamond, 1991).

### *2.3 Firm-level characteristics*

The importance of firm-level characteristics and their relation with leverage vary according to the different views of corporate finance theories. The *trade-off theory* holds that firms choose the optimal leverage after comparing the losses and the gains to be obtained with debt or equity. On the one side, corporate tax may offer a debt tax shield in the form of interest deductibility and an incentive to increase debt. On the other side, there are direct and indirect bankruptcy costs of debt, both linked to agency costs between shareholders and debt holders and between shareholders and managers.[5] The *pecking order theory*, connected with problems of asymmetric information, asserts

[5] The drawbacks of debt include: a) risk shifting (Jensen and Meckling, 1976), the incentive for levered firm to overinvest in risky projects; b) underinvestment (Myers, 1977), which occurs when a highly levered firm passes up an

that an optimal value of leverage does not exist. It holds that firms prefer internal financing to external sources; among external forms of financing, debt is preferred to equity.[6]

More specifically, the relation between profitability and leverage could be ambiguous. On the one hand, pecking order theory implies that the relation is negative, because firms prefer internal funds to debt and equity. On the other hand, trade-off theory suggests that debt is preferred to equity in order to benefit from the debt tax shield, which is higher for profitable firms. Also the size and age of a firm can have an ambiguous relation to leverage: according to the pecking order theory, as a firm becomes larger or older it can rely more on retained earnings to finance its investments; hence a negative relation is expected. However, larger and older firms are generally safer, partly because they have less incentive to invest in risky projects, and this reputation effect could increase leverage. The composition of the balance sheet is also important, because tangible assets can be used as collateral for financing, while intangible assets may indicate opaqueness, thus reducing leverage.

The survey of Harris and Raviv (1991) shows that leverage is positively related to firms' tangible assets, NDTS, growth opportunities, and size, while it is negatively related to volatility, bankruptcy probability, intangible assets, profitability, and uniqueness of the product. In a more recent survey, Murray and Vidhan (2009) confirm that leverage calculated at market value is positively associated with industry leverage, tangible assets and size and negatively linked to profitability, while the relation with growth is negative. However, the impact of size and growth becomes no longer significant when leverage is calculated at book value.

## 3. Data

This section summarizes the main characteristics of the Amadeus database, the source of our firm-level data. We then illustrate our variables of interest and provide some descriptive statistics.

### *3.1 The Amadeus database*

We use an unbalanced panel data of around 487,000 firm-year observations in 13 European countries in the period 2004-2007.[7] Bureau Van Dijk's Amadeus database is the source of unconsolidated balance-sheet and income-statement data. The sample is largely composed of unlisted firms (listed firms are only 2 per cent). The data include the main components of assets and liabilities. Unfortunately, it is not possible to distinguish between loans and bonds in order to evaluate the role played by banks. Nor is it possible to distinguish between provisions and long-term financial debt. The income-statement data include the main items; there are a few countries for which value added and its components are not reported. We use information on the number of employees, turnover and total asset to classify firm size largely following the European Commission's definitions: small, medium-sized and large (Table 1).[8] We classify firms into four

investment with positive net present value; c) the behaviour of shareholders, who could extract value from the firm at the expense of debt holders through higher dividends. Also, there is the free cash flow problem (Jensen, 1986), the possibility that managers of highly profitable firms may invest in empire-building or in unprofitable projects. In this view, debt represents a limit to the amount of cash flow at their disposal. These agency problems may be mitigated by the ownership structure: firms that are strictly controlled by a small number of shareholders have lower agency costs, because the owners have a greater interest in avoiding bankruptcy.

[6] The order depends on the relative cost of the different sources (Myers and Majluf, 1984; Myers, 1984). A related theory evaluates the relationships between old and new investors and the importance of signalling effects when new securities are issued (Ross, 1977). Firms usually sell new equity when its existing shares are overpriced (so that the value of shares drops after issues), while the issue of debt signals that the firm is profitable and can borrow money.

[7] We restrict the sample to around 373,000 observations in our regression analysis because of outliers in our variables of interest.

[8] See http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/index_en.htm. A firm that is either micro or small according to the European Commission's definition is small in our classification.

sectors – energy, manufacturing, construction and services – according to their SIC code (Table 2). The breakdown of firms among countries by size and sector is reported in Table 3a.

Some caveats concerning the use of the Amadeus data need to be noted. Differences in its coverage of countries and firm size affect the representativeness of the sample. In general, smaller firms are underrepresented because of minimum requirements for entry into the Amadeus database.[9] The ratio of medium-sized and large firms to the total number as reported in Eurostat (2009) and European Commission (2011) is relatively high (Table 3b). It is at least 45 per cent in all the countries we include, except Austria and Germany, for which the number of firms is quite low; no data are available for Greece. De Socio (2010) presents a descriptive analysis of the database and of the main indices derived from balance sheets and income statements, and develops an econometric analysis of the persistence of cross-country differences when firm sector and size are considered.

The countries considered are the members of the euro area in 2002 and the United Kingdom. This allows us to consider countries with the same currency and policy interest rate, but the United Kingdom. The time span considered is restricted to the 2004-07 mainly for two reasons. First, there was a substantial increase in the number of firms included with respect to previous years, so the results are less influenced by the changes in the sample and our dataset is representative for nearly all the countries we consider. Second, during this period of economic growth it was easier for firms to borrow more; by ending the period at 2007, we leave out the effects of the financial crisis and the recession.

### *3.2 Description of the variables*

Our variable of interest – denoted *Leverage* – is defined as the ratio of financial debt (including provisions) to the sum of financial debt and equity, both at book value.[10] Summary statistics are reported in Table 4, which shows the large differences in firm variables within and between countries. The mean leverage in the sample period ranges from 35 per cent in France to 54 per cent in Italy, which has the highest ratio among all the countries we analyze. Other highly levered firms are in Germany and Greece (53 per cent and 49 per cent, respectively), while leverage is below 40 per cent in Finland, Luxembourg and the Netherlands.

The source of the statutory corporate tax rate (*Tax*) is the European Commission (2011).[11] Between 1994 and 2004, the tax rate decreased among the countries we consider, whereas in the period we examine it remained relatively stable: it was constant in four countries (Belgium, Ireland, Italy and the UK) and changed only once in six countries (Austria, Finland, Germany, Luxembourg, Portugal and Spain). We rely on statutory corporate tax rate as our taxation variable since it allows us to capture cross-country differences and to avoid some of the issues discussed in Section 2.1. To improve the accuracy of our measure of taxation, we also consider the proxies of the marginal tax rate suggested by Graham (1996; see Section 2.1). We actually employ the corporate tax rate just for a large subsample of firms – around 70 per cent of the whole sample – that are more likely not to have losses and whose tax rate presumably coincides with *Tax*. These highly profitable firms are defined in each year *t* as firms having positive operating income in all sample years and positive profit in year *t*.

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[9] Smaller firms make up more then 98 per cent of the population of firms in every country of European Union (Eurostat, 2009), while the firms included in Amadeus have more than €20 million of total assets (or more than €10 of turnover) or else have more than 150 employees.

[10] In our sample we exclude firms with zero leverage because we are interested in debt-intensity decision of firms with financial debt. Moreover, firms with zero leverage make up just 4 per cent of the sample; they are a small minority because we include the largest firms of each country. Our results are not affected by this restriction.

[11] These adjusted top statutory corporate tax rates are base rates and exclude targeted taxation (reduction for sector or size). For Italy the rate also includes the regional tax on productive activities, or IRAP (3.9 per cent), which is levied on a measure of value added instead of corporate income. We used these rates to have a uniform source. The results are basically unchanged when IRAP is excluded.

We also consider a set of institutional variables and firm characteristics, to control for their effect on leverage as summarized in Section 2. As regards the legal system indicators, we use some proxies from the World Bank's Doing Business project, ranging between 0 and 10.[12] *Investor protection* (*Invprot*) summarizes the strength of control over managers' actions and measures the protection offered primarily to shareholders but also to debt holders.[13] *Legal right protection* (*Legright*) measures how much laws protect creditor rights. These two variables increase when a legal system is stronger and should be positively related to leverage. *Time to close a business* (*Closbus*) is the number of years required to close a business, which decrease with bankruptcy time and should be negatively related to leverage. We include data from Transparency International, which provides the *Corruption Perception Index* (*Cor*), a measure of how public officials use their power for private gains and which should be negatively related to leverage. The index goes from 0 to 10 and a higher value indicates a lower level of corruption.

Our financial variables are derived from data on bonds and shares of non financial corporations (NFC), taken from financial accounts, whose source is Eurostat; data on loans from the banking sector are taken from European Central Bank and Bank of England.[14] As measures of the development of financial markets, we calculate the ratio of bonds to financial debt or GDP (*Bond* or *Bond_gdp*, respectively), the ratio of bank loans to financial debt or GDP (*Loan* and *Loan_gdp*, respectively), and the ratio of total shares or listed shares to GDP (*Sh_gdp* and *Qsh_gdp*, respectively). We prefer these ratios to others used in literature, such as stock market capitalization or loans to the private sector in relation to GDP, because our measures include only firm-level data and are not influenced by listed shares of financial corporations or loans to households. In particular, we introduce *Sh_gdp* as a measure of the expected profits of non-financial corporations in a given country, which should be negatively related to leverage. It should be stressed that these country-level data are valued at market prices, so they are different from book-value, firm-level data. We also consider a proxy of the strength of the bank-firm relationship: the median number of banks that firms typically borrow from in each country (*Numba*), taken from Ongena and Smith (2000).

All the country-level variables are summarized in Table 5, which reports annual averages in the sample period. The highest tax rates are in Germany (38.6 per cent) and Italy (37.3 per cent), which are also two of the countries with the highest leverage. The rates range between 27 per cent and 35 per cent in other countries, except Ireland (12.5 per cent). Highly levered firms are more common in countries with a higher level of perceived corruption, greater reliance on bank loans and lower total share value/GDP ratios; these countries also rank lower in terms of legal rights (except for Germany). Firms with low leverage are more common in countries with a lower rate of taxation, less corruption and more developed financial markets. The United Kingdom has a unique position because its firms have quite high leverage but it has characteristics in common with low-leverage countries, for example more developed financial markets and stronger investor protection. A more detailed relation between leverage and taxation is presented in Table 6. On one hand it confirms a positive cross-section correlation between the two variables; however, it also shows that there is no clear relation over time between the two variables, owing in part to limited time variation in tax rates.

Correlations between country-level variables are reported in Table 7. There is a quite high correlation between the corruption index and measures of financial market development and legal system. Stronger protection of legal rights, more developed financial market and a smaller banking sector are associated with a lower perception of corruption. Given this evidence, we do not include *Cor* in our base regression analysis because we prefer to distinguish the effect of both the legal and

[12] For a detailed description see http://www.doingbusiness.org/methodology.

[13] This variable is an extension of the dummy which identifies civil law countries. In our sample they are the UK and Ireland, which have by far the highest values.

[14] The use of these variables does not allow to consider Luxemburg, for which they are not available.

the financial system. We also exclude *Numba*, which is highly correlated with legal variables and taxation, to avoid multicollinearity problems. We use these two excluded variables in robustness checks presented in Section 5.

Finally, we calculate some firm-level variables from the Amadeus dataset. We introduce net working capital (*NWC*), given by the ratio between trade receivables plus inventories minus trade payables over total assets, because we focus on financial debt and our leverage measure does not include trade debt, which mainly depends on business transactions and not on the effect of the debt tax shield. Therefore, we control for the role of net working capital, which could have a positive effect on leverage because trade credit and inventories are usually financed by trade debt and short-term (banking) debt.

The other variables we consider are typically used in the empirical literature: *ROA* (return on assets), defined as operating income over total assets; *Tangibles*, given by tangible fixed assets over total assets; *Age*, the minimum age of firms in the sample; *Size*, derived from firms' turnover, assets and employees (see Table 1); *Listed* as a dummy equal to one if the firm is listed; *NDTS* defined as depreciation over fixed assets; *Intangibles*, computed as intangible fixed assets over total assets; *Growth*, equal to the annual percentage variation of total assets. Finally, we derive two measures of risk, which should be negatively related to leverage: *Sd_ROA*, calculated in each year and country as the standard deviation of ROA in the sector and the size class to which the firm belongs; *Z_score*, computed as a variant of Altman's (1968) indicator of bankruptcy as in Graham (1999).[15]

## 4. Regression analysis and main results

In this section we illustrate the model for the level of leverage and the estimation methods. Then we summarize the main results for the whole sample and for highly profitable firms, as defined in Section 3.2.

### *4.1 The model*

A standard static panel data model may be written as:

$$y_{ikt} = \mathbf{x}_{kt}'\boldsymbol{\beta} + \mathbf{z}_{it}'\boldsymbol{\gamma} + \alpha_{ik} + u_{ikt} \quad \text{for } i=1,\ldots, I;\ k=1,\ldots, K;\ t=1,\ldots, T_i\,, \tag{1}$$

where $y_{ikt}$ is the leverage of firm $i$ in country $k$ at time $t$, $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ are the parameter vectors for the corresponding country variables $\mathbf{x}_{kt}$ and firm variables $\mathbf{z}_{it,}$ respectively; $\alpha_{ik}$ is the unobserved firm-specific heterogeneity and $u_{ikt}$ is the stochastic error, which is allowed to be cross-firm heteroskedastic and serially autocorrelated.[16] The unobserved heterogeneity may capture all time-constant effects either relating to firm characteristics, as the skill of managers, or connected to omitted country variables.

We use a static analysis of leverage because we are not interested in an economic model of the dynamic adjustment towards an optimal level of leverage. Including lags of leverage could lead to a misspecified model and its results could depend on the instrumental variables required to perform the estimation. Moreover, we have a short time span and our country-level variables have limited time-variability, so the use of a standard GMM approach for a dynamic model (Arellano and Bond, 1991) would imply a loss of information about the variables we are most interested in.

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[15] The Z-score we consider is defined as:

$$Z = \frac{1.2 * working\_capital + 1.4 * retained\_earnings + 3.3 * operating\_income + 0.999 * sales}{total\_asset}$$

[16] We tackle this issue by clustering at the firm level using Huber-White sandwich variance estimator which is consistent when the errors are heteroskedastic or serially correlated over the panel observations (see Petersen, 2009).

In our base regressions we include as country variables: a) *Tax*, given by the statutory corporate tax rate; b) *Sh_gdp*, the market value of non-financial corporations; c) *Qsh_gdp*, financial market development; d) *Invprot*, a proxy of legal characteristics. The firm variables we include in our base regression are the most relevant in corporate finance empirical literature (see Section 2.3): profitability (*ROA*), tangible assets (*Tangibles*) and *Age*. As explained before, we introduce a measure of net working capital (*NWC*).[17] We control for firm size and sector using the dummies described in Section 3.1. Finally we include time dummies.

*4.2 The estimation methods*

First we estimate the model with a pooled ordinary least square (OLS). Since it is a cross-sectional regression, it neglects the unobserved heterogeneity by construction. To limit the possible inconsistency of our estimations, we add to our OLS regression institutional variables that may capture the omitted unobserved heterogeneity at the country level (we assess the impact of the inclusion of different country-level variables in Section 5). In order to consider serial correlation due to the unobserved heterogeneity, we introduce a random effect estimator (RE).

It is well known that the OLS and the RE estimators become inconsistent if the unobserved heterogeneity is correlated with the regressors. Therefore, we suggest applying the correlated random effect approach (CRE) as proposed by Mundlak (1978; see also Wooldridge, 2010). The method is based on the estimation of the following augmented equation:

$$y_{ikt} = \mathbf{x}'_{kt}\boldsymbol{\beta} + \mathbf{z}'_{it}\boldsymbol{\gamma} + c + \bar{\mathbf{w}}'_{ik}\boldsymbol{\xi} + a_{ik} + u_{ikt}\,, \qquad (2)$$

obtained from the combination of the main equation (1) and the auxiliary equation for the unobserved time-invariant heterogeneity, defined as:

$$\alpha_{ik} = c + \bar{\mathbf{w}}'_{ik}\boldsymbol{\xi} + a_{ik} \qquad (3)$$

where $\bar{\mathbf{w}}_{ik}$ is the time mean of the time-variant covariates in $\mathbf{w}_{ikt} = [\mathbf{x}'_{kt}\ \mathbf{z}'_{it}]'$, including the time dummies as we have an unbalanced panel, and $a_{ik}$ is the stochastic error that has zero mean and is uncorrelated with $\bar{\mathbf{w}}_{ik}$ by assumption.

Mundlak (1978) showed that the RE estimated coefficients of $\mathbf{w}_{ikt}$ in (2) are equivalent to the within (fixed effect) estimator of the main equation (1), while the estimated coefficients of $\bar{\mathbf{w}}_{ik}$ correspond to the difference between the between and the within estimators.[18] Moreover, the CRE directly tests the hypothesis of the absence of correlation between unobserved effects and single time-variant covariates (regression-based Hausman test). In fact, looking at the significance of each coefficient of $\bar{\mathbf{w}}_{ik}$ means testing the difference of the between and the within estimators which are both consistent under the null (see Hausman and Taylor, 1981).

The CRE differs from the fixed effect method because the former allows us to recover cross-country variability by estimating also the coefficients of time-invariant regressors. On the other hand, as in the fixed effect case, the CRE gives valid estimates for time-variant regressors, provided there is enough time variability. It is relevant to note here that our variable of interest, taxation, has little time series variation in the sample. In fact, six countries out of 13 change the tax rate only once and four never change it. To sum up, the CRE allows us to some extent to relate leverage to

[17] The regressions exclude the outliers of all firm variables. We exclude values below the 1st percentile and above the 99th percentile. We calculate the outliers of the variables for each country and each year.

[18] The within estimator exploits only the time variation, using the deviations from the time mean of all variables. By contrast, the between estimator considers only the time averages between sample units.

time-invariant cross-country differences, which is the main aim of our paper, through the parameter vector $\xi$.

As a last approach we consider the quantile regression model to analyse the conditional distribution of leverage, given the determinants of capital structure. Since there is high heterogeneity in our dependent variable, the underlying idea is that the impact of taxation could differ according to the firm's position in the leverage distribution. Our expectation is that more levered firms are already using debt tax shield and have less incentive to increase their debt, also because they have a higher cost of distress. Quantile regression can give informative results by modelling non-linear effects (Koenker and Basset, 1978) and is robust to heavy tailed regression errors. We assume a linear model for the *θth*-conditional quantile function (25th-, 50th- and 75th-percentiles) as follows:

$$y_{ikt} = \mathbf{x}_{kt}^{'}\boldsymbol{\beta}_{\theta} + \mathbf{z}_{it}^{'}\boldsymbol{\gamma}_{\theta} + \alpha_{\theta ik} + u_{\theta ikt} \qquad (4)$$

where the conditional quantile of error $u_{\theta ikt}$ is supposed equal to zero. The conditional quantile is the best predictor of **y** given the regressors, under the asymmetric absolute loss function. How to deal with the unobserved heterogeneity is not obvious in this context. In fact, quantile is not a linear operator and so it is impossible to directly apply a quantile regression to the deviations from the mean. Abrevaya and Dahl (2008) propose a CRE estimation for conditional quantiles allowing correlation between the unobserved effects and the regressors. In a similar way, we substitute equation (3) in (4) to obtain a linear approximation of the quantile function.

*4.3 Main results: taxation*

We present our main findings in Tables 8-11. In Table 8 we compare the results of different estimation methods. We begin with pooled OLS, in a base form (1) and in a modified version (2) where country dummies replace country-level variables. This second estimation allows us to test if there are major changes in firm-level coefficients due to the introduction of different country-level variables. The fact that firm-level estimates are basically unchanged and that the fit is quite identical suggests that taxation and institutional variables can be used instead of country dummies to evaluate cross-country differences. We then present the results of the random effect (3) and of the CRE (4) estimators. In Table 9 we show the quantile regression results. Tables 10 and 11 present the same regressions for highly profitable firms.

In all the estimations the influence of taxation is positive and significant. In general, the OLS looks like an upper bound and the CRE estimator a lower bound. The estimated value of the OLS regression indicates that an increase in the tax rate of 4.6 percentage points, which corresponds to a standard deviation, is associated with an increase in leverage of 3.3 percentage points. The impact is also significant when the cross-country effect is measured considering the variation between the lowest and the highest tax rate (Ireland, 12.5 per cent and Germany, 38.6 per cent): it amounts to a difference in leverage of nearly 19 percentage points. The influence of taxation on leverage is consistent with the evidence found by Bartholdy and Mateus (2008) and Pfermayer et al. (2008), even if their estimates are restricted to a sample of manufacturing firms. Our estimated coefficient is lower, because we also include proxies of the financial markets and the legal system not all of which were considered in these previous works.

The RE estimator confirms a positive relation: an increase in taxation of one standard deviation is associated with an increase in leverage of 2 percentage points.

The effect of taxation from the CRE, though lower, is still economically significant: an increase in the tax rate of 4 percentage points is associated with an increase in leverage of about 1 percentage point. Nevertheless, these results are based on the rather small time-variation of our variable and should be read with caution. For our purposes it is relevant to assess if there is any relation between

taxation and individual heterogeneity, once time-variation of firm and country characteristics is taken into account. The estimated coefficient of the time-mean regressor gives a measure of the relation between taxation's cross-sectional variability and the individual effects and confirms that firms are more indebted in countries with a higher level of corporate tax. The fact that the coefficient is higher for the time-mean taxation than for the time-variant taxation suggests that cross-country differences are more important than changes in the tax rate over time. However, this result cannot be easily generalized because it could depend on the short time span and on the limited time-variation with respect to cross-sectional one.

Quantile regressions show that the variability of leverage affects the coefficients of the independent variables. Taxation has a larger impact if firms have lower leverage: the estimated coefficient is 1 for the first quartile, dips to 0.9 for the median and drops to 0.6 for the third quartile. Moreover, the coefficients for the first and the second quartiles are higher than the OLS estimate. These results are consistent with the expectation that more highly levered firms are already using debt tax shield and have less incentive to increase their debt, also because they have a higher cost of distress. The CRE quantile regressions confirm the greater effect for the first two quartiles (0.4 against 0.2 of CRE linear model). At the same time, taxation also presents a higher coefficient in the time-mean variable, confirming the importance of the cross-sectional difference.

When only highly profitable firms are considered, the estimated coefficients for *Tax* remain significant and are larger (Tables 10-11). The rationale of the restriction to this large subsample (around 70 per cent of all observations) is the fact that these firms are more likely to have *Tax* as their tax rate, so that our measure of taxation is more accurate and its relation with leverage should be more precise. OLS coefficient is 0.8 instead of 0.7, while there are the same differences for CRE estimations. The coefficient of the time-variant variable is similar to that of the whole sample (0.2), while the coefficient of the time-mean regressor is higher (0.6 instead of 0.5). These findings are basically confirmed when the quantile method is used. In general, all these results support the existence of a positive correlation between taxation and leverage and the significance of cross-country differences, which is greater for structurally more profitable firms that can obtain greater benefits from debt tax shield.

*4.4 Main results: institutional and firm variables*

OLS regression provides evidence of a significant relation between institutional variables and leverage (Table 8, col. 1; Table 10, col.1 for highly profitable firms). The development of financial markets (*Qsh_gdp*) has a negative effect on leverage, as expected (see Section 3.2). The impact of the market value of listed and unlisted companies of a country (*Sh_gdp*) is also negatively related to leverage. The economic effect of *Qsh_gdp* is smaller than *Sh_gdp*: an increase of one standard deviation is related to a decrease of 2.7 and 4.3 percentage points in leverage, respectively. The magnitude is greater when the cross-country effect is measured comparing the countries with the highest and the lowest values. It is equal to 7.6 percentage points for *Qsh_gdp* (which goes from 28 per cent in Italy to 105 per cent in Finland) and to 10.4 percentage points for *Sh_gdp* (which ranges from 79 per cent in Greece to 218 per cent in Belgium). Finally, the influence of investor protection is positive and also economically significant: an increase of one standard deviation also raises leverage by 3.5 percentage points. The impact in terms of cross-country differences is much bigger and equal to 14.4 percentage points as the variable ranges between 3 in Greece and 8.3 in Ireland.

As regards the sign and the significance of the individual characteristics, the results are coherent with those of previous literature. Profitability has the biggest impact on leverage, confirming that more profitable firms are less levered, presumably because they have more internal resources to finance investment. Both tangible assets and net working capital show a positive relation to leverage and their effects are similar. Age has a negative effect, as older firms can produce more cash flow to finance their investments. Listed firms show lower leverage, owing

mainly to their easier access to alternative financing markets. Finally, there is an effect of sector and size dummies, even if it is not always statistically significant. In general, leverage is higher for construction firms and lower for manufacturers, while large companies are more levered than smaller ones.[19]

The main results of CRE estimates are reported in Table 8, col. 4 and Table 10, col. 4 for highly profitable firms. In general CRE estimations should be preferred to the pooled OLS especially for firm characteristics because it is quite likely that firms' unobserved heterogeneity may be correlated with firm-level variables. CRE confirms OLS results, which are slightly higher. An exception is *Qsh_gdp*, which has a positive sign in the time-variant variable. This finding can be explained by the fact that only time-variation is used: during the period we consider there was an equity market boom and smaller financial frictions facilitated an increase in debt, so that a positive relation is found. Corroboration of the negative correlation between leverage and financial market development comes from the time mean regressor: when cross-country variability is considered the sign is strongly negative. Another interesting result is that all variables explain part of the cross-sectional variability by means of their correlation with the unobserved fixed effects, except for *ROA*, unless only highly profitable firms are considered.[20]

Quantile regressions (Table 9 and Table 11 for highly profitable firms) confirm linear regression results. The effects appear lower in the first quartile. In particular, the effect of profitability is much greater for the last quartile, which suggests that highly indebted firms have more incentive to finance their investments with internal resources.

## 5. Robustness checks

In this section we check the results of our base regressions, paying special attention to the coefficient of taxation. We focus on the OLS and the CRE linear regressions along three main dimensions: 1) restriction of estimations to subsamples; 2) use of different proxies of institutional variables; 3) introduction of further firm-level characteristics. We finally assess if our results are influenced by endogeneity issues or by how standard errors are clustered.

First, we run our regressions for different subsamples: unlisted firms, since their financial structure could be influenced by more agency problems and asymmetric information; large firms, which could be less opaque and have more reliable data than other; manufacturing companies because they are a more homogeneous group and their results are comparable with previous studies. We find that our results hold in all subsamples; in particular, the tax coefficient is slightly higher for unlisted, larger and manufacturing firms.[21]

As a second check on our results we evaluate the effects of including different combinations of legal system variables (*Legright* or *Closbus* instead of *Invprot*) and financial development proxies

[19] We also considered a continuous definition of firm size using the logarithm of total assets. We find a positive relation, but the results are not always statistically significant.

[20] This means that in the whole sample the impact of firm profitability is related to leverage only through its time variation. This is not completely surprising since profitability can be highly time-varying. Consequently, it is reasonable for a firm not to consider average profitability as a reliable measure of income, so that average probability is not necessarily related to leverage. On the other hand, when only highly profitable firms are considered a measure of average profitability (used in the augmented regression) becomes significant, possibly because these firms expect to have positive income.

[21] We also focus on firm sector or size by running a regression for each category. The impact of taxation on leverage is confirmed in all size classes (only for small firms is the coefficient of the time-mean regressor of CRE significant). The effect is confirmed in all sectors except energy (only for construction firms is the coefficient of the time-mean regressor of CRE significant). Lastly, we check the robustness of our results with respect to the exclusion of each country, leaving countries out one by one; in the OLS regression our estimated coefficients all remain significant, while in the CRE case leaving out some countries makes a difference in the coefficients of time-variant regressors.

(*Bond*, *Bond_gdp*, *Loan*, or *Loan_gdp* instead of *Qsh_gdp*).[22] We also test the effect of excluding *Sh_gdp*, which we introduced in our paper to take into account the market value of all non-financial corporations in a country. In general, the relation between taxation and leverage remains positive and strongly significant. The use of different proxies of legal system slightly reduces the coefficient of taxation; our base regression includes *Invprot* because it is the most significant variable and it is related to the concept of "civil law" countries. The use of the other proxies of financial market development slightly increases the estimated parameter of taxation. Finally, eliminating *Sh_gdp* from the basic model slightly lowers the impact of taxation.[23] We also take into account that in the period the NFC debt/GDP ratio rose sharply in some countries (Greece, Ireland, Italy, Portugal, Spain and the UK); this may have been the outcome of relatively easier access to credit (or lower initial debt levels) and can be treated as an omitted country characteristics. We include a dummy for these countries and our results are basically the same.

As we have several institutional variables which are quite correlated and may represent the same phenomenon, we synthesize the information using principal component analysis (PCA). We initially derive two new variables from the six proxies of financial development (*mkt*) and from the three variables of legal system (*law*) separately by taking the first principal component.[24] We include these two variables in the base regression in place of *Qsh_gdp* and *Invprot* and the results on the other variables are unchanged. These two variables are significant and with the expected sign: negative for *mkt* and positive for *law* for the OLS and for the coefficient of the average variables in the CRE. However, since they are correlated (0.5), we also derive a single proxy from all nine variables (*mkt_law*) and use it in our base regression.[25] The relation with taxation is confirmed.[26]

Some empirical studies suggest that corruption is associated with higher leverage (e.g. Fan et al., 2012). In our sample *Cor* is quite highly correlated with financial development and investor protection, which corporate finance theory indicates is determinant of leverage. However, these two country characteristics are in opposite relation with leverage: negative for financial development and positive for investor protection. Since *Cor* includes these two contrasting characteristics, we prefer to use two different variables instead of just that proxy in our base regression.[27] As a robustness check, we include *Cor* in our regression; the coefficients of *Tax* and institutional variables are nearly unchanged.

A third set of controls involves the inclusion of other firm-level variables. We checked that they do not change our results of linear regression. We introduce asset growth, intangible assets, NDTS, volatility of earnings, and Z-score. The estimations of previous variables are similar in terms of sign and significance; some differences are mainly due to the change in the sample size. The firm-level variables added to the regression are statistically significant but do not always have the expected sign. NDTS and Z-score are negatively linked to leverage, while asset growth, intangible assets and volatility of earnings are positively related to leverage, although theory suggests the relation should be negative. We do not include these variables in our base regression for two main reasons. First

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22 We do not consider *Numba* because it is highly correlated with other variables.

23 A referee suggested that financial account variables may cause some volatility problems. For this reason we also check our results replacing *Sh_gdp* and *Qsh_gdp* with two dummies, each dividing the countries in two groups according to certain threshold values (1.36 and 0.5 respectively). The results remain quite similar.

24 The first principal component seems a good proxy of all the variables we consider in both cases. It accounts for more then 70 per cent of total variance, the eigenvectors are similar in absolute value for all the variables and its correlation with the base variables is above 0.7.

25 The first principal component accounts for 60 per cent of the variance and is strongly correlated (above 0.75) with all the base variables, except *Closbus*.

26 When *mkt* and *law* are considered in the CRE, the coefficient of taxation is significant only for the time-mean regressor.

27 We find a high correlation between *mkt_law* and *Cor* (0.8), which confirms that the Perceived Corruption Index may sum up both the financial development and the legal structure of countries.

and foremost, because they reduce the number of observations (except for volatility of earnings), and for some of them we lose nearly all the observations for Austria (asset growth) or Ireland (intangible assets). Second, these variables do not seem good proxies of the measures suggested by the theoretical models.

Finally, we address a possible endogeneity problem. We control for the simultaneity bias of some firm variables (profitability, tangible asset, and net trade credit) by replacing them with: a) their lags as regressors; b) their mean calculated on the firm's size class and sector (for each year and country). The results of country-level variables are basically unchanged.

We also consider the possibility of within-country correlation, which could be relevant since we are interested in country-level variables. We clustered standard errors at country-year level for OLS estimates and our main results still hold. We choose not to use country-level cluster as a robustness check because otherwise we would not have enough clusters and the estimates of the standard errors would be unreliable (partly owing to the fact that the clusters are very unbalanced).

## 6. Conclusion

In this paper we study the relation between financial structure and several country- and firm-level variables in a sample of European non-financial companies – highly representative of medium-sized and large firms – during the period 2004-2007. We focus on the link between cross-section differences in taxation of corporate income and firms' leverage to assess if debt tax shield plays a role in their financial decisions, once other institutional factors and individual firm characteristics are taken into account.

In our analysis we construct some variables which are new or different with respect to previous literature. First, our dependent variable is a measure of leverage that only includes financial debt, thus excluding the effect of other liabilities like trade payables which we consider to be unrelated to financial decisions. We then rely on a simple variable, the statutory corporate tax rate, to assess the impact of taxation on our dependent variable. Since this measure could be more precise for firms that are unlikely to have losses, we opt to verify the effect of our taxation variable on highly profitable firms rather than to use different and possibly less precise measures of taxation. We use several institutional variables to take account of cross-country differences in legal systems and financial development; for the latter we introduce some innovative variables, taken from the financial accounts, to restrict the role of the financial system – loan, bond or equity markets– to non-financial corporations only. We also try to use all our variables together by means of PCA techniques. At firm level, we introduce a measure of net working capital to consider the role played by trade debt.

In our regression analysis we use different estimation methods to assess the impact of taxation on leverage: pooled OLS, CRE, and quantile regression. The first method is widely used to consider both cross-sectional and time variation but it could suffer from correlation between firms' unobserved heterogeneity and regressors. To address this issue, we opt for the CRE method to estimate both the fixed effect coefficients (time variability) and the relation between leverage and time-constant taxation (cross-country variability). We also include quantile regression to evaluate if the impact of taxation differs depending on a firm's position in the leverage distribution. According to corporate finance theory, less levered firms should have a greater incentive to use debt tax shield, so we expect the impact of our taxation variable to differ.

Panel regressions show a positive effect of taxation on leverage and the results remain significant in different subsamples. These findings are robust to different estimation methods and to the use of different proxies for the degree of financial development and the characteristics of the legal system of the country where firms are located. More specifically, OLS results are confirmed by CRE estimations; the effect of taxation is lower when unobserved heterogeneity is considered, even if this result may be affected by the rather small time-variation in taxation. For our purposes it

is significant that there is a strong cross-section relation between leverage and the time-average of taxation, a component of individual heterogeneity: this result confirms that firms are more indebted in countries with a higher level of corporate tax. The results of quantile regressions show that the effect of taxation is greater for less levered firms. Consistently with the theory of debt tax shield, the relation between debt and taxation is stronger for highly profitable firms.

As regards the other country-level variables, they too are related to cross-country differences in leverage. The development of financial markets has a negative effect on leverage. In particular, the higher the market value of a country's listed and unlisted companies, the lower the level of leverage. The influence of the investor protection is positive and economically significant. Our analysis confirms that individual characteristics influence firm leverage: more profitable and older firms are less levered, while both tangible assets and net working capital are positively related to leverage.

## Appendix A – Descriptive tables

**Table 1. Firm size (amounts in thousands of euros)**

| | No. employees | Revenue | OR Total assets |
|---|---|---|---|
| *Small* | <50 | ≤10,000 | ≤10,000 |
| *Medium-sized* | <250 | ≤50,000 | ≤43,000 |
| *Large* | ≥250 | >50,000 | >43,000 |

**Table 2. Firm sector**

| Sector | Standard Industrial Classification (SIC) Code |
|---|---|
| *Energy* | 1094 Uranium-Radium-Vanadium Ores<br>1200 Coal/Lignite Mining<br>1300 Oil and Gas Extraction<br>4900 Electric, Gas & Sanitary Services (excluding 4950, 4960, 4970) |
| *Manufacturing* | 1000 Metal Mining (excluding 1094)<br>1400 Mining And Quarrying Of Nonmetallic Minerals, Except Fuels<br>2000 Food and Kindred Products<br>2100 Tobacco Manufacturing<br>2200 Textile Mill Products<br>2300 Apparel and Other Textile Products<br>2400 Lumber and Wood Products<br>2500 Furniture and Fixtures<br>2600 Paper and Allied Products<br>2700 Printing and Publishing<br>2800 Chemicals and Allied Products<br>2900 Petroleum and Coal Products<br>3000 Rubber/Misc. Plastic Products<br>3100 Leather and Leather Products<br>3200 Stone, Clay, Glass and Concrete Products<br>3300 Primary Metal Industries<br>3400 Fabricated Metal Products<br>3500 Industrial and Commercial Machinery and Computer Equip<br>3600 Electrical Equipment and Components<br>3700 Transportation Equipment<br>3800 Measurement Analyzing, Control Instr and Related Prod.<br>3900 Misc. Manufacturing Industries |
| *Construction* | 1500-1700 Division C - Construction |
| *Services* | 4000-4800 Division E - Transportation and Public Utilities (excluding 4900)<br>4950: Sanitary Services<br>4960: Steam And Air-conditioning Supply<br>4970: Irrigation Systems<br>5000-5100 Division F - Wholesale Trade<br>5200-5900 Division G - Retail Trade<br>6500 Real Estate<br>7000-8900 Division I - Services |

**Table 3a. Distribution by country. Sample period 2004-2007**

| Country | Obs | Size | | | Sector | | | |
|---|---|---|---|---|---|---|---|---|
| | | *Small* | *Medium* | *Large* | *Energy* | *Manufact* | *Construct* | *Services* |
| *Au* | 3,776 | 0.53 | 0.27 | 0.20 | 0.02 | 0.21 | 0.08 | 0.59 |
| *Be* | 29,479 | 0.38 | 0.46 | 0.17 | 0.01 | 0.25 | 0.06 | 0.66 |
| *Fi* | 11,834 | 0.30 | 0.47 | 0.22 | 0.04 | 0.32 | 0.06 | 0.57 |
| *Fr* | 74,811 | 0.19 | 0.53 | 0.27 | 0.01 | 0.27 | 0.06 | 0.66 |
| *Ge* | 49,794 | 0.23 | 0.40 | 0.37 | 0.05 | 0.28 | 0.03 | 0.62 |
| *Gr* | 9,853 | 0.20 | 0.59 | 0.20 | 0.01 | 0.35 | 0.05 | 0.59 |
| *Ir* | 9,527 | 0.38 | 0.41 | 0.22 | 0.01 | 0.15 | 0.08 | 0.50 |
| *It* | 81,174 | 0.19 | 0.59 | 0.23 | 0.02 | 0.35 | 0.06 | 0.45 |
| *Lu* | 1,818 | 0.52 | 0.32 | 0.16 | 0.01 | 0.16 | 0.08 | 0.41 |
| *Ne* | 24,956 | 0.25 | 0.40 | 0.35 | 0.02 | 0.22 | 0.08 | 0.66 |
| *Po* | 14,771 | 0.33 | 0.49 | 0.17 | 0.02 | 0.27 | 0.11 | 0.58 |
| *Sp* | 63,798 | 0.25 | 0.52 | 0.23 | 0.02 | 0.23 | 0.12 | 0.60 |
| *Uk* | 111,394 | 0.28 | 0.31 | 0.41 | 0.02 | 0.21 | 0.07 | 0.63 |
| *Total* | 486,985 | 0.25 | 0.46 | 0.29 | 0.02 | 0.26 | 0.07 | 0.60 |

Note: The total by sector does not sum to 1 because of unclassified firms.

**Table 3b. Estimated coverage of medium and large firms (per cent)**

| Country | Ratio Amadeus/Eurostat |
|---|---|
| *Au* | 8.0 |
| *Be* | 96.8 |
| *Fi* | 75.1 |
| *Fr* | 60.0 |
| *Ge* | 25.2 |
| *Gr* | n.a. |
| *Ir* | 56.9 |
| *It* | 77.5 |
| *Lu* | 52.2 |
| *Ne* | 68.7 |
| *Po* | 44.6 |
| *Sp* | 56.3 |
| *Uk* | 74.0 |

Sources: Eurostat (2009), European Union (2011) and authors' calculations.

**Table 4. Summary statistics for firm variables**
**Mean values in the sample period 2004-2007 (standard deviations in italics)**

| Country | Leverage | ROA | Tangibles | NWC | Growth | Intangibles | NDTS | Sd_ROA | Z-score | Age | Listed |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Au* | 0.42 | 0.16 | 0.37 | 0.15 | 0.88 | 0.02 | 0.18 | 0.30 | 3.14 | 24.04 | 0.02 |
| | *0.32* | *0.63* | *0.33* | *0.20* | *24.46* | *0.06* | *0.38* | *0.52* | *2.52* | *28.26* | *0.14* |
| *Be* | 0.41 | 0.07 | 0.20 | 0.21 | 0.09 | 0.02 | 0.19 | 0.09 | 3.28 | 24.95 | 0.01 |
| | *0.29* | *0.09* | *0.22* | *0.23* | *0.24* | *0.05* | *0.16* | *0.01* | *2.70* | *19.76* | *0.11* |
| *Fi* | 0.37 | 0.10 | 0.22 | 0.22 | 0.09 | 0.04 | 0.18 | 0.12 | 3.20 | 21.44 | 0.04 |
| | *0.28* | *0.12* | *0.24* | *0.23* | *0.23* | *0.08* | *0.17* | *0.01* | *2.52* | *22.25* | *0.19* |
| *Fr* | 0.35 | 0.07 | 0.16 | 0.19 | 0.07 | 0.05 | 0.17 | 0.08 | 3.38 | 25.13 | 0.02 |
| | *0.26* | *0.08* | *0.19* | *0.21* | *0.19* | *0.09* | *0.14* | *0.01* | *2.33* | *21.51* | *0.14* |
| *Ge* | 0.53 | 0.08 | 0.32 | 0.21 | 0.07 | 0.02 | 0.18 | 0.11 | 2.95 | 24.69 | 0.03 |
| | *0.27* | *0.11* | *0.30* | *0.23* | *0.19* | *0.04* | *0.17* | *0.01* | *4.47* | *28.19* | *0.17* |
| *Gr* | 0.49 | 0.07 | 0.24 | 0.29 | 0.12 | 0.02 | 0.15 | 0.08 | 2.46 | 17.33 | 0.09 |
| | *0.27* | *0.08* | *0.22* | *0.26* | *0.22* | *0.04* | *0.15* | *0.01* | *1.63* | *14.08* | *0.29* |
| *Ir* | 0.41 | 0.08 | 0.29 | 0.20 | 0.15 | 0.12 | 0.12 | 0.14 | 2.75 | 16.99 | 0.01 |
| | *0.33* | *0.14* | *0.31* | *0.25* | *0.37* | *0.17* | *0.18* | *0.03* | *1.51* | *16.97* | *0.12* |
| *It* | 0.54 | 0.05 | 0.17 | 0.26 | 0.09 | 0.03 | 0.21 | 0.06 | 2.67 | 21.03 | 0.01 |
| | *0.28* | *0.06* | *0.19* | *0.24* | *0.20* | *0.06* | *0.25* | *0.01* | *4.09* | *16.62* | *0.09* |
| *Lu* | 0.38 | 0.07 | 0.19 | 0.31 | 0.13 | 0.02 | 0.22 | 0.10 | 3.24 | 15.52 | 0.02 |
| | *0.31* | *0.11* | *0.24* | *0.30* | *0.31* | *0.05* | *0.34* | *0.03* | *2.10* | *17.71* | *0.13* |
| *Ne* | 0.39 | 0.09 | 0.27 | 0.40 | 0.10 | 0.07 | 0.19 | 0.11 | 3.26 | 28.60 | 0.02 |
| | *0.28* | *0.11* | *0.27* | *0.28* | *0.25* | *0.12* | *0.17* | *0.01* | *2.02* | *30.15* | *0.15* |
| *Po* | 0.45 | 0.05 | 0.25 | 0.35 | 0.10 | 0.03 | 0.21 | 0.08 | 2.64 | 21.40 | 0.01 |
| | *0.28* | *0.08* | *0.23* | *0.25* | *0.22* | *0.07* | *0.28* | *0.01* | *2.03* | *19.28* | *0.08* |
| *Sp* | 0.45 | 0.06 | 0.20 | 0.35 | 0.13 | 0.04 | 0.11 | 0.08 | 2.65 | 18.25 | 0.01 |
| | *0.30* | *0.08* | *0.21* | *0.28* | *0.24* | *0.08* | *0.11* | *0.01* | *2.15* | *15.27* | *0.10* |
| *Uk* | 0.47 | 0.05 | 0.28 | 0.17 | 0.10 | 0.12 | 0.19 | 0.15 | 2.99 | 22.37 | 0.04 |
| | *0.30* | *0.16* | *0.28* | *0.22* | *0.27* | *0.17* | *0.20* | *0.04* | *4.11* | *23.46* | *0.20* |
| *Total* | | | | | | | | | | | |
| *mean* | 0.46 | 0.06 | 0.23 | 0.24 | 0.10 | 0.04 | 0.18 | 0.10 | 2.94 | 22.48 | 0.02 |
| *st. dev.* | 0.29 | 0.11 | 0.25 | 0.25 | 1.68 | 0.09 | 0.19 | 0.03 | 1.75 | 21.78 | 0.15 |
| *min* | 0.00 | -1.47 | 0.00 | -0.50 | -0.70 | 0.00 | 0.00 | 0.04 | 0.05 | 0.00 | 0.00 |
| *max* | 1.00 | 9.72 | 1.00 | 1.00 | 986.47 | 0.94 | 14.10 | 0.22 | 11.25 | 389.00 | 1.00 |

Note: Except for *Age* and *Listed*, values are computed excluding observations below the 1st percentile and above the 99th percentile of each variable.

*Leverage*: book value ratio of financial debt (including provisions) over the sum of financial debt and equity; *ROA*: operating income over assets; *Tangibles*: tangible fixed assets over total assets; *NWC*: ratio of trade receivables plus inventories minus trade payables debt to total assets; *Growth*: annual percentage variation of total assets; *Intangibles*: intangible fixed assets over total assets; *NDTS*: depreciation over fixed assets; *Sd_ROA*: time- and country- standard deviation of ROA in the sector and the size class to which the firm belongs; *Z_score*: a variant of Altman's (1968) indicator of bankruptcy; *Age*: firm's minimum age in the sample; *Listed*: dummy equal to one if the firm is listed.

**Table 5. Summary statistics for country variables. Mean values in the sample period 2004-2007**

| Country | Tax | Cor | Sh_gdp | Qsh_gdp | Bond_gdp | Bond | Loan_gdp | Loan | Numba | Invprot | Legright | Closbis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Au* | 0.280 | 8.45 | 1.06 | 0.30 | 0.11 | 0.14 | 0.50 | 0.63 | 3 | 4.0 | 7.0 | 1.1 |
| *Be* | 0.340 | 7.32 | 2.86 | 0.43 | 0.05 | 0.03 | 0.31 | 0.21 | 7 | 7.0 | 7.0 | 0.9 |
| *Fi* | 0.267 | 9.57 | 1.74 | 1.05 | 0.14 | 0.15 | 0.27 | 0.28 | 3 | 5.7 | 7.0 | 0.9 |
| *Fr* | 0.348 | 7.32 | 2.18 | 0.67 | 0.20 | 0.21 | 0.37 | 0.39 | 9 | 5.3 | 4.5 | 1.9 |
| *Ge* | 0.386 | 8.05 | 0.81 | 0.40 | 0.05 | 0.07 | 0.35 | 0.52 | 5 | 5.0 | 8.0 | 1.2 |
| *Gr* | 0.299 | 4.40 | 0.79 | 0.40 | 0.08 | 0.14 | 0.36 | 0.66 | 6 | 3.0 | 3.0 | 2.0 |
| *Ir* | 0.125 | 7.45 | 1.08 | 0.30 | 0.04 | 0.04 | 0.74 | 0.69 | 2 | 8.3 | 8.0 | 0.4 |
| *It* | 0.373 | 4.97 | 1.08 | 0.28 | 0.05 | 0.07 | 0.48 | 0.69 | 12 | 5.7 | 3.0 | 1.5 |
| *Lu* | 0.299 | 8.48 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | 4 | 4.3 | 7.0 | 2.0 |
| *Ne* | 0.302 | 8.77 | 1.25 | 0.75 | 0.09 | 0.09 | 0.48 | 0.50 | 3 | 4.7 | 6.0 | 1.1 |
| *Po* | 0.272 | 6.47 | 1.83 | 0.35 | 0.16 | 0.13 | 0.59 | 0.46 | 10 | 6.0 | 3.0 | 2.0 |
| *Sp* | 0.343 | 6.90 | 1.72 | 0.47 | 0.01 | 0.01 | 0.70 | 0.62 | 7 | 5.0 | 6.0 | 1.0 |
| *Uk* | 0.300 | 8.55 | 1.50 | 0.96 | 0.27 | 0.26 | 0.30 | 0.29 | 2 | 8.0 | 9.0 | 1.0 |
| *Total* | | | | | | | | | | | | |
| *mean* | 0.331 | 7.28 | 1.56 | 0.60 | 0.13 | 0.13 | 0.43 | 0.47 | 6 | 6.0 | 6.2 | 1.3 |
| *st. dev.* | 0.046 | 1.33 | 0.57 | 0.27 | 0.10 | 0.09 | 0.15 | 0.17 | 4 | 1.3 | 2.2 | 0.4 |
| *min* | 0.125 | 4.30 | 0.65 | 0.18 | 0.01 | 0.01 | 0.24 | 0.20 | 2 | 3.0 | 3.0 | 0.4 |
| *max* | 0.387 | 9.70 | 3.24 | 1.25 | 0.29 | 0.26 | 0.93 | 0.82 | 12 | 8.3 | 9.0 | 2.0 |

Note: The statistics of the total sample are calculated cross-country.
*Tax*: statutory corporate tax rate; *Cor*: Corruption Perception Index; *Sh_gdp*: ratio of non financial corporations (NFC) shares to GDP; *Qsh_gdp*: ratio of NFC listed shares to GDP; *Bond_gdp*: ratio of NFC bonds to GDP; *Bond*: ratio of NFC bonds to NFC financial debt; *Loan_gdp*: bank loans to NFCs over GDP; *Loan*: bank loans to NFCs over NFC financial debt; *Numba*: median number of banks that firms typically borrow from; *Invprot*: investor protection; *Legright*: legal right protection; *Closbus*: number of years required to close a business.

**Table 6. Leverage and taxation (mean values)**

| Country | Leverage (1) | | | | Tax | | | |
|---|---|---|---|---|---|---|---|---|
| | 2004 | 2005 | 2006 | 2007 | 2004 | 2005 | 2006 | 2007 |
| *Au* | 0.59 | 0.45 | 0.37 | 0.29 | 0.340 | 0.250 | 0.250 | 0.250 |
| *Be* | 0.43 | 0.42 | 0.40 | 0.39 | 0.340 | 0.340 | 0.340 | 0.340 |
| *Fi* | 0.35 | 0.35 | 0.37 | 0.40 | 0.290 | 0.260 | 0.260 | 0.260 |
| *Fr* | 0.36 | 0.36 | 0.35 | 0.34 | 0.354 | 0.350 | 0.344 | 0.344 |
| *Ge* | 0.57 | 0.55 | 0.53 | 0.51 | 0.383 | 0.387 | 0.387 | 0.387 |
| *Gr* | 0.47 | 0.48 | 0.50 | 0.51 | 0.350 | 0.320 | 0.290 | 0.250 |
| *Ir* | 0.39 | 0.40 | 0.41 | 0.42 | 0.125 | 0.125 | 0.125 | 0.125 |
| *It* | 0.52 | 0.51 | 0.55 | 0.55 | 0.373 | 0.373 | 0.373 | 0.373 |
| *Lu* | 0.35 | 0.32 | 0.38 | 0.42 | 0.304 | 0.304 | 0.296 | 0.296 |
| *Ne* | 0.41 | 0.41 | 0.38 | 0.35 | 0.345 | 0.315 | 0.296 | 0.255 |
| *Po* | 0.42 | 0.42 | 0.45 | 0.47 | 0.275 | 0.275 | 0.275 | 0.265 |
| *Sp* | 0.43 | 0.44 | 0.46 | 0.47 | 0.350 | 0.350 | 0.350 | 0.325 |
| *Uk* | 0.48 | 0.48 | 0.47 | 0.46 | 0.300 | 0.300 | 0.300 | 0.300 |

(1) The mean values are computed excluding observations below the 1st percentile and above the 99th percentile.
*Leverage*: book value ratio of financial debt (including provisions) over the sum of financial debt and equity; *Tax*: statutory corporate tax rate.

**Table 7. Sample correlation matrix for country variables**

| | Tax | Cor | Sh_gdp | Qsh_gdp | Bond_gdp | Bond | Loan_gdp | Loan | Numba | Invprot | Legright | Closbus |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tax | 1.00 | | | | | | | | | | | |
| Cor | -0.41 | 1.00 | | | | | | | | | | |
| Sh_gdp | -0.10 | 0.17 | 1.00 | | | | | | | | | |
| Qsh_gdp | -0.43 | 0.77 | 0.25 | 1.00 | | | | | | | | |
| Bond_gdp | -0.37 | 0.54 | 0.20 | 0.82 | 1.00 | | | | | | | |
| Bond | -0.31 | 0.49 | 0.11 | 0.77 | 0.98 | 1.00 | | | | | | |
| Loan_gdp | -0.08 | -0.41 | -0.04 | -0.45 | -0.58 | -0.64 | 1.00 | | | | | |
| Loan | 0.27 | -0.73 | -0.53 | -0.72 | -0.72 | -0.66 | 0.71 | 1.00 | | | | |
| Numba | 0.57 | -0.86 | 0.08 | -0.72 | -0.48 | -0.44 | 0.32 | 0.57 | 1.00 | | | |
| Invprot | -0.48 | 0.41 | 0.15 | 0.54 | 0.63 | 0.55 | -0.37 | -0.60 | -0.50 | 1.00 | | |
| Legright | -0.36 | 0.83 | 0.01 | 0.65 | 0.43 | 0.36 | -0.35 | -0.61 | -0.91 | 0.61 | 1.00 | |
| Closbus | 0.36 | -0.47 | 0.09 | -0.24 | 0.08 | 0.16 | -0.05 | 0.20 | 0.65 | -0.47 | -0.70 | 1.00 |

*Tax*: statutory corporate tax rate; *Cor*: Corruption Perception Index; *Sh_gdp*: ratio of non financial corporations (NFC) shares to GDP; *Qsh_gdp*: ratio of NFC listed shares to GDP; *Bond_gdp*: ratio of NFC bonds to GDP; *Bond*: ratio of NFC bonds to NFC financial debt; *Loan_gdp*: bank loans to NFC over GDP; *Loan*: bank loans to NFC over NFC financial debt; *Numba*: median number of banks that firms typically borrow from; *Invprot*: investor protection; *Legright*: legal right protection; *Closbus*: number of years required to close a business.

## Appendix B – Regression analysis

**Table 8. Linear regression model: different estimators**

| | OLS (1) | OLS with country-dummy (2) | RE (3) | CRE (4) | |
|---|---|---|---|---|---|
| | | | | *Main eq.* | *Auxiliary eq.* |
| *Tax* | 0.721*** | | 0.507*** | 0.219*** | 0.483*** |
| | (0.019) | | (0.017) | (0.033) | (0.038) |
| *Sh_gdp* | -0.075*** | | -0.067*** | -0.051*** | -0.024*** |
| | (0.001) | | (0.001) | (0.003) | (0.003) |
| *Qsh_gdp* | -0.099*** | | -0.055*** | 0.062*** | -0.165*** |
| | (0.004) | | (0.003) | (0.008) | (0.008) |
| *Invprot* | 0.027*** | | 0.018*** | 0.028*** | |
| | (0.001) | | (0.001) | (0.001) | |
| *ROA* | -0.450*** | -0.451*** | -0.375*** | -0.365*** | -0.034 |
| | (0.016) | (0.015) | (0.020) | (0.025) | (0.028) |
| *Tangibles* | 0.181*** | 0.182*** | 0.171*** | 0.142*** | 0.046*** |
| | (0.003) | (0.004) | (0.003) | (0.007) | (0.008) |
| *NWC* | 0.172*** | 0.175*** | 0.148*** | 0.131*** | 0.042*** |
| | (0.003) | (0.003) | (0.003) | (0.005) | (0.006) |
| *Age* | -0.001*** | -0.001*** | -0.001*** | -0.001*** | |
| | (0.000) | (0.000) | (0.000) | (0.000) | |
| *Listed* | -0.067*** | -0.073*** | -0.085*** | -0.042*** | -0.055*** |
| | (0.004) | (0.004) | (0.004) | (0.009) | (0.010) |
| *Constant* | 0.215*** | 0.344*** | 0.305*** | 0.223*** | |
| | (0.011) | (0.006) | (0.010) | (0.011) | |
| N | 373044 | 373044 | 373044 | 373044 | |
| adj. R-sq | 0.120 | 0.125 | | | |

Note: Dependent variable is individual firm leverage. White robust standard errors clustered at firm level in parentheses. Significance level: * p<0.10; ** p<0.05; *** p<0.01. Regressions include year, size and sector dummies. In regression (2) France is the benchmark country.

*Tax*: statutory corporate tax rate; *Sh_gdp*: ratio of non financial corporations (NFC) shares to GDP; *Qsh_gdp*: ratio of NFC listed shares to GDP; *Invprot*: investor protection; *ROA*: operating income over assets; *Tangibles*: tangible fixed assets over total assets; *NWC*: ratio of trade receivables plus inventories minus trade payables to total assets; *Age*: firm's minimum age in the sample; *Listed*: dummy equal to one if the firm is listed.

**Table 9. Quantile regression model: different estimators**

| | OLS | | | CRE | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | First quartile | Median | Third quartile | First quartile | | Median | | Third quartile | |
| | | | | *Main eq.* | *Auxiliary eq.* | *Main eq.* | *Auxiliary eq.* | *Main eq.* | *Auxiliary eq.* |
| *Tax* | 0.977*** | 0.898*** | 0.601*** | 0.389*** | 0.616*** | 0.379*** | 0.536*** | 0.209*** | 0.412*** |
| | (0.012) | (0.017) | (0.020) | (0.082) | (0.087) | (0.066) | (0.074) | (0.072) | (0.067) |
| *Sh_gdp* | -0.075*** | -0.093*** | -0.086*** | -0.038*** | -0.038*** | -0.065*** | -0.029*** | -0.069*** | -0.017* |
| | (0.001) | (0.001) | (0.001) | (0.007) | (0.007) | (0.010) | (0.010) | (0.009) | (0.009) |
| *Qsh_gdp* | -0.082*** | -0.139*** | -0.107*** | 0.048*** | -0.135*** | 0.073** | -0.219*** | 0.087*** | -0.198*** |
| | (0.003) | (0.003) | (0.004) | (0.018) | (0.019) | (0.034) | (0.034) | (0.017) | (0.017) |
| *Invprot* | 0.023*** | 0.033*** | 0.032*** | 0.024*** | | 0.035*** | | 0.033*** | |
| | (0.001) | (0.001) | (0.001) | (0.001) | | (0.001) | | (0.001) | |
| *ROA* | -0.398*** | -0.789*** | -0.879*** | -0.320*** | -0.098*** | -0.577*** | -0.262*** | -0.699*** | -0.227*** |
| | (0.006) | (0.009) | (0.010) | (0.013) | (0.016) | (0.019) | (0.018) | (0.020) | (0.022) |
| *Tangibles* | 0.240*** | 0.257*** | 0.175*** | 0.207*** | 0.033*** | 0.215*** | 0.044*** | 0.114*** | 0.063*** |
| | (0.004) | (0.003) | (0.003) | (0.010) | (0.012) | (0.016) | (0.017) | (0.012) | (0.011) |
| *NWC* | 0.180*** | 0.257*** | 0.185*** | 0.121*** | 0.066*** | 0.201*** | 0.063*** | 0.163*** | 0.025*** |
| | (0.002) | (0.003) | (0.003) | (0.009) | (0.011) | (0.011) | (0.011) | (0.007) | (0.007) |
| *Age* | -0.001*** | -0.001*** | -0.001*** | -0.001*** | | -0.001*** | | -0.001*** | |
| | (0.000) | (0.000) | (0.000) | (0.000) | | (0.000) | | (0.000) | |
| *Listed* | -0.029*** | -0.066*** | -0.099*** | -0.023 | -0.007 | -0.057*** | -0.009 | -0.067*** | -0.033 |
| | (0.003) | (0.002) | (0.004) | (0.020) | (0.020) | (0.018) | (0.018) | (0.026) | (0.026) |
| *Constant* | -0.126*** | 0.157*** | 0.521*** | -0.132*** | | 0.159*** | | 0.529*** | |
| | (0.009) | (0.008) | (0.011) | (0.010) | | (0.009) | | (0.011) | |
| N | 373044 | 373044 | 373044 | 373044 | | 373044 | | 373044 | |

Note: Dependent variable is individual firm leverage. Bootstrapped standard errors clustered at firm level in parenthesis. Significance level: * p<0.10; ** p<0.05; *** p<0.01. Regressions include year, size and sector dummies.

*Tax*: statutory corporate tax rate; *Sh_gdp*: ratio of non financial corporations (NFC) shares to GDP; *Qsh_gdp*: ratio of NFC listed shares to GDP; *Invprot*: investor protection; *ROA*: operating income over assets; *Tangibles*: tangible fixed assets over total assets; *NWC*: ratio of trade receivables plus inventories minus trade payables to total assets; *Age*: firm's minimum age in the sample; *Listed*: dummy equal to one if the firm is listed.

**Table 10. Highly profitable firms - Linear regression model: different estimators**

| | OLS (1) | OLS with country-dummy (2) | RE (3) | CRE (4) | |
|---|---|---|---|---|---|
| | | | | *Main eq.* | *Auxiliary eq.* |
| *Tax* | 0.787*** | | 0.545*** | 0.174*** | 0.580*** |
| | (0.022) | | (0.019) | (0.036) | (0.042) |
| *Sh_gdp* | -0.082*** | | -0.073*** | -0.050*** | -0.034*** |
| | (0.001) | | (0.001) | (0.003) | (0.004) |
| *Qsh_gdp* | -0.092*** | | -0.060*** | 0.047*** | -0.148*** |
| | (0.005) | | (0.004) | (0.009) | (0.010) |
| *Invprot* | 0.029*** | | 0.020*** | 0.030*** | |
| | (0.001) | | (0.001) | (0.001) | |
| *ROA* | -0.697*** | -0.701*** | -0.485*** | -0.410*** | -0.233*** |
| | (0.035) | (0.034) | (0.038) | (0.041) | (0.062) |
| *Tangibles* | 0.203*** | 0.201*** | 0.186*** | 0.140*** | 0.062*** |
| | (0.004) | (0.004) | (0.004) | (0.009) | (0.010) |
| *NWC* | 0.178*** | 0.179*** | 0.155*** | 0.142*** | 0.033*** |
| | (0.004) | (0.004) | (0.003) | (0.005) | (0.007) |
| *Age* | -0.001*** | -0.001*** | -0.001*** | -0.001*** | |
| | (0.000) | (0.000) | (0.000) | (0.000) | |
| *Listed* | -0.044*** | -0.051*** | -0.061*** | -0.031*** | -0.038*** |
| | (0.005) | (0.005) | (0.005) | (0.011) | (0.012) |
| *Constant* | 0.196*** | 0.342*** | 0.283*** | 0.216*** | |
| | (0.013) | (0.008) | (0.011) | (0.014) | |
| N | 259959 | 259959 | 259959 | 259959 | |
| adj. R-sq | 0.163 | 0.169 | | | |

Note: Dependent variable is individual firm leverage. White robust standard errors clustered at firm level in parenthesis. Significance level: * p<0.10; ** p<0.05; *** p<0.01. Regressions include year, size and sector dummies. In regression (2) France is the benchmark country.

*Tax*: statutory corporate tax rate; *Sh_gdp*: ratio of non financial corporations (NFC) shares to GDP; *Qsh_gdp*: ratio of NFC listed shares to GDP; *Invprot*: investor protection; *ROA*: operating income over assets; *Tangibles*: tangible fixed assets over total assets; *NWC*: ratio of trade receivables plus inventories minus trade payables to total assets; *Age*: firm's minimum age in the sample; *Listed*: dummy equal to one if the firm is listed.

**Table 11. Highly profitable firms - Quantile regression model: different estimators**

| | OLS | | | CRE | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | First quartile | Median | Third quartile | First quartile | | Median | | Third quartile | |
| | | | | *Main eq.* | *Auxiliary eq.* | *Main eq.* | *Auxiliary eq.* | *Main eq.* | *Auxiliary eq.* |
| *Tax* | 0.962*** | 0.985*** | 0.706*** | 0.388*** | 0.592*** | 0.320*** | 0.675*** | 0.150 | 0.575*** |
| | (0.016) | (0.026) | (0.024) | (0.094) | (0.095) | (0.118) | (0.132) | (0.100) | (0.108) |
| *Sh_gdp* | -0.075*** | -0.097*** | -0.095*** | -0.038*** | -0.038*** | -0.067*** | -0.031*** | -0.071*** | -0.025*** |
| | (0.001) | (0.001) | (0.001) | (0.008) | (0.008) | (0.011) | (0.010) | (0.009) | (0.009) |
| *Qsh_gdp* | -0.077*** | -0.122*** | -0.092*** | 0.055*** | -0.136*** | 0.053* | -0.179*** | 0.073*** | -0.167*** |
| | (0.003) | (0.004) | (0.004) | (0.019) | (0.020) | (0.029) | (0.029) | (0.022) | (0.023) |
| *Invprot* | 0.023*** | 0.033*** | 0.034*** | 0.024*** | | 0.034*** | | 0.034*** | |
| | (0.001) | (0.001) | (0.001) | (0.001) | | (0.001) | | (0.001) | |
| *ROA* | -0.611*** | -1.028*** | -1.073*** | -0.334*** | -0.334*** | -0.624*** | -0.481*** | -0.779*** | -0.353*** |
| | (0.006) | (0.009) | (0.012) | (0.019) | (0.020) | (0.026) | (0.025) | (0.027) | (0.031) |
| *Tangibles* | 0.256*** | 0.270*** | 0.201*** | 0.200*** | 0.056** | 0.200*** | 0.070*** | 0.118*** | 0.083*** |
| | (0.005) | (0.005) | (0.004) | (0.026) | (0.028) | (0.018) | (0.018) | (0.020) | (0.021) |
| *NWC* | 0.180*** | 0.252*** | 0.196*** | 0.126*** | 0.056*** | 0.210*** | 0.047*** | 0.189*** | 0.007 |
| | (0.003) | (0.004) | (0.003) | (0.010) | (0.011) | (0.011) | (0.012) | (0.012) | (0.012) |
| *Age* | -0.001*** | -0.001*** | -0.002*** | -0.001*** | | -0.001*** | | -0.002*** | |
| | (0.000) | (0.000) | (0.000) | (0.000) | | (0.000) | | (0.000) | |
| *Listed* | -0.011** | -0.041*** | -0.070*** | -0.025 | 0.015 | -0.042* | 0.001 | -0.061 | -0.009 |
| | (0.005) | (0.005) | (0.005) | (0.023) | (0.023) | (0.024) | (0.025) | (0.037) | (0.037) |
| *Constant* | -0.106*** | 0.136*** | 0.477*** | -0.099*** | | 0.149*** | | 0.497*** | |
| | (0.010) | (0.014) | (0.012) | (0.006) | | (0.015) | | (0.010) | |
| N | 259959 | 259959 | 259959 | 259959 | | 259959 | | 259959 | |

Note: Dependent variable is individual firm leverage. Bootstrapped standard errors clustered at firm level in parenthesis. Significance level: * p<0.10; ** p<0.05; *** p<0.01. Regressions include year, size and sector dummies.

*Tax*: statutory corporate tax rate; *Sh_gdp*: ratio of non financial corporations (NFC) shares to GDP; *Qsh_gdp*: ratio of NFC listed shares to GDP; *Invprot*: investor protection; *ROA*: operating income over assets; *Tangibles*: tangible fixed assets over total assets; *NWC*: ratio of trade receivables plus inventories minus trade payables to total assets; *Age*: firm's minimum age in the sample; *Listed*: dummy equal to one if the firm is listed.

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