Data for research in European business taxation

Giorgia Maffini*
Oxford University Centre for Business Taxation

Abstract

In the last 30 years, the empirical literature on the effects of taxation on business behaviour has addressed key questions for growth and for revenue collection: firms' investment, financing decisions, and avoidance behaviour have been investigated in their relationship to taxation. In general, despite variation in the magnitude of estimated effects, the literature agrees on the direction of the effects.

Three elements are missing from this vast literature, though. First, we know very little about the heterogeneity of firms' responses to various features of the corporate tax system. Most of the results derived in the literature focus on larger businesses, generally in the US but most European economies are characterised by a considerable proportion of smaller firms. The focus of the literature on larger companies has been determined by data availability. Second, to summarize the effects of the corporate tax system, the literature has generally employed two types of tax rates: either country-level or firm-level average tax rates. Country-level rates cannot account for the heterogeneity of tax positions across firms. Firm-level rates are mostly calculated as the ratio between the accounting tax expense and the accounting pre-tax profit, whereby the variables are derived from publicly available accounts. They are generally endogenous and they may not reflect the real tax burden of the firm, as accounting and tax data may differ substantially. The literature is therefore likely to estimate the real effective tax rate with measurement error. The third element missing from the literature is research on the financial sector. The financial sector has largely been excluded from the empirical research on the effects of taxes on business behaviour.

This paper surveys the literature on firm's capital structure as an example of how administrative and tax return data could potentially address the shortcomings of the literature.

* Oxford University Centre for Business Taxation, Said Business School, Park End Street, OX1 1HP, Oxford, United Kingdom.
Giorgia.maffini@sbs.ox.ac.uk

Introduction

In the last 30 years, the empirical literature on the effects of taxation on business behaviour has addressed key questions for growth and for revenue collection: firms' investment, foreign direct investment, financing decisions, and avoidance behaviour have been investigated in their relationship to taxation. In general, despite variation in the magnitude of estimated effects, the literature agrees on the direction of the effects. Through the increase in the tax component of the user cost of capital (Jorgensen, 1963, Hall and Jorgensen, 1967), taxation and more specifically the corporate income tax is found to reduce investment on the intensive margin (that is, the size of investment).[1] The corporate tax system is also found to reduce investment on the intensive margin (that is, whether to invest or not). In particular, for foreign direct investment, the tax system affects the location decision, that is, the choice of the jurisdiction where to locate investment, as originally described by Devereux and Griffith (1998): corporate taxes affect the extensive margins of the investment project by lowering the infra-marginal return to capital.[2]

In the last ten years, the literature on profit shifting has also generated overwhelming evidence that the tax system affects the location of profits too, irrespective of where the real, productive activities take place.[3] Companies with operations in multiple jurisdictions can shift income from high to low-tax jurisdictions.

Finally, since the mid-eighties, a large collection of empirical works describes how deductibility of passive interest has created a tax incentive to debt financing and how this feature of traditional tax systems has systematically affected firms' choice between debt and equity financing.

Three elements are missing from this vast literature, though. First, we know very little about the heterogeneity of firms' responses to various features of the corporate tax system, apart from a general idea that multinationals are more sensitive to tax changes than domestic firms.

[1] For extensive literature reviews on the effect of the corporate tax system on investment see, among others, Hassett and Hubbard (2002) and Bond and Jing (2012).

[2] For a review of the literature on the effect of the tax system on foreign direct investment, see de Mooij and Ederveen (2003), de Mooij and Ederveen (2008), Devereux (2007), Feld *et al.* (2011).

[3] For extensive analyses of the literature on profit shifting activities, see de Mooij and Ederveen (2008) and Heckemeyer and Overesch (2012).

A structure spanning across different jurisdictions allows multinationals to easily shift taxable income and to move real activities to low-tax countries.

Most of the results derived in the literature focus on larger businesses, generally in the US but most European economies are characterised by a considerable proportion of smaller firms which generally are privately owned if not family owned. For example, in the UK between 2003/4 and 2010/11, only about 5 per cent of companies paid the main statutory rate[4] and a large part of tax policy between 1997 and the financial crisis has focused on small and medium sized enterprises. The functioning of European financial markets is also quite different from that of the US financial markets. Financial intermediation in the Euro area is bank-based for at least three-quarters of firms' financing; whilst in the US, companies rely more heavily on financial markets for both equity and debt financing (Draghi, 2013). There are many reasons why small and medium sized companies may react differently to changes in the tax system. For example, smaller, newer businesses could be severely cash constrained and consequently, tax incentives to investment may not work. Alternatively, very small business could not be investing very much anyway and any reduction in the corporate statutory tax rate would simply encourage incorporation as a way to minimize the tax bill.

The focus of the literature on larger companies has been determined by data availability. In publicly available, firm-level accounting data such as AMADEUS and to a larger extent such as COMPUSTAT, small and medium-size companies are generally underrepresented. Although some contributions address heterogeneity, there is no systematic empirical evidence on whether, how far, and why dissimilar businesses react differently to changes in the tax system. To guide policy effectively, it is important to understand which agents will be more likely to respond to certain policy changes.

Second, to summarize the effects of the corporate tax system, the literature has generally employed two types of tax rates: either country-level rates (such as, among others, the corporate statutory rates, the effective marginal tax rates (EMTRs) and the effective average tax rates (EATRs)[5]) or firm-level average tax rates. Country-level rates cannot account for the heterogeneity of tax positions across firms: although the corporate statutory rate is the same

[4] Companies paying the main corporate tax rate contributed between 68.79 per cent and 78.37 per cent of total corporate income tax in the same period.

[5] For a detailed description of the rates used by the literature see de Mooij and Ederveen (2003), de Mooij and Ederveen (2008), Devereux (2007), Feld *et al*. (2011).

for all firms,[6] some companies may face a lower or zero effective marginal tax rate in presence for example of loss carry forwards or large capital allowances. Firm-level rates are mostly calculated as the ratio between the accounting tax expense and the accounting pre-tax profit, whereby the variables are derived from publicly available accounts. They would in principle allow controlling for firm-level characteristics but they are generally endogenous as they are determined together with profitability and investment and financing decisions. Additionally, they may not reflect the real tax burden of the firm, if they are derived from accounting data as accounting and tax data may differ substantially.[7] The literature is therefore likely to estimate the real effective tax rate with measurement error.

To effectively investigate heterogeneity of responses across firms, it is important that the data employed by researchers display three main features: provide firm-level data, provide full coverage of the population of firms (or at least a representative sample of the universe of companies) and provide accurate data on the firm's individual tax position. Clearly, administrative data such as tax return data or financial data gathered by regulatory bodies (such as Central Banks) or National Statistical Offices are the natural candidates: administrative records offer coverage of the full population of firms and they provide higher quality information. In particular, tax returns data allow researchers to accurately estimate the tax burden of the firm. This would have two advantages: first, measurement error will be reduced and second, by observing the real tax position of each firm, researchers will be able to draw conclusions on the heterogeneous responses of firms to the tax system.

The third element missing from the literature is research on the financial sector. The financial sector has largely been excluded from the empirical research on the effects of taxes on business behaviour. This has profound implications for tax policy making. First, as noted above, the banking system is extremely important for European firms which derive three-quarters of their financing from the sector. Second, in the aftermath of the financial crisis, tax policy has been used to address distortions in the financial-services industry. New taxes have been introduced[8] without the guidance of the public finance literature mainly because of little academic research on the taxation of financial-services (Keen, 2011), although scholars and

[6] In a progressive corporate tax system such as the UK and the US systems, cross-sectional variation can be derived also using national statutory rates.

[7] See Hanlon and Heitzman (2010) for a survey of the literature on book-tax differences.

[8] The new taxes include financial transaction taxes (France, Italy and a proposal for the EU), bonus taxes (Italy, UK) and bank levies (Austria, Belgium, Cyprus, France, Germany, Hungary, the Netherlands, Portugal, Romania, Slovakia, Sweden, UK).

policymakers consider taxes as supplements to regulation (Acharya *et al*., 2010, Beck and Losse-Müller, 2010, Devereux, 2011, Keen, 2010).

The seminal empirical research on the taxation of the financial sector has been carried out employing mainly BANKSCOPE, a dataset gathering profit and loss and balance sheet items for financial sector firms across the world (Chiorazzo and Milani, 2011, Capelle-Blancard and Havrylchyk, 2013, Demirgüc-Kunt and Huizinga, 1999, 2001, Devereux *et al.*, 2013, Huizinga *et al.*, 2011, Hemmelgarn and Teichmann, 2013, Keen and de Mooij, 2012, Gu *et al.*, 2012). A part of the literature investigates the important question of the incidence of taxes levied on banks, that is, whether such institutions are able to shift taxes on to the firms they finance and on to their customers. Demirgüc-Kunt and Huizinga (1999, 2001), Huizinga *et al.* (2011) and Chiorazzo and Milani (2011) all find that the corporate income tax is passed on to banks' customers. Albertazzi and Gambacorta (2010) investigate the incidence of the corporate income tax on the financial sector using aggregated data for OECD countries and find that the corporate income tax is substantially passed on to customers in the form of increased lending rates. Capelle-Blancard and Havrylchyk (2013a) do not find any evidence of this and they attribute their results to the fact that they are effectively controlling for endogeneity. Capelle-Blancard and Havrylchyk (2013b) employ data gathered from the Hungarian Central Bank for the universe of Hungarian banks and find that the bank levy is completely shifted on to customers.

Well capitalised banks are important for a stable financial and economic system. Keen and de Mooij (2012) find that the capital structure of financial institutions is sensitive to the tax system, above and beyond the effect of the regulatory capital requirements. There are some important exceptions: the largest banks seem to be unresponsive to taxation. Hemmelgarn and Teichmann (2013) use a dataset of corporate income tax reforms to investigate the effect of changes in the statutory corporate tax rate on leverage, dividend policies and earnings management of banks. They find that leverage increases with corporate income tax rate and so do dividend pay-outs. Gu *et al.* (2012) find evidence for both the local tax rate and the difference between the local and the international tax rate to positively affect the debt ratio, with the latter effect being larger than the former.

Devereux *et al*., (2013) find that EU bank levies on average increased equity-asset ratios by 1-1.5 percentage points and customer deposit-asset ratios by around 1 percentage point. They also find that the levy has increased the asset riskiness of banks constrained by regulation.

Although research in the field is growing, systematic empirical research is missing. The reasons could be traced to the fact that the financial system is different from the traditional,

manufacturing sector on which empirical and theoretical research has traditionally focused. Second, the balance sheet and the profit and loss accounts of financial firms are very different from those of firms belonging to more traditional sectors. Hence, generally available accounting data such as COMPUSTAT and AMADEUS/ORBIS are not suitable for research on the effects of the tax system on the financial sector. BANKSCOPE is the equivalent of ORBIS for the financial industry and reports rather detailed accounting information. Nonetheless, financial data available with the regulators of the financial sector, that is, with the National Central Banks are likely to have a complete coverage of the industry together with very reliable information on the financial structure of financial services.

In the next session, I will survey the literature on firm's capital structure as an example of how administrative and tax return data could potentially address the shortcomings of the literature. The financial crisis has highlighted the importance of well-capitalised firms which in principle should be better equipped to stand a sharp and sudden collapse in credit supply. While little is known on the magnitude of externalities from increased leverage, there is evidence that high leverage is correlated with greater output losses in bad times: Davis and Stone (2004) find that higher debt-equity ratios are associated with greater post-crisis output declines, and IMF (2008) observes that the cumulative output loss following periods of financial distress tends to be larger the greater the run-up in nonfinancial corporate debt before the onset of a financial crisis. Given the value of well capitalised firms for the stability of the economy, it is important to understand how much the current European tax system encourages firms to finance investment through debt (and not through equity).

Taxation and the capital structure of the firm

The empirical literature on the effects of taxes on the firm's capital structure is rooted in the seminal work by Modigliani and Miller (1958) which, under the assumption of perfect capital markets prove that the capital structure of the firm is irrelevant for firm's value. The assumption of perfect capital markets implies the absence of capital and personal taxes. When the corporate income tax is introduced and passive interest payments are deductible from taxable income (but returns to equity holders are not), the value of the firm increases with debt (Modigliani and Miller, 1963). When also taxes on the return to equity and debt are introduced, in equilibrium the corporate tax advantage of debt is compensated by higher

effective personal income tax rates on active interest so that effect of debt on the firm's value depends on the interaction between the taxation of the returns to debt and equity at the personal level and the corporate income tax (Miller, 1977).

The empirical literature has tried to assess whether the firm's capital structure is in fact affected by the tax system. The literature has been summarised in Auerbach (2002), Graham (2003), Graham (2008), and in Graham and Leary (2011) in a way that is beyond the scope of this paper. Although this section integrates such reviews with some new contributions employing European data and two meta-studies[9] (Feld *et al*., 2013, and de Mooij, 2011a), the focus of this work is on the data.

If the early empirical literature did not find robust effects (Myers, 1984; Parrino and Weisbach, 1999), more recent work converges on a significant effect of taxes on financing decisions. de Mooij (2011a) and Feld *et al.* (2013) find that the responsiveness of the capital structure to taxes increases with the average sample year, suggesting that either the literature has adopted more effective identification strategies and (or) the firms' capital structure is becoming more responsive to tax incentives.[10]

Despite a common agreement on the direction of the effect, the literature estimates a wide range of magnitudes of the effect of the tax system on the firm's debt and equity choices.

De Mooij (2011a) surveys 19 different studies to investigate the factors that affect the semi-elasticity of debt to the tax rate (SEDTR), defined as

$$SEDTR = \frac{\partial \ln(\frac{D}{A})}{\partial \tau}$$

The relative standard deviation of the SEDTR is 0.9. [11] The typical results yield that a ten percentage point increase in the tax rate raises the debt-asset ratio between 1.7 and 2.8 percentage points. The study highlights that differences in the magnitude of the SEDTR can be explained by the type of marginal tax rate employed and also by the debt variable used. The elasticity also varies with the level of the tax rate: firms are more responsive when tax rates are higher.

[9] Meta-analyses show how different characteristics of the studies affect the magnitude of the results.
[10] This could also identify a publication bias (Feld *et al.*, 2013).
[11] The relative standard deviation is measured by the ratio of the absolute standard deviation of the marginal tax effects on debt to its mean.

Feld *et al.* (2013) survey 48 studies for a meta-analysis study of the factors affecting the marginal tax effect on debt (MTED), defined as

$$MTED = \frac{\partial(\frac{D}{A})}{\partial \tau}$$

The authors show that estimates of the MTED also vary substantially. More specifically, in their sample of 48 studies and 1,021 estimates of the MTED, the relative standard deviation is about 2.9. In their preferred specification, they predict a MTED of 0.30, that is, the debt-to-assets ratio increases by 3 percentage points if the marginal tax rate[12] increases by 10 percentage points. This is a large effect if compared, for example, to the effect of tangibility (0.126), a variable considered very important in the capital structure literature.

On top of the type of tax rate used, Feld *et al.* (2013) find that the magnitude of the marginal tax effect depends on various characteristics of the study. Importantly, controlling for common time trends seems to increase the identified marginal tax effect. This is not surprising as, among other things, the economic cycle affects investment and investment and financing decisions are generally taken simultaneously. Other firm's characteristics influence the size of the MTED. Controlling for firm size, collateral, and firm growth reduces the MTED whilst the opposite happens when controlling for profitability, inflation and industry-level leverage ratios.

Choice of tax rate

The evolution of the literature has been shaped by the search for the appropriate measure of the marginal tax benefit of debt, τ, where τ is the firm's effective tax rate which can be thought of as the net present value of the current and expected future taxes on an additional unit of income earned today (Graham, 1996a, Scholes *et al.*, 2008).

A very simple proxy for the marginal tax advantage of debt is the corporate statutory tax rate. Using statutory tax rates as a proxy for the marginal effective tax rate will inevitably mis-measure the true marginal tax benefit of debt as statutory rates are unable to distinguish

[12] The tax rate in this case would be the simulated marginal effective tax rate, as calculated in Shevlin (1990) and Graham (1996a). See below for more details.

between two firms with different tax positions, for example between a tax-exhausted firm and a firm with positive taxable profits.

Given little or no cross-sectional within-country variation, the early literature concentrated on time-series variations in statutory tax rates but coefficients were often insignificant or with the wrong size (de Mooji, 2011). This is not surprising as a further challenge with statutory rates is that they generally display scarce time variation within the same country, leaving very little or no statistical power to identify the effect.

A way around the little statistical power provided by a country-specific study is to carry out a cross-country study so to exploit cross-country variation in statutory tax rates, as first indicated in Rajan and Zingales (1995) who suggest a positive correlation between aggregate debt levels and corporate statutory tax rates. The authors employ COMPUSTAT Global Vantage which gathers accounting and financial data for listed, nonfinancial companies. The problem with this kind of studies is that different countries are not always comparable and although it is possible to control for many institutional differences across jurisdictions, it is not possible to control for all of them.[13] In the same spirit, Overesch and Voeller (2010) investigate the effect of companies and personal income taxes on firms' financing decisions in 23 European countries, using firm-level accounting data from AMADEUS (2000-2005) for standalone companies. They find positive effects of tax rates on the debt ratio. In their preferred specification, an increase in the tax benefit of debt by 10 percentage points leads to an increase of the fraction of debt by around 3 percentage points. They control for country time-invariant characteristics using firm fixed effects but they cannot control for country-specific time-varying effects, as this would wipe out the variation in the statutory corporate tax rates.

Altshuler and Grubert (2003) are the first to empirically study firms' financing choices by exploiting the fact that multinational companies differ from domestic companies in their response to tax changes. Multinational companies (MNCs) face different tax regimes across the world and they are able to shift deductible interest payments from low-tax to high-tax jurisdictions. Since MNCs are exposed to different tax rates across the globe, the authors exploit the cross-country variation in statutory tax rates to identify an effect of taxes on the financing choices of foreign affiliates of US multinationals.

[13] Country-year dummies would account for time-varying differences across countries but would also eliminate the possibility of estimating the effect of corporate statutory tax rates.

Altshuler and Grubert (2003) employ the 1996 cross-section of the US Treasury data file for multinational parents and their affiliates and find that affiliates in countries with a high corporate statutory tax rate are characterised by higher debt ratios, with the result being robust only for intra-company debt.[14] Altshuler and Grubert (2003) started a stream of literature on international debt shifting which is surveyed by De Mooij and Ederveen (2008) and Heckermeyer and Overesch (2012).

Given that statutory corporate tax rates are challenging from both the theoretical and the empirical view point, later studies have employed various forms of firm-specific tax rates which display considerably more time-series and cross-sectional variation and additionally, they can better approximate the real tax status of the firm.

A set of earlier studies has employed firm-level non-debt tax shields (NDTS) to proxy for the marginal benefit of debt. The tax benefit of an additional unit of debt depends on the tax position of the firm which is in turn affected by NDTS such as loss carry-forwards and carry-backs, capital allowances and tax credits. Deductions from the tax base and tax credits reduce the marginal tax rate if they reduce the taxable income of the firm to zero and consequently, also the marginal rate on interest deductions to zero (MacKie-Mason, 1990).[15] For example, firms with sufficient loss carry-forwards to fully compensate current taxable income will face a lower expected tax rate and therefore, the marginal benefit of debt will be smaller than suggested by the corporate statutory tax rate. This idea dates back to DeAngelo and Masulis (1980) who show that in presence of realistic tax code provisions such as depreciation allowances and investment tax credits, there is a unique interior optimum leverage decision for each firm. In a cross-section of US non-financial firms[16] available in COMPUSTAT, Bradley *et al*. (1984) do not find any evidence of a negative relationship between leverage and non-debt tax shields. Their measure of NDTS is the ratio of depreciations charges plus annual investment tax credit to earnings before depreciation, interest, and taxes. Bennett and Donnelly (1993) analyse non-financial UK firms and find that non-debt tax shields negatively

[14] Desai *et al*. (2004) employ a panel of confidential affiliate-level financial data of about 30,000 foreign affiliates of approximately 3,700 U.S. multinational firms for three years: 1982, 1989, and 1994. The country tax rate they use is not the statutory rate but the country-year median of the affiliate-level ratio of foreign affiliate tax over foreign affiliate profits. The results show that affiliates of multinational firms adjust the level and composition of debt as a response to tax incentives. The estimates imply that 10 per cent higher tax rates are associated with 2.8 per cent greater debt as a fraction of assets. The elasticity of external borrowing with respect to the tax rate is lower (0.20) than that of internal borrowing (0.34).

[15] Deductions and credits always lower the average tax rate.

[16] The cross-section is derived by averaging observations over the period 1962-1981.

affect the debt to asset ratio. These studies identify the effects in a cross-section. This strategy is valid as far as the NDTS are not affected by unobservable characteristic which could also affect the debt-to-equity ratio (Gordon and Lee, 2001). Gordon and Lee (2001) point out that this is rarely the case. For example, investment decisions are generally taken simultaneously to financing decisions. Investment decisions clearly affect capital allowances and the use of investment tax credits.

Using COMPUSTAT, the 10k report,[17] and the Center for Research in Security Prices (CRSP) database on daily returns and dividends for a panel of around 180 firms, Auerbach (1985) estimates that loss carry-forwards[18] have a significant and negative effect on changes in the debt to assets ratio. MacKie-Mason (1990) employs a dataset of public debt and share issuances of US listed companies (1977-1987) and tests the effect of tax loss carry-forwards and investment tax credits on incremental financing decisions, that is, on the probability of issuing debt versus shares. He finds a considerable tax effect on the probability of issuing debt, that is, NDTS such as loss carry-forwards decrease the likelihood of a new debt issuance, supporting the idea that taxes have an important role for financing decisions.

Graham and Leary (2011) report that more recent studies such as Graham *et al.* (2004), Graham and Tucker (2006) and Shivdasani and Stefanescu (2010) describe a large negative effect of NDTS (such as deductions for executive stock options exercises, various tax shelters and defined benefit deductions) on taxable income. Tax shelters will therefore decrease the tax benefit of an additional unit of debt. Nonetheless, measures of NDTS do not capture the dynamic features of the tax code, as for example the fact that net-operating loss carry-forwards (NOLs) will decrease the expected effective marginal tax rate.

Another group of studies has used the average tax rate defined as the ratio between the accounting tax charges and accounting profits (see for example Lasfer, 1995, Booth *et al.*, 2001).

There are four issues with this measure. First, firm-level average tax rates do not account for the fact that the marginal tax advantage of debt also depends on whether the firm will be profitable in the future (Graham, 2003; Feld *et al.*, 2013).[19] Second, average tax rates reflect

[17] The Form 10-K is required by the US Securities and Exchange Commission (SEC) and it includes information such as capital stock, depreciation, and investment for several classes of capita, organizational structure, executive compensation, equity, subsidiaries, and audited financial statements, among other information.

[18] Auerbach (1985) employs a dummy which takes value one if the accounts report a positive value for net-operating loss carry-forwards.

[19] Interest deductions which cannot be deducted in the current period would need to be deducted sometimes in the future for the tax benefit of debt to materialise.

the burden on the average dollar of income (Feld *et al.*, 2013) and not on the marginal dollar, which could be rather different.[20] Third, in a regression where debt is regressed on the firm-specific average tax rate, the effective tax rate faced by the firm is endogenous as it is jointly determined with financing decisions. In other words, the higher the debt level, the lower the effective tax rate.[21] This means that studies which do not account for endogeneity issues will underestimate the effect of taxes on debt. Feld *et al.* (2013) find that work using endogenous average tax rates do in fact display lower marginal tax effects on debt with respect to a benchmark study employing statutory rates, *ceteris paribus*. For example, using a panel of UK firms (1972-1983), Lasfer (1995) finds that the effective average firm-level tax rate does not affect the capital structure choice of firms in the short run, although tax-exhausted firms have a lower debt ratio.

Fourth, the accounting tax charge may not represent the real tax payment, especially in countries where there are large book-tax differences. In the same way, accounting profits may not be the same as taxable profits, for example, when accounting amortization rules are different from tax rules for capital allowances. In summary, firm-level average tax rates could lead to measurement error and, because of endogeneity, to a downward bias in the estimation of the MTED.

The first and second issues are addressed by calculating simulated forward-looking firm-level marginal tax rates (SMTRs). Shevlin (1990) is the first to propose the use of SMTRs calculated applying the corporate statutory tax rate and loss carry-forward and carry-back provisions of the US tax code to a forecasted stream of taxable income. Graham (1996a) adopts the same approach and includes tax credits and the alternative minimum tax. The starting assumption is that the firm's taxable income evolves as a random walk with drift:

$$\Delta TI_{it} = \mu_{it} + \varepsilon_{it} \qquad (1)$$

[20] Assume for example that the statutory corporate tax rate is 20%. A firm has profits for 100, deductions for 20 so that it tax bill will be 20%*80=16. In this case, the average tax rate is 16%. Assume that profit is now 101. In this case, the tax bill will be 20%*(101-20)=16.2. This implies that the marginal tax rate is 16.2-16 = 20%.

[21] An additional source of endogeneity derives from the high correlation between the average tax rates and the business cycle and the nominal interest rates (and inflation) which are a determinant of the financing choices of the firm (Gordon and Lee, 2001). For example, the 2007/08 global credit crunch has reduced the availability of credit to firms. At the same time, the credit crunch has led to a strong economic contraction which will be reflected in profits and therefore in the firm-level average tax rates. It is worth noting that statutory tax rates could be endogenous too (Gordon and Lee, 2001). The credit crunch has led to a sovereign debt crisis forcing many European countries to change their tax provisions in order to either raise more revenues or stimulate the economy. This creates a correlation between the tax variable and the debt variable.

Where μ_{it} is the sample mean of ΔTI_{it} (first difference in taxable income) and ε_{it} is distributed normally with mean zero and variance equal to the sample variance of ΔTI_{it}. Taxable income is calculated as pre-tax book income. Since pre-tax book income includes deferred tax liabilities, Graham (1996a) subtracts deferred tax expenses (divided by the appropriate statutory rate) from pre-tax book income. In a first step, to forecast future taxable income for year *t+1*, the author draws 18 random realizations of ε_{it}, one for each one of the next 18 years[22] and using equation (1), he derives taxable income TI_{it} for the next 18 years. In the next step, by applying tax code provisions[23] to the generated pattern of TI_{it}, the author calculates the net present value of the tax bill (discounted by applying the average corporate bond yield as published by Moody's Bond Record). In a further step, a one US$ is added to the generated income for year 1 and the net present value of the new tax bill is recalculated. The marginal tax rate will be the difference between the net present value of the new tax bill and the present value of the original tax bill. The aforementioned steps are repeated 50 times for each firm-year observation and the SMTR used in the estimations is an average of the 50 marginal tax rates.

SMTRs account for the fact that the marginal tax benefit of debt is also influenced by the evolution of taxable income. Such SMTRs are defined as after-financing SMTRs, that is, they are based on earnings after interest deductions and therefore they measure the tax rate levied on one additional dollar of interest deduction (Graham, 1999).

Until today, the SMTRs are probably the closer measures to the tax rates considered by the management of a firm when assessing financing and investment decisions.[24] This explains the result in Feld *et al.* (2013) who find that studies using simulated marginal rates deliver a much higher effect of the tax system (almost double those delivered by studies employing statutory rates).[25]

[22] The 18 years period is chosen because in the US, losses can be carried-forward for 18 years.

[23] Graham applies the following tax code provisions: net operating losses, investment tax credit, the alternative minimum tax, the progressivity of the statutory tax rate.

[24] SMTRs are complex to calculate. Graham (1996b) shows that some simpler variables could be a good alternative if the researcher aims at proxying the true marginal tax rate defined as the "perfect foresight marginal tax status", that is, the marginal tax rate in year *t* if the values of taxable income that will occur in years *t+1* through *t+15* are known with certainty in year *t*. Such simpler variables are a trichotomous variable (equal to the statutory corporate tax rate if the firm has positive taxable income and no net-operating loss carry-forwards (NOLs), half the corporate statutory tax rate if the firm has either NOLs or negative taxable income, zero if the firm has negative taxable income and a NOL), the contemporaneous statutory marginal tax rate, and a dummy which takes value one if the firm has positive taxable income.

[25] Using non-parametric methods, Blouin *et al.* (2010) calculate SMTRs for a panel of US companies derived from COMPUSTAT and they state that Graham's rates are too high (low) for profitable (unprofitable) firms. This happens because historical income volatility could be substantially underestimated for growing firms.

The contemporaneous SMTRs employed in Graham (1996a, 1999) are endogenous as the pre-tax book income will be reduced by interest deductions and this will reduce the SMTRs. To avoid this problem, Graham (1996a) relates the lag of the contemporaneous SMTR to the first difference in the book value of long-term debt. Graham (1999) and Graham and Mills (2008) employ before-financing SMTRs to avoid endogeneity issues, that is, they simulate SMTRs employing earnings before interest and taxes. Therefore, they measure the tax rate levied on the first dollar of interest deduction (Graham, 1999). SMTRs have been employed in studies on other European countries. Alworth and Arachi (2001) calculate SMTRs for a panel of Italian firms (1982-1994) following Graham's methodology. They find that, at the mean level, a 100 basis point increase in the SMTR raises the growth of debt to total assets by about 8 basis points. Hartmann-Wendels *et al*. (2012) also calculate SMTRs for a panel of small, medium and large German firms (1973-2008) and find that a 10% increase in the marginal tax benefit of debt at the corporate level implies a 1.5% increase in the debt ratio.

Another way to tackle endogeneity of firm-level tax rates is to use instrumental variables. Dwenger and Steiner (2012) adopt an instrumental variable approach by instrumenting the average tax rate, calculated as the assessed corporate income tax over earnings before interest, taxes and depreciation with the counterfactual tax rate, that is, the tax rate the firm would have paid, had there been no changes in the firm's capital structure.[26] For a pseudo-panel[27] derived from German corporate and local tax returns (1998 and 2001), the authors find a very large effect of the tax rate on leverage: on average an increase of the tax rate by 10 per cent would increase the firm's leverage by 5 per cent.

Finally, to tackle the endogeneity of firm-level tax rates, a recent, still unpublished literature has employed a quasi-experimental setting by exploiting the introduction of the Belgian notional interest deduction (NID) in 2006 (Panier *et al.*, 2012 and Princen, 2012). The NID operates as a deduction from taxable income based on a company's qualifying equity funding. A notional interest rate[28] is applied to the firm's capital and the result is deducted

[26] The counterfactual rate is calculated using a simulation model (BizTax) whereby the exogenous tax rate is calculated using changes in the tax law and changes in the economic cycle only.
[27] Since German tax returns are not available as a panel, Dwenger and Steiner (2012) aggregate the data in a pseudo-panel where the individual observation is the sector-region and the dataset overall contains around 1,000 individual groups providing a large scope for cross-sectional variation.
[28] The applied interest rate is equal to the rate on the ten-year government bond.

from the corporate income tax. In this way, the different tax treatment of debt and equity funding is partially abolished. [29]

Panier *et al.* (2012) use the introduction of the NID in Belgium in 2006 as a quasi-experiment to investigate the effect of tax incentives on the firm's capital structure using a difference in differences approach (DD). Their findings suggest that the Belgian NID has significantly increased the capitalization of firms, mainly because of higher equity levels (and not by a reduction in other liabilities). The effects are identified using a DD approach where the treatment group is constituted by Belgian firms whilst the control group is composed by firms located in neighbouring countries: France, Germany, Luxembourg and the Netherlands. The authors use a mix of data spanning between 2001 and 2009. For Belgian firms, they employ accounting information submitted to the National Bank of Belgium. For firms in their control group, they employ AMADEUS data, a publicly available dataset collecting balance sheet and profit and loss account information. The paper results also explain some of the cross-sectional variation detected by Graham and Leary (2011) for US data. Panier *et al.* (2012) find that both incumbent and new firms increase their equity ratios after the NID is introduced and that the largest responses to changing tax incentives are found among large and new firms.

Princen (2012) also uses a DD approach comparing Belgian firms (treatment group) to German and French firms (treatment group) before and after the introduction of the NID in Belgium in 2006. The author uses a sample of firms from AMADEUS (2001-2007) to find that the introduction of the Belgian NID had a significant negative effect on companies' leverage. Her results suggest that a standard corporate tax system without an NID mechanism encourages companies to use on average 2-7% more debt than a neutral system.

If most studies are simply concerned with the effect of corporate taxes on financing decisions, some works investigate how personal income taxes affect the marginal tax benefit of debt. According to Miller (1977) the personal tax penalty on debt could negate the tax advantage to debt (Graham, 1999) so that there should not be any tax-induced debt equilibrium.

[29] Boadway and Bruce (1984) and Wenger (1983) placed the theoretical foundations of a corporate tax system that is neutral to investment financing decisions. In 1991, the London-based Institute for Fiscal Studies (IFS) recommended a practical proposal, the Allowance for Corporate Equity (ACE) whereby firms could deduct a notional interest for equity financing from the corporate income tax base. Such notional interest was defined as the product of the previous year equity stock times a notional interest rate equal to the risk free nominal interest rate (IFS, 1991, Devereux and Freeman, 1991, Klemm, 2006).

Graham (1999) addresses the effects of personal income taxes on corporate financing decisions by adjusting the SMTRs for the personal income tax penalty as follows. The net advantage of debt is

$$(1-\tau_P)-(1-\tau_c)(1-\tau_e)$$

Or equivalently,

$$\tau_c-[\tau_p-(1-\tau_c)\tau_e]$$

Where τ_C is the marginal statutory corporate tax rate, τ_P is the personal tax rate on interest and τ_e is the tax rate on the return to equity. The term $[\tau_p-(1-\tau_c)\tau_e]$ is the personal tax penalty.

Graham (1999) finds that, personal taxes on active interest do in fact discourage firm-level debt but not to the point of completely off-setting the corporate tax advantage to debt.[30] The author employs a panel of listed US companies from COMPUSTAT (1980-1994). Among others, Graham (1999), Alworth and Arachi (2001), Gordon and Lee (2001, 2007), Overesch and Voeller (2010), and Hartmann-Wendels (2012) also account for the effect of personal taxes on dividends, capital gains and interest and they all find a significant effect of those taxes on the firm's financing decisions.

In an open economy, it is difficult to find a satisfactory way of including personal income taxes as both equity and debt are likely to be held by investors resident in different jurisdictions with different personal income tax schedules and different systems of capital income taxation at the individual level. Additionally, in many countries, pension funds and other institutional investors are tax-exempt. Consistently with the tax-adjusted capital asset pricing model (Brennan, 1970) the effective tax rate will depend on the weighted average of tax rates across all investors. De Mooij (2011) finds that studies controlling for the personal tax penalty (Miller tax effect) do not display significantly different average semi-elasticities. This is partially at odds with the finding that specifications simply controlling for domestic personal income taxation deliver higher SEDTRs. Although this indicates the need of further research on the role of taxes on capital income at the individual level, the effect of domestic capital taxes would depend on how open the economy is.

[30] Other studies adjust for personal income taxes (Rajan and Zingales, 1995; Graham, 1996a; Graham *et al.*, 1998) but they do not investigate the effect of personal taxes separately from that of corporate income taxes. Graham (1999) also notes that such studies employ measures of personal income taxes which do not vary across firms.

In this light, a study exploiting a large reform and employing a DD analysis is probably able to abstract from personal income tax considerations and to deliver a clean result on the effect of corporate taxes on the capital structure of the firm (if changes in personal tax rates have not affected the control and the treatment group differently). There are two major challenges with a quasi-natural experiment approach, though. The researcher has first to identify a reform and second, a suitable control group which has not been affected by the reform. This is generally a daunting task, as tax reforms usually affect the entire economy.

Data and remaining challenges

Graham and Leary (2011) surveyed the literature on capital structure published since 2005. Using COMPUSTAT, they establish that, in the US between 1974 and 2008, a large part of the variation in firms leverage ratios is cross-sectional, particularly within the same sector. Overall, only a small part of that variation is explained by factors and firms characteristics analysed in the literature. A large and growing share of cross-sectional variation remains unexplained (Graham and Leary, 2011). This could be due to many factors, including mis-measurement of the main variables such as the leverage ratio and the effective tax rates. Graham and Leary (2011) note that careful measurement of key variables such as leverage and marginal tax rates could help reduce the amount of unexplained cross-sectional variation in firm's capital structure. This is important since the large and growing unexplained cross-sectional variation has been cited in the literature as one of the reasons why the traditional trade-off theory and the pecking order theory may not adequately explain firm's decisions in terms of capital structure.

To address cross-sectional firm variation, individual, firm-level data are necessary. The literature has mainly employed accounting data from COMPUSTAT, concentrating in particular on US corporations (see table 1), that is, large, listed corporations with access to capital markets. Two issues are worth pointing out here. First, although Graham and Leary (2011) detect growing unexplained cross-sectional variation using COMPUSTAT, the dataset may not be the most suitable to address the growing, within-industry cross-sectional variation in financing decisions. Second, it is not clear how far the conclusions derived using a dataset of large, listed firms can be generalised to European economies where the presence of small, medium-sized and family-owned businesses is important: small and medium sized companies

(that is, companies with fewer than 250 employees) employ around two-thirds of workers in the euro area (Draghi, 2013). Additionally, in the euro area financial intermediation is bank-based for at least three-quarters of firms' financing (Draghi, 2013). On the contrary, US companies generally rely heavily on capital markets for both equity and debt financing. The effect of taxes on small, young firms could be different than that on larger firms for many reasons. For example, asymmetric information problems could be more severe for smaller companies where the fortunes of the firm are more related to the entrepreneur's behaviour and good management skills may be scarcer than in a larger company. Because of asymmetric information, banks would charge higher interest rates or ask for more collateral to small and medium-sized firms and when the interest rate is too high or collateral is not available the tax advantage of debt could become irrelevant. In fact, in the current economic climate, there is evidence that small and medium sized enterprises are encountering much more difficulties in securing credit from the banking system.

Studies investigating the effect of the tax system on capital structure decisions of European firms do not explore the heterogeneity of firms' responses to taxes, with the exception of Overesch and Voeller (2010) and Dwenger and Steiner (2012) and Panier *et al*. (2012).
The earlier studies on European firms use country-specific datasets which generally contain accounting data (among others, Bennett and Donnelly, 1993, Lasfer, 1995, for the UK, Alworth and Arachi (2001) for Italy). More recently, researchers have employed AMADEUS, a pan-European dataset gathering accounting information for listed and non-listed companies across Europe (for example, Overesch and Voeller, 2010 for 23 European countries and Princen (2012) and Panier *et al*. (2012) for Belgium). Depending on the licensing, AMADEUS provides information also on smaller companies and on a wide set of ownership characteristics such as the type and number of shareholders of the firm and the number and location of its subsidiaries. In principles, this allows researchers to investigate a much more diverse set of companies than those represented in COMPUSTAT. COMPUSTAT records financial information only for listed and therefore fairly large companies. The availability of AMADEUS has allowed Overesch and Voeller (2010) and Panier *et al*. (2012) to investigate differential responses to the tax system across firms of different size.

For 23 European countries, Overesch and Voeller (2010) estimate elasticities which are significantly higher than those found in literature based on US firm data. They also find that

the capital structure of smaller firms is more responsive to tax incentives, in terms of both the corporate income tax and personal capital income taxes. On the contrary, Panier *et al*. (2012) find that Belgian larger firms are more sensitive to taxation than smaller firms.

The literature has generally employed accounting data to analyse the effect of the tax system on financing decisions. Accounts and tax returns are filed with different aims, hence accounting profits and taxable profits could be very different. Both AMADEUS and COMPUSTAT can at best proxy the real effective marginal tax rate. Graham and Leary (2011) explain that various tax deductions not reported in the accounts (off-balance sheet) such as those for tax shelters could substantially alter the marginal benefit of debt. The authors also note that the precise measurement of the effective marginal tax rates could help reduce the amount of unexplained cross-sectional variation in firm's capital structure. Blouin *et al*. (2010) state that many NDTS are not recorded on financial statements and therefore they are not included in the calculation of Graham's SMTRs, based on accounting income. This leads to the overestimation of the marginal benefit of debt and hence to the well-known result that firms are under-levered. One way of by-passing the problem of accurately measuring tax rates is to employ a quasi-experimental approach, such as in Panier *et al.* (2012) and Princen (2012).

If a reform affecting the marginal tax benefit of debt (versus equity) and (or) a suitable control group are not available, researchers could employ tax returns data to precisely calculate marginal tax rates and to control for other non-debt tax shields (loss carry forwards, capital allowances, special regimes) which would reduce substantially the value of interest deductions. Graham and Mills (2008) argue that SMTRs calculated using data from financial statements (book SMTRs) are highly correlated with SMTRs calculated using tax returns data (tax SMTRs). They also find that book SMTRs are more correlated to debt ratios than tax SMTRs and they state that such correlation is due to the fact that book SMTRs reflect more closely global, worldwide firm's decisions since financial data are consolidated at the group level whilst tax data are not.[31] In fact, the higher correlation between debt ratios and book SMTRs is hardly surprising as the ratios and the book SMTRs are calculated from the same set of books and may be affected by the same unobservable shocks. Additionally, it is not clear whether the results in Graham and Mills (2008) should hold for European countries, too. Some features of the European tax systems create permanent book-tax differences which

[31] There is an easy test of this idea: it would be interesting to see whether the correlation between tax SMTRs and debt ratios is higher for purely domestic firms.

would widen the difference between book and tax SMTRs. For example, most European countries now adopt a territorial system of taxation of corporate profits whereby dividends and capital gains are fully or partially exempt from the corporate income tax. In this context, it is not clear whether book SMTRs are more appropriate than tax SMTRs in approximating the relevant, real marginal tax rate for European multinationals.

An additional advantage of tax returns data is that they cover the universe of companies filing a tax return, so a lot of variation in the characteristics of the firms would be available for identification purposes. At present, only Gordon and Lee (2001) and Dwenger and Steiner (2012) employ tax return data to investigate the effect of the tax system on the firm's capital structure. Only Dwenger and Steiner (2012) focus on European data, that is, on German firms.

Gordon and Lee (2001) are the first to employ tax returns for US companies and interestingly, they are the first to estimate the tax effect on debt across small, medium and large companies. They find a large effect of taxes on the debt ratio for small and large firms (but no differential effect) whilst the effect for medium-sized firms is much smaller. This could be linked to the characteristics of their dataset. Because of confidentiality reasons, their data are aggregated by company's size. This may lead to some mis-measurement in the tax rate, especially for medium-sized firms as some strong assumptions are needed to calculate the average marginal tax rate for firms in each size interval. In particular, the authors assume a uniform distribution of firms across assets bands and also that all firms within the same size band earn the same rate of return. This is unlikely if firms of comparable size belong to different industries. Dwenger and Steiner (2011) are the first to use tax return data for a European country, that is, Germany and the first to address the heterogeneity of responses across different types of firms. They employ a pseudo-panel drawn from German corporate tax returns and find that leverage is less responsive to the tax rate for small firms, in contrast to Overesch and Voeller (2010)[32] and in accordance to what Panier *et al.* (2012) find for Belgian firms.

Another aspect of research into heterogeneity is to investigate financial firms. The literature mentioned above generally excludes non-financial firms. Despite the importance of the financial sector and of its appropriate capitalization, analyses of the effect of taxes on the

[32] Hartman-Wendels *et al.* (2012) employ a panel of firm-level accounting data for German firms. The dataset allows controlling for the size of the firm. They do not control for heterogeneous responses to tax changes but they simply control for the effect of size on the debt ratio. In a pooled OLS the size seems to exert a negative effect on the debt ratio whilst when controlling for fixed effects, the effect of size becomes positive.

firms' capital structure are scarce. One of the few contributions in the area is Keen and de Mooij (2012) who investigate leverage in commercial banks across 82 countries. They find that the tax benefit of debt also affects financial choices of financial firms. They also examine heterogeneity in responses across banks and find that capital-tight banks are more insensitive to debt and so is the largest 5 per cent of institutions. Using a sample of 558 bank subsidiaries, Gu *et al.* (2012) find that the leverage ratio of banks depends on both the local tax rate in the host country of the subsidiary (traditional debt bias effect) and on the difference between the international and the local tax rate (international debt shifting).[33] Both effects are statistically significant and large but the international debt shifting channel appears to be more robust and is often larger in the regressions than the traditional debt bias effect.
Using a panel of banks in 87 countries, Hemmelgarn and Teichmann (2013) estimate the effect of changes in the corporate income tax rate on leverage, dividend policies and earnings management of banks. They find that leverage increases with corporate income tax rate and so do dividend pay-outs.

Generally, no detailed information on assets, liabilities, and ownership structure is available from tax returns. This is why it would be useful for researchers to be able to merge tax returns with other data sources such as accounting data or other data such as those gathered for national firms' surveys (for example, the UK firms' surveys produced by the Office of National Statistics).

Understanding whether and why there are cross-sectional differences in firms' capital structure responses to the tax system is crucial for tax policy making. There is very little empirical evidence about the differential effects of taxes on capital structure across different types of firms. This is primarily due to the fact that publicly available datasets underreport small and medium sized firms and at the same time, they generally do not include a reliable figure for the effective tax burden of the firm.
This means we know very little about the potential differential effects of tax policy across diverse types of companies. For example, the Allowance for Corporate Equity (ACE) initially suggested by IFS (1991) has been recently re-proposed by the International Monetary Fund and by the European Commission to reduce the incentives of the tax system to excessive debt financing (de Mooij, 2011b, Fatica *et al*. 2012, European Commission, 2012) but there is

[33] The difference between the local and the international tax rate is measured by the international tax difference vis-a-vis other bank subsidiaries in the same group.

very little discussion on how the ACE is likely to benefit different types of firms. In Belgium, the Notional Interest Deduction provides an additional 0.5% interest deduction for small firms.

Santoro (2005) employs a weighted sample of 16,069 Italian individual corporate tax returns for the year 2000 and investigates the characteristics of firms using the Italian ACE (as opposed to non-ACE-users). The author finds a great diversity of responses to the introduction of the allowance: the probability of claiming an ACE is positively associated to profitability, size, and location in northern regions, with some smaller companies not claiming the ACE at all. The effectiveness of an ACE will then depend strongly on the structure of the economy.

Conclusion

Empirical research on the effects of taxation on firm's behaviour focused on larger firms and on the non-financial sector. The reason lies on data availability: publicly available accounting data generally under-represent small and medium sized business and is designed for non-financial firms. Accounting data also do not provide a precise measure of the effective marginal tax burden of the firm so that the results in the literature are based on approximations affected by measurement error and therefore could lead to biased estimates of the effect of taxes.

In order to be able to address heterogeneity of responses and therefore to better target tax (and regulatory) policy within the EU, administrative data covering the full population would help researchers dealing with some of the drawbacks of the current literature. Administrative data provide full coverage of the economy and generally, they also deliver very reliable information. For example, tax return data record the real tax burden of the firm, although such burden is reported at an unconsolidated level. Data logged with National Central Banks provide very reliable information about the capital structure of the financial industry, given the role of National Central Banks as regulators.

Generally, when administrative data do not provide enough information on some crucial characteristics of the firm (for example, on ownership structure, size, and different types of

liabilities) such as in tax returns, it would be useful for researchers to merge administrative data with other data sources such as accounting data or other data gathered for national firms' surveys (for example, the UK firms' surveys produced by the Office of National Statistics). This is already a possibility at the UK-based HMRC Datalab where it is possible to work on a dataset which merges corporate tax returns and accounting information from FAME, the UK subset of AMADEUS.

Table 1. Summary of literature

Paper	Journal	Countries	Period	Data	Dataset	Type of firms	Identification	Tax rate	Debt
Bradley et al. (1984)	Journal of Finance	US	1962-1981 (but an average)	Cross-section of average values (1962-1981)	Compustat	Listed, non-financial	Cross-sectional	NDTS=(depreciations charges+annual investment tax credit)/earnings before depreciation, interest and taxes.	Long-term debt (book value)/asset Average over 1962-1981
Auerbach (1985)		US	1869-1977	Panel	Compustat, 10k report, CRSP	Listed, non-financial	FE (firm; year)	Dummy for loss carry-forward	Debt/assets (book debt; book-based and market-based assets measures) Long and short term.
Mackie-Mason (1990)	Journal of Finance	US	1977-1987	Pooled sample	SEC Registered Offerings Statistics and Compustat	Listed, non-financial, non-real estate firms which have issued either debt or shares	Probit model of firm choices between publicly issued debt and equity	Book tax loss carryforward/net sales; Investment tax credit/net sales	Decision to publicly issue debt (versus equity)
Bennett and Donnelly (1993)	British Accounting Review	UK			Datastream	Non-financial	Cross-sectional	Deferred tax liability/total assets – as a proxy for NDTS	Debt/value of the firm. Three different measures of debt: long-term, total and short-term debt. Two measure for denominator: firm's book and market value
Lasfer (1995)	European Financial Management	UK	1972-1983	Panel, accounting data	Exstat, Extel card, Datastream	Non-financial firms with main activities in UK,	OLS, random effect model	(Taxable profits before interest*stat. rate)/pre-tax profit; Tax-exhaustion dummy	Long-term debt/(long term debt + year-end market value of equity);
Rajan, Zingales (1995)	Journal of Finance	G7	1987-1991	Firm-level, accounting, consolidated	Compustat Global Vantage	Listed, non-financial		Corporate statutory tax rates	Changes in debt
Graham (1996)	Journal of Financial Economics	US	1980-1992	Pooled cross-section Cross-section for each year	Compustat	Listed, non-financial	OLS	SMTR (after financing)	First difference of long-term debt/lagged mkt value of firm (book values) Long-term; long plus short term; long+short term + convertible.
Graham (1999)	Journal of Public Economics	US	1980-1994	Pooled sample Cross-section made of	Compustat	Listed, non-financial	OLS (with time dummies)	SMTRs (before and after	(Long-term debt + current

				average of all years			Within-group	financing)	liabilities)/(tot. assets – book equity + market equity)
Alworth and Arachi (2001)	International Tax and Public Finance	Italy	1982-1994	Panel of firm-level accounting data, unconsolidated	Centrale dei bilanci	Manufacturing with sales over Lit 10bn	OLS, firm-fixed effects, Time fixed effects.	SMTRs (before and after financing)	First difference in the book value of debt (long and short term)/lagged book value of total assets. Also, first difference of bank loans, bonds, other financial liabilities.
Booth et al. (2001)	Journal of Finance	10 developing countries (India, Pakistan, Thailand, Malaysia, Turkey, Zimbabwe, Mexico, Brazil, Jordan, and Korea)	1980-1991	International Finance Corporation (IFC) data comprise	Abbreviated balance sheets and income statements	Largest companies in each country	Pooled OLS and fixed-effects estimates		Book-debt ratio as total liabilities divided by total liabilities and net worth; long-term liabilities, divided by long-term liabilities plus net worth
Gordon and Lee (2001)	Journal of Public Economics	US	1954-1995	Summary tax return data, aggregated by size class.	US Statistics of Income (SOI) Corporate Income Tax Returns	Universe of US firms that file tax returns, including small firms.	Cross-section and time-series. Instrument tax rate with average profit rate before interest deductions.	Tax law applied to average taxable income of size band	Debt/assets (book debt and assets) Long and short term
Althuler and Grubert (2003)	Journal of Public Economics	US	1996	Foreign-affiliate-level, unconsolidated	Corporate tax files	Foreign affiliates of US multinationals (largest 7,500)	OLS	Statutory corporate income tax rates	
Desai *et al.* (2004)	Journal of Finance	US	1982, 1989, 1994	Foreign-affiliate-level, unconsolidated	Bureau of Economic Analysis	Foreign affiliates of US multinationals		Country-year median of the affiliate-level ratio of foreign affiliate tax over foreign affiliate profits	
Overesch and Voeller (2010)	FinanzArchiv	23 EU countries	2000-2005	Firm-level panel, Accounting, unconsolidated	AMADEUS	Panel of standalone, non-financial companies (not controlled to more than 50% by another corporation during the considered period)	Firm fixed effects	Statutory corporate and personal rates; dummy for loss carryforward (equal one if the respective company's profit in the previous year was negative).	Debt to assets ratio (debt to total assets); from financial accounting.
Panier *et al.* (2012)	Unpublished	Belgium, (France, Germany, Luxembourg the Netherlands)	2001-2009	Firm-level, accounting,	AMADEUS; Belgium Central Bank (Belgium)	All firms with assets larger than £1m for at least one year	DD	None	Equity (leverage) ratio

Princen (2012)	Unpublished	Belgium, (France, Germany)	2001-2007	Firm-level, accounting	AMADEUS	Non-financial, non-real estate firms.	DD Propensity score matching	None	Book leverage = (long-term debt + current liabilities) / total assets. Financial leverage = (long term debt + loans)/ total assets
Dwenger and Steiner (2012)	International Tax and Public Finance	Germany	1998 and 2001	Pseudo-panel	German corporate and local tax returns (German Federal Statistical Office)	Universe of German firms	OLS, IV. Firm-level average tax rate, instrumented by the counterfactual tax rate a firm would face had there be no endogenous change of corporate debt. This counterfactual is obtained from micro-simulations based on tax return micro data for the years 1998 and 2001.	Corporate income tax assessed/EBITD	Long-term debt/ total capital
Hartmann-Wendels (2012)	Deutsche Bundesbank Discussion paper	Germany	1973-2008	Firm-level, accounting	Deutsche Bundesbank corporate balance sheet data	Non-financial firms, small, medium-sized and large	Pooled OLS, Firm fixed effects	SMTRs (before and after financing)	(Short + long term financial debt)/book assets; First difference in Debt/assets; First difference of debt/lagged book asset
Keen and de Mooij (2012)	IMF Working paper	82 countries (EU, Americas and Asia)	2001-2009	Firm-level, unconsolidated, accounting	BANKSCOPE	Commercial, savings and cooperative banks.	System GMM	Statutory tax rates	Tot. liabilities/tot. assets; Non-hybrid debt to assets; Hybrids to assets.
Gu, de Mooij and Poghosyan (2013)	IMF Working paper	Various countries in Bankscope	1998-2011	Subsidiary-level, unconsolidated/consolidated, accounting	BANKSCOPE	558 commercial bank subsidiaries of the 86 largest multinational banks in the world		Statutory tax rates (local and international differences)	Debt-ratio
Hemmelgarn and Teichmann (2013)	EU Commission Taxation Paper	87 countries	1997-2011	Firm-level, unconsolidated, accounting	BANKSCOPE	Commercial, savings and cooperative banks.	First differencing; Difference GMM and System GMM	Statutory tax rates	Leverage ratio; Capital buffer=(equity/total assets)-capital requirement

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