Currency change and capital structure decisions: evidence from the birth of the Euro area

Marco Botta
Universita Cattolica del Sacro Cuore, Milan, Italy and EU Business School, Geneva, Switzerland

Received 1 April 2022
Revised 27 September 2022
Accepted 25 May 2023

Abstract

Purpose – The paper investigates if the process that led to the birth of the Euro Area had a significant impact in homogenizing the capital structure decisions of European firms since the first introduction of the common currency.
Design/methodology/approach – A large sample of firms was constructed, and a Tobit-censored regression model was utilized to investigate the determinants of firms' observed capital structures. The Black–Scholes–Merton model was used to infer market values of assets, as well as the volatility of those values, from the observed market values of equity and the corresponding volatility. The existing differences in national tax rules were considered for estimating firm-specific marginal tax rates.
Findings – It was found that, despite the currency union and the institutional harmonization process, certain factors still play a different role. In particular, the impact of profitability is consistent with the pecking order view in some countries, and with the trade-off theory in others. Assets risk, measured as the annualized volatility of the market enterprise value, is the best predictor of observed leverage ratios. The sector of activity is significant in determining leverage decisions even when assets' risk is taken into account. Despite the monetary union and the increased financial and institutional integration in the Euro Area, the country of origin still plays a significant role in capital structure decisions, suggesting that other country-level factors may affect firms' financing behaviour.
Practical implications – The paper indicates that, despite the long harmonization process of institutions, regulations and public budget required to join the Euro, firms' financing decisions are still affected by country-specific factors once the common currency is introduced. Therefore, new entrant countries in the Euro area should not expect their companies to immediately conform with those located in other countries within the common currency area.
Originality/value – This article investigated the impact of the currency change from national currencies to the Euro on the determinants of capital structure choices. It was shown that, despite the long harmonization process that led to the birth of the Euro Area, national factors still affect firms' financing decisions. This provides guidance for policymakers in countries that are planning to join the Euro about the impact this will have on firms' financing decisions in the entrant country.

Keywords Capital structure, Currency change, Euro area, Pecking order theory, Trade-off theory
Paper type Research paper

1. Introduction

A long-standing issue in corporate finance is the importance of capital structure and the analysis of what factors affect firms' financing decisions. In their seminal paper, Modigliani and Miller (1958) show under what conditions capital structure has no effect on firm value, hence opening the way for a large stream of research trying to detect what factors may instead make capital structure relevant. Myers (2001) provides a thorough review of the theoretical research in the field. The three most important factors that may cause

Funding: Open Access Funding provided by Università Cattolica del Sacro Cuore within the CRUI-CARE Agreement.

International Journal of Managerial Finance
Vol. 20 No. 3, 2024
pp. 821-850
Emerald Publishing Limited
1743-9132
DOI 10.1108/IJMF-04-2022-0153

the irrelevance proposition to be violated are the potential tax benefits of debt (Modigliani and Miller, 1963), the costs of financial distress (Stiglitz, 1969) and informational asymmetries (see, among others, Myers (1977), Leland and Pyle (1977), Myers (1984) and Myers and Majluf (1984)).

Empirical research has consistently worked on finding what factors affect the observed capital structure decisions of firms, at the same time trying to discern between alternative explanations. Most studies try to explain debt policies within countries (see, among others, Titman and Wessels (1988), Fama and French (1998), Graham and Harvey (2001), Frank and Goyal (2003), or Flannery and Rangan (2006)), but the most recent empirical literature investigates the topic also on international samples of firms, thus also analysing if and how the impact of various firm characteristics on the debt ratio may (or may not) change in different economic and institutional contexts, thus providing evidence on the robustness of single-country studies when the same model is applied to international samples (see, for example, Gungoraydinoglu and Öztekin, 2011; Gungoraydinoglu *et al.*, 2017; Çolak *et al.*, 2018; Botta and Colombo, 2022). Their findings show how the national context may have both a direct and an indirect impact on capital structure decisions, through their interaction with firm-level characteristics, leading to the conclusion that, to a certain extent, financing decisions are country-specific. Therefore, capital structure decisions are not independent from the country in which the company is incorporated. Öztekin (2015) provides a thorough review of this stream of research.

Building on this literature, we aim at testing a set of variables as potential determinants of observed capital structures for non-financial listed firms located in one of the twelve original countries of the Euro area, in order to understand if the creation of a common financial market and a common currency has made firms' financing decisions consistent across countries, or if differences can still be observed despite the long harmonization process of financial markets regulation. Therefore, we choose the Euro area as a geographical sample precisely because, on the one hand, the freedom of capital movements across countries and the monetary union has created an integrated financial market within the area, eliminating the exchange rate risk which might otherwise prevent firms from raising funds abroad; on the other hand, while financial regulation has been harmonized across countries, tax rules, bankruptcy laws and the degree of protection of property rights still differ to a large extent, thus leaving open the possibility of different behaviours by comparable firms located in different countries.

In our analysis, we also improve on the empirical approach typically used in the literature by estimating proper market-value measures of leverage ratios. Indeed, while the theoretical literature on capital structure is based on market-value measures of debt, and hence leverage, the empirical tests use book-value measures of debt, and therefore leverage ratios that non necessarily reflect the true market value capital structure. As a consequence, if the difference between the two measures of leverage is relevant, then empirical results obtained with book values of debt may be inconsistent and unreliable for testing alternative hypothesis. The use of book values as proxies for market values reflects the fact that only a fraction of debt issued by firms is traded debt, so that a market value of debt can only be observed in a minority of cases. This may create biases in the estimation of capital structure determinants, since, as Sweeney *et al.* (1997) report, many corporate bonds trade at values which differ significantly from their book value, and the consequences of these differences can be remarkable, as outlined by Eberhart (2005). In our work we use both market and book values of debt, and we find that, despite the corresponding leverage ratios are strongly correlated, the two approaches yield partially different results and goodness-of-fit measures are higher when market, rather than book, values of leverage are used to measure the debt ratio.

Since most European firms do not have publicly traded debt, we estimate the market value from the book value and observable data from stock markets, using the Black-Scholes-Merton model, derived from option pricing theory (see Black and Scholes (1973) and Merton

(1974)). By means of that same model we also estimate the volatility of the enterprise value, that we then use as a proxy measure of the operational risk of firms' assets.

Our results indicate that, despite the introduction of the common currency, firms' financing decisions still differ across countries, suggesting that national factors still play a significant role. In particular, we find that the strongest predictor of leverage is the volatility in the market value of assets, a result that is consistent across the Euro area. However, the role of taxes, growth opportunities and profitability varies across countries, indicating that national tax rules and institutions still play a significant role in shaping firms' financing decisions, and a complete financial markets' integration requires more than a common currency and harmonized financial regulation.

The work is organized as follows: Section 2 provides a survey on the literature in the field. Section 3 illustrates the model and the variables used for the analysis, while Section 4 describes our dataset. In Section 5 we report our findings, and Section 6 concludes.

2. Literature review

Modigliani and Miller (1958) represent the basic reference for the research on capital structure decisions. In their work, they prove under what conditions – the perfect capital markets assumption – the value of a firm is independent of how it chooses to raise funds, and therefore capital structure is irrelevant. However, if we remove the perfect markets hypothesis, and introduced imperfections in the model, capital structure may become relevant, and it may affect the profitability and the value of firms. The literature has therefore investigated what factors may affect financing choices in an imperfect world, and two main theories have been proposed. One is the trade-off theory, as described, among others, by Kraus and Litzenberger (1973) and Scott (1977), which explains that firms should target an optimal mix of sources of capital in order to maximize their value. The optimal level of leverage, in turn, depends on the trade-off (hence the name of the theory) between the various costs and benefits generated by alternative sources of funds, which may depend on corporate income taxes (Modigliani and Miller, 1963), the costs arising in the event of bankruptcy (Stiglitz, 1972), and agency costs due to informational asymmetries connected both with the use of debt and equity (Jensen and Meckling, 1976; Myers, 1977). The main alternative is the pecking order theory (Myers and Majluf, 1984), which instead states that firms do not have an optimal capital structure, but instead follow a hierarchy of financing sources as a consequence of asymmetric information between insiders and external investors about the true value of the company, and, hence, of the securities issued to raise capital. As a consequence, rather than targeting an optimal debt ratio, due to informational asymmetries that lead to a potential mispricing of securities issued by firms, the optimal financial policy consists in using the least-information-sensitive financing source first, and then moving on to more sensitive securities. As a result, firms prefer to rely on internally generated funds, to avoid the agency costs necessary to raise outside capital, and then prefer debt over equity when external funds are necessary, due to the lower sensibility of debt value to asymmetric information. Finally, Baker and Wurgler (2002) suggest instead that current capital structure depends on historical market values equity, and that the capital structure we observe is simply the cumulative result of past attempts by firms to time the equity market in order to raise capital at the most favourable conditions (the so-called market timing hypothesis). Under this view, firms do not worry about whether it would be preferable to use debt or equity, they simply choose the form of financing which, under current market conditions, appears to be more valued by financial markets [1].

The empirical literature has worked extensively to test the various theories on real data, trying to understand which of the alternative theoretical explanations better reflects the behaviour of firms in real economies. Many empirical studies analyse debt policies within individual countries, mainly in the US (see among others Titman and Wessels (1988), Fama

and French (1998), Graham and Harvey (2001), Frank and Goyal (2003)), but there are also works, starting with Rajan and Zingales (1995), that try to shed light on whether the same model can be applied to international samples, in order to understand if capital structure policies are consistent across countries, or if geographical differences emerge. Frank and Goyal (2009) find that the factors that most reliably impact capital structure for US firms are the market-to-book assets ratio, tangibility of assets, profitability and firm size.

The analysis of capital structure decisions made by companies incorporated in countries with different institutional contexts, different financial market development, different levels of economic development, different political conditions or different cultural factors has grown extensively in recent years, sometimes leading to contrasting results (see Öztekin (2015) for a thorough review). Demirguc-Kunt and Maksimovic (1996) report a negative impact of stock market development on financial leverage. Booth *et al.* (2001) analyse data from ten developing countries, and report that the same factors used for developed countries affect capital structure of firms in developing ones, but also highlight how country-specific elements generate differences across countries. Mitton (2008) shows how capital structure for firms in emerging economies depends both on firm-level characteristics and country-specific factors. In a very large international sample of firms, Gungoraydinoglu and Öztekin (2011) show how both institutional settings and firm characteristics contribute at determining capital structure decisions, with the former accounting for around one-third of the explained variation, and the latter for the remaining two-thirds. Çolak *et al.* (2018) and Botta and Colombo (2022) show how institutions and political settings may also affect capital structure decisions, not just directly but also indirectly by affecting the impact of rim characteristics on debt ratios.

Therefore, the literature suggests that the country of incorporation may affect capital structure decisions, as well as the role of firm-level factors in shaping such decisions. The aim of this study is to investigate whether the creation of a common currency and, as a consequence, a larger and unified financial market, preceded by a long harmonization process of financial regulation in the adhering countries, allows to eliminate the impact of national factors, or whether these persist despite the new ultra-national institutional setting.

3. Methodology

The purpose of this article is to analyse the determinants of observed debt ratios, in order to shed light on what firm characteristics affect firm's financing decisions, and to compare any potential difference between countries. To this end, we rely on a Tobit model, with a lower censoring value of zero and an upper value of one to reflect the natural bounds of our dependent variable, the debt ratio and as regressors a set of potentially relevant firm characteristics. We estimate the model for each country separately, as well as for the Euro area as a whole. The regression model is the following:

$$\frac{D_{i,t}}{A_{i,t}} = X_{i,t}\beta + \nu_i + \epsilon_{i,t} \tag{1}$$

where D is the value of debt, A is the value of assets, i indicates firm, t indicates time, β is a vector of coefficients, ν represents firms' random effects and ϵ is the error term.

The debt ratio, that here is to be intended as financial debt only, is measured with two different approaches: first, it is determined using market values of both debt and equity, and calculated as the ratio between the market value of debt and the market enterprise value, both obtained using the so-called Black-Scholes-Merton (BSM) method through reverse-engineering [2]. Then, debt ratio is defined as the ratio between the book value of financial debts and the sum of market capitalization and book value of debt. In both cases, the debt ratio takes values which are naturally bounded between zero – if the firm has no debt – and one – in the extreme case where the value of equity is zero, and the company is entirely funded with debt.

More specifically, we use the following system of two equations to indirectly price corporate liabilities, where the two unknowns to be determined are the market enterprise value (or market value of total assets) and its volatility:

$$\begin{cases} E(A,T) = Ae^{-\delta T}N(d_1) - Fe^{-rT}N(d_2) \\ \sigma_e = N(d_1)\cdot\sigma_a\cdot\dfrac{A}{E} \end{cases} \quad (2)$$

where E is the market value of equity, A is the market value of total assets, T is time to maturity, δ is the weighted average payment rate to financiers (dividends and interests on debt), F is the face value of financial debt, r is the risk-free interest rate; σ_e is the volatility of equity returns and σ_a is the volatility of asset returns [3].

The rate δ is the continuous-time rate equivalent of the rate obtained as the weighted average of the dividend yield and the average cost of debt retrieved from the Worldscope database. Time to maturity T is the weighted average maturity of debt, while F is the face value of both short and long-term financial debt. The risk-free rate is the rate paid by a 5-year t-bond issued by the government of the country where the company is incorporated. The market value of equity is the total market capitalization at the balance-sheet closing date, while the volatility of equity is measured as the annualized standard deviation in the log of weekly changes in the stock prices during the two years preceding the balance-sheet date. Thus, by solving the system of two equations we can obtain the market value of total assets and the asset volatility [4]; this procedure is applied for each firm for each year for the period 2000–2003, in order to obtain the value of those two variables for each of the four years. Finally, the market value of debt is given, in each period, by the difference between the market enterprise value and the total market capitalization.

Looking at the results we obtain, we can observe how debt ratios – whether measured at market values or book values – differ significantly between the twelve countries considered. Figure 1 shows the mean and median debt ratio and the standard deviation for each country at the end of 2003.

Values range between the lowest mean of 29.5% in Ireland (the only country which falls below 30%) to the highest mean of 57.3% in Portugal. Italy and Austria are the only two other countries with a mean debt ratio above 40%; the remaining countries are positioned between 30 and 40%. Standard deviations are very similar, with most countries taking values between 0,2 and 0.24, with the exception of Spain, with displays a lower volatility (0.19), and Germany, which on the other hand shows an higher volatility (0.27).

Figure 2 shows instead the mean, median and standard deviation of book debt ratios again at the end of 2003.

As one can see, values change significantly from one country to another also whendebt ratios are measured at book values, ranging from the lowest mean of Ireland, with an average debt ratio of 25.8%, to a maximum of 55.3% in Portugal. Spain, Netherlands, Germany and France have mean values of around 31%, while Finland and Luxembourg fall below the 30% value, with average ratios of 26 and 28% respectively; Belgium is just above 35%, while Austria, Greece and Italy have average ratios around 37%. These data alone suggest that, despite having a common currency and a potentially integrated financial market, firms make on average different financing decisions in the twelve countries of the Euro area.

Figure 3 shows instead the relation between debt ratios of a company measured at full market values versus the debt ratio of the same company measured at book values of debt.

The values we obtain, as summarized in the figure, show that debt ratios measured at book and market values of debt are not perfectly correlated, as there are a significant number of situations in which the obtained combination lies far from the 45° line.

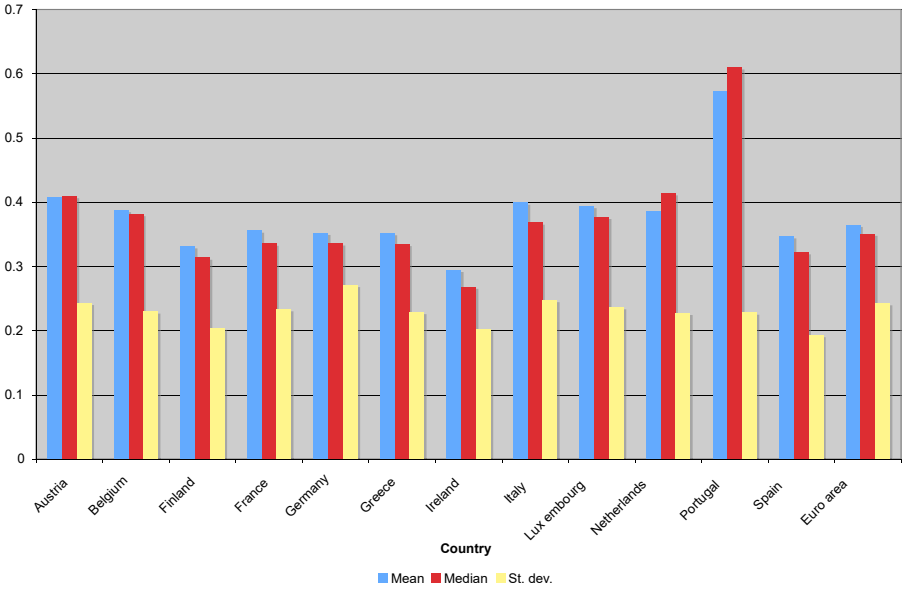


Figure 1.
Debt ratios at market values of debt across the Euro area

Source(s): Author's own work

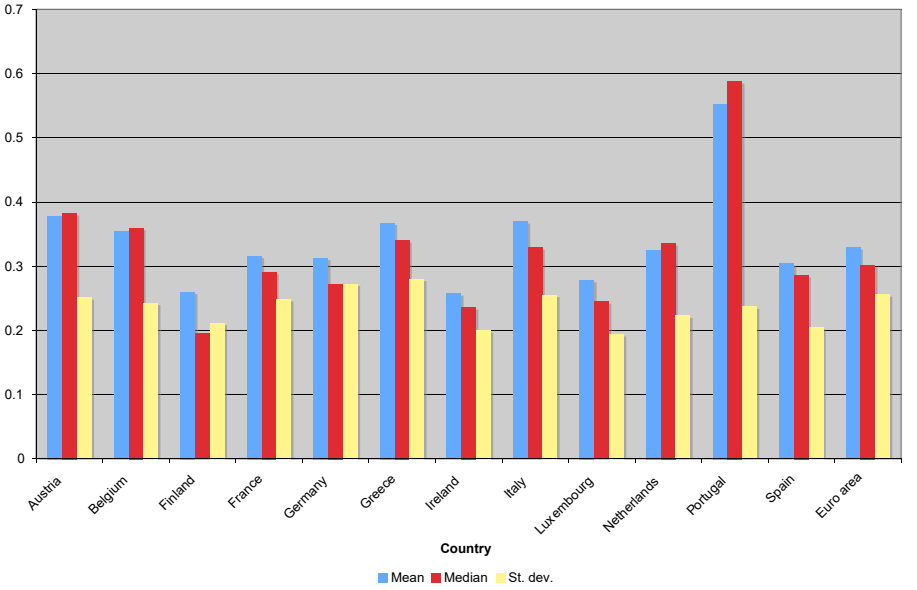
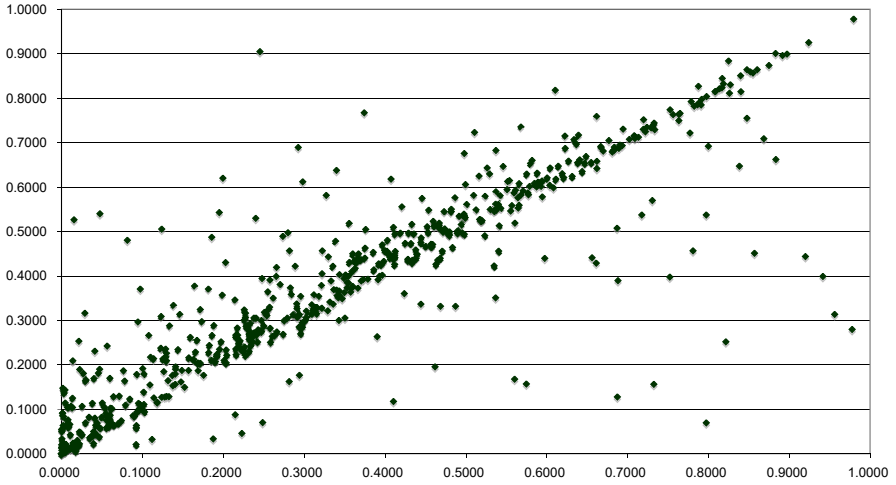


Figure 2.
Debt ratios at book values of debt across the Euro area

Source(s): Author's own work

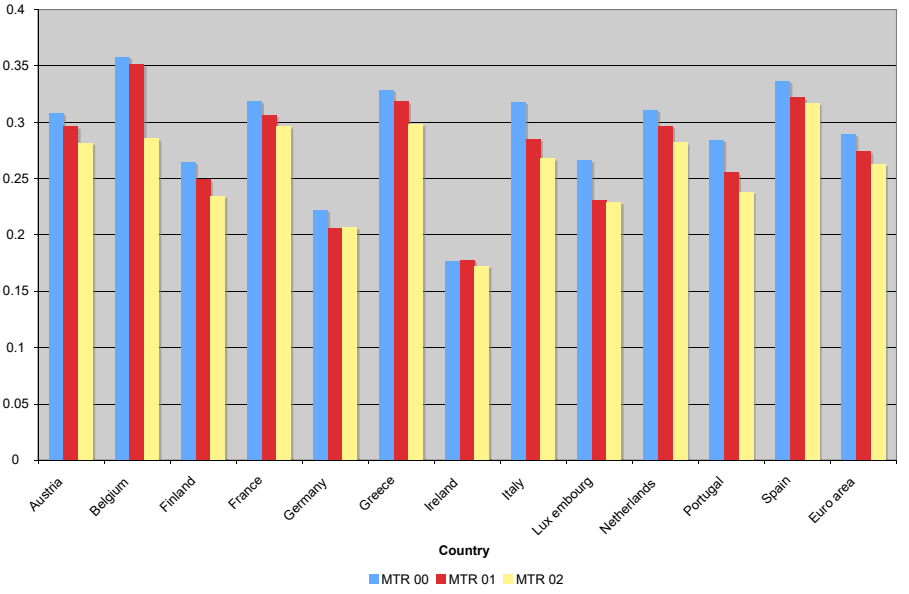
As potential regressors, we include a list of firm characteristics that, according to previous research, may have an impact on capital structure decision. The first factor that the literature suggests may have a significant impact on firms' financing decisions is the effective marginal



Source(s): Author's own work

Figure 3.
Debt ratios at book vs market values of debt

tax rate (*MTR*) that firms face, given the different tax treatment of debt and equity (Modigliani and Miller, 1963; Faccio and Xu, 2015). We therefore estimate firm-specific marginal tax rates, following the method proposed by Shevlin (1990), Graham (1996a), and Graham (1996b)[5]. Indeed, as summarized in Appendix 2, the twelve countries differ quite significantly on the main aspects of the tax code, like the treatment of net operating losses, the level of statutory tax rates and minimum tax provisions, creating a very varied fiscal environment within the Euro area, thus opening the possibility of different behaviors for firms located in different countries. Figure 4 shows the average MTR for each country for



Source(s): Author's own work

Figure 4.
Marginal tax rate: mean values

each of the three years considered. We observe a general decline between the year 2000 and 2002 in MTRs in each country, reflecting the decline of statutory corporate tax rates in most European countries. France, Greece and Spain are the countries with the highest average MTR both at the beginning and at the end of the period; Belgium has high tax rates for the first two years, but then falls below the average of the Euro area in 2002, as a consequence of the tax reform introduced in 2002 which lowered significantly the statutory rates. Italy, a country usually known for having high rates, appears here to have lower MTRs than many other countries in the sample. This is mainly due to the fact that rates were constantly declining during the period: an extra-euro of (positive or negative) income, when affecting future, rather than current, taxable incomes, would be taxed in the future at lower rates than today, hence pushing downwards the MTR [6]. The change in the MTR for Germany, despite the absence of changes in the statutory rate, is due to reforms introduced in the treatment of loss carryforward and carryback and the introduction of a minimum taxation [7]. As expected, Ireland has the lowest mean MTR, with a value below half of the value of the highest MTR in the sample.

We also estimate the probability of having net operating losses in the following year (*NOL*), and use it as an additional measure of the tax advantage of debt: the higher the probability of having losses, the lower the probability of being able to deduct from the tax bill the interests paid on debt, and, consequently, smaller the tax advantage of debt (Graham, 1996a). We thus expect a negative correlation between the level of debt and the probability of having net operating losses [8].

Bankruptcy costs (*BC*) represent another relevant factor in determining leverage policies, as shown in Stiglitz (1972), Opler and Titman (1994), Leland and Toft (1996), Andrade and Kaplan (1998), Mukherjee and Wang (2013) and Öztekin (2015). We estimate firm-specific individual bankruptcy costs again relying on the Black-Scholes-Merton model, thus deriving them as an implicit component of the market value of debt. The model prices debt by discounting its face value at the risk free rate and then subtracting from such value the value of the put option which is implicit in a risky debt contract. In other words, the value of the put option, which is basically the value of the option for the stockholders to default and transfer the company to the debtholders, determines the spread between the risk free rate and the rate paid by the firm on the debts outstanding. The main component of this spread (or, in terms of values, the difference between the market value of debt and its present value at the risk-free rate) is assumed to be the expected loss in firm value in case of bankruptcy (the implicit *"Bankruptcy Costs"*) [9] To calculate the implicit bankruptcy costs, we first calculate the *Distance to Default*, obtained as the ratio between the market value of equity and the volatility of the value of assets. In the BSM world, this is equal to the parameter d_2 from the pricing formula. Then, given the basic assumption that the asset value is lognormally distributed (that is, changes in the asset value are normally distributed), the *"Probability of Default"* can be obtained from the Distance to Default, by simply taking the value $N(d_2)$, where $N(\bullet)$ indicates the cumulative standard normal distribution. Finally, the *"Expected Loss"* in the event of default can be calculated as the value of a put option written on the asset value of the firm, with strike price equal to the face value of debt and time to maturity equal to the average maturity of debt; the pricing formula is then the standard Black-Scholes equation for pricing a put option, modified, as already described before, to account for interests and dividend payouts. Once we have the expected loss and the probability of default, we can obtain the *"Loss Given Default"* by dividing the expected loss by the probability of default, which represents our proxy for the ("levered") implicit Bankruptcy Costs. Given that we need to study the level of the debt ratio at a specific point in time, rather than marginal variations in the ratio, an "unlevered" measure is needed. We therefore divide the estimated Loss Given Default by the market value of the outstanding debt in order to obtain an estimate of the bankruptcy costs per unit of debt.

The empirical literature consistently reports firm size (*Size*) as a significant predictor of observed capital structure (see, among others, Rajan and Zingales (1995), Flannery and Rangan (2006), Öztekin and Flannery (2012), Gungoraydinoglu *et al.* (2017), Çolak *et al.* (2018) and Botta and Colombo (2022)). We measure size by means of the market value of total assets, or market enterprise value, estimated with the BSM approach from Equation (2) In order to avoid the impact of scale effects, we use the log of the market enterprise value as a measure of firm size, rather than the absolute value. Larger firms are often found to have higher debt ratios than smaller firms, and lower costs of debt: the traditional interpretation of this empirical finding is that larger firms have lower informational asymmetries between insiders in the firm and financiers in the financial market, and so they can reduce the cost of financing and issue more debt. Larger firms might also be considered less risky by external financiers, because of their higher possibility of asset diversification and their better chances to survive "troubled times" thanks to their larger size.

We then use the volatility in the market value of assets (*Risk*), again obtained as an output of the BSM model from Equation (2) as a measure of the risk of firms' assets. We expect a negative relationship between volatility and debt: more volatile, hence riskier, firms should find debt less attractive than less volatile firms (Leland, 1998). Risk can affect financing choices through various channels (see, again, Leland (1998)): higher risk causes an higher probability of default, and hence a lower incentive to use debt (Pinegar and Wilbricht, 1989); moreover, assuming that asset volatility reflects the volatility of earnings, higher volatility can also indicate an increase in the probability of not being able to take full advantage of the tax advantage of debt (Graham, 2000); finally, risk also affects potential agency costs connected with debt, causing issues like risk-shifting (Jensen and Meckling, 1976; Almeida *et al.*, 2011) and debt overhang (Myers, 1977) which tend to reduce the use of debt as a financing source. All these theoretical explanations suggest a negative impact of risk on the level of leverage.

We then measure the market-to-book ratio (*Growth*) as the ratio between the market enterprise value and the book value of total assets, and use it as a proxy for the level of growth opportunities of a firm, as is commonly done in the literature (Rajan and Zingales, 1995; Öztekin, 2015). An higher market-to-book ratio indicates that the proportion of a firm's total market value accounted for by the value of growth options compared to that accounted for by the value of assets in place is higher, compared to firms with lower market-to-book ratios [10]. As Myers (1977) has shown, debt can be a costly source of financing to firms with high investment opportunities, because projects with positive net present value may be forgone when the increase in the debt value is higher than the increase in the total asset value, hence reducing the market value of equity (the debt overhang problem). As a consequence, managers of firms with excellent investment opportunities could decide to limit the amount of debt in order to avoid, or at least minimize, this negative effect. If this is true, then we should expect a negative correlation between debt and a measure of growth opportunities. The risk-shifting problem (Jensen and Meckling, 1976; Almeida *et al.*, 2011) could also reduce the ability of firms with high growth opportunities to raise large amounts of debt: the larger the investment opportunities the larger is the risk for the debt-holders to suffer from the risk-shifting problem, and this would induce them to increase the cost of lending to firms with proportionally higher investment opportunities. Again, this would imply a negative relation between debt and growth opportunities.

We also consider firm profitability (*Profit*), measured as the difference between the return on total assets and the opportunity cost of capital, as a possible determinant of capital structure decisions. In the light of the "Pecking Order Theory" proposed by Myers and Majluf (1984), firms, due to adverse selection, prefer internal to external financing when they need to raise funds: as a consequence, profitable firms should have lower debt ratios due to their higher ability to use internally-generated funds to increase their available financial resources. With respect to cash flows and profitability, Myers (1993) notes that the most common

empirical regularity in the studies of capital structure is probably the inverse relationship between the level of debt financing and firm profitability. However, this effect may be offset by other agency costs associated with the free cash flow generated by the firm. Jensen (1986) shows that managers of firms with high free cash flow may lack discipline: as a consequence, firms with high free cash flows should issue debt to increase managers' discipline into working efficiently. By issuing debt, firms commit to pay out an higher stake of income to debtholders, thus reducing the amount of resources under managerial control, thus adding discipline to the management. The impact of profitability on capital structure decisions will therefore depend on which of these two contrasting effects prevail, also as a result of the incentives provided by national institution.

We also include two additional variables that in previous works appear to have a significant role in explaining debt policy: the ratio of tangible assets to total assets (*Tan*) and that of intangible assets to total assets (*Intan*). The level of tangible assets is consistently found to be positively correlated with debt (Harris and Raviv, 1991; Öztekin, 2015): the underlying theory is that firms with an higher level of tangible assets have more "collateralizable" assets to use to secure their debt (or assets to be sold in order to recover part or all of the debt in the event of default), so that they can issue more debt, or issue debt at a lower cost (Jensen and Meckling, 1976). The level of intangible assets has been used as a proxy to estimate bankruptcy costs, under the assumption that most of their value could not be recovered in the event of default. As a consequence, we expect a negative relationship between intangible assets and the observed debt ratio (Myers, 2001).

4. Dataset

We collect data for all listed non-financial firms based in the Euro area. We exclude financial corporations such as banks and insurance companies because their financial choices are strongly influenced by specific sectoral regulations and capital requirements. The sample includes data for the time period 2000–2003, corresponding to the years immediately following the introduction of the Euro as a common currency for the original twelve members of the currency area. We obtain data from two main sources: Worldscope and Datastream. We rely on Worldscope to retrieve all the required accounting data, while Datastream for market data such as stock prices, market capitalization and interest rates. The sample includes a total of 2,030 firms; in Table 1 we report the distribution among the twelve Eurozone countries.

We also classify firms by sectors of activity, relying on the Global Industry Classification Standard (GICS) of Standard and Poor's to divide them into twelve sectors. Table 2 *shows* the distribution of firms across countries and sectors: consumer discretionary is the most populated sector in the entire sample, and for most countries as well (the only exceptions being Finland and Greece, where the most populated sector is *industrials*), followed by industrials, information technology and consumer staples [11].

Austria	Belgium	Finland	France	Germany	Greece	Ireland
53	75	111	550	536	213	36
Italy	Luxembourg	Netherlands	Portugal	Spain	Euro area	
175	11	126	45	99	2.030	

Table 1.
Sample size by country

Source(s): Author's own work

	Energy	Materials	Industrials	Discretionary	Staples	Health
Austria	1	1	16	19	4	0
Belgium	0	2	14	26	14	2
Finland	1	2	32	23	7	2
France	7	8	81	185	59	28
Germany	2	4	103	197	42	27
Greece	3	10	68	61	33	9
Ireland	1	2	9	8	4	3
Italy	3	1	38	58	10	5
Luxembourg	0	0	0	4	1	0
Netherlands	2	1	30	38	12	4
Portugal	0	2	15	10	6	0
Spain	3	5	22	21	12	1
Euro Area	23	38	428	650	204	81

	IT	Diversified	Real estates	Utilities	Others
Austria	3	1	3	4	0
Belgium	5	0	9	4	2
Finland	24	2	6	3	1
France	66	25	27	12	43
Germany	82	9	27	17	16
Greece	18	1	3	9	6
Ireland	4	0	1	0	2
Italy	15	3	13	13	10
Luxembourg	0	0	1	3	1
Netherlands	19	2	12	2	1
Portugal	3	0	0	4	4
Spain	1	2	11	9	9
Euro Area	240	45	113	80	95

Source(s): Author's own work

Table 2. Distribution of firms across sectors

5. Empirical results

In this section we report our findings for the estimate of the model from Equation (1) in Section 3 – first using the market debt ratio and then the book debt ratio as dependent variable – by means of the Tobit model, with a lower censoring value of zero and an upper value of one, reflecting the natural boundedness of the debt ratio. We estimate various specifications of the model: an equation including all the explanatory variables described in the previous paragraph, an equation where Nol probability is not considered, an equation where the two variables tangible and intangible assets are not considered, and one equation without asset volatility [12].

5.1 Results with market-value debt ratios

We first focus on models having the leverage ratio measured at market values as dependent variable. We report the regression results in Table 3. Rather than illustrating the results for each country, we highlight the most common patterns and then discuss contrasting results.

The first result which is worth noting is the high R^2 we obtain in regressions including asset volatility, and the large decrease when that variable is excluded. This result seems to suggest that the volatility of the market enterprise value is a very important determinant of financing decisions. In other words, the main driver of capital structure decisions is the riskiness of the assets in which capital is invested. As expected, the coefficient for volatility is negative: the riskier the firm value, the more conservative managers are in choosing

Table 3.
Regression results with market debt ratios

Intercept	MTR	BC	Profit	Growth	Size	Risk	Intan	Tan	NOL	R^2	*Adj* R^2	RegrS.E.
Austria												
0.5399*	0.5732*	−2.11***	0.0456**	0.0807	0.0183	−0.644***	−1.3222***	−0.268	−0.5357*	0.6031	0.5086	0.1707
1.0728***	1.8924***	−2.6918**	0.0261	0.0668	0.0114	−0.5111***	−1.2034***	−0.2025		0.57	0.48	0.1756
1.027***	1.5807**	−2.607***	0.0261	−0.0316	0.0012	−0.4918***				0.5165	0.4413	0.182
0.6934***	1.8807***	−4.7933***	−0.0276	−0.0433	0.0312*		−1.1426***	0.0104		0.4465	0.3459	0.1969
Belgium												
0.5757***	0.0108	−0.3543**	0.0115	−0.1826***	−0.0115	−0.6785***	0.7096***	0.2457***	−0.4549***	0.5718	0.5079	0.1618
0.8993***	0.2191	−0.267*	0.0314	−0.1834***	−0.0218**	−0.6735***	0.7255***	0.2238**		0.5027	0.4368	0.1731
0.9022***	0.1931	−0.6892	0.009	−0.1458**	−0.0132	−0.6597**				0.373	0.3103	0.1915
0.683***	0.327	−0.3417	0.0418	−0.2599***	−0.0129		0.6386***	0.3629***		0.386	0.3148	0.1909
Finland												
0.4061**	0.6322	0.006	0.0385***	−0.0267*	0.0152*	−0.4591***	−0.126	0.189**	−0.1179	0.5313	0.4845	0.1472
0.5215***	0.9762***	0.0031	0.0406***	−0.0244*	0.0154*	−0.459***	−0.1406	0.1771**		0.5278	0.4857	0.147
0.5721***	0.9588***	0.0019	0.0515*	−0.0275**	0.0174**	−0.5393***				0.5039	0.4702	0.1492
0.1854*	0.0336	−0.0703***	0.0396***	−0.0707***	0.0108		−0.1337	0.3175***		0.3941	0.3465	0.1657
France												
0.4928***	0.2759*	0.0018	0.0002***	−0.0102**	−0.0004	−0.4465***	0.2167***	0.2581***	−0.2146**	0.3851	0.3736	0.1849
0.6914***	0.7622***	0.008	0.0002***	−0.0098*	−0.0008	−0.4396***	0.2195***	0.2618***		0.3778	0.3675	0.1859
0.7378***	0.8108***	0.0062	0.0003***	−0.0096	0.0055	−0.4939***				0.3493	0.341	0.1898
0.1947***	0.2215	−0.012*	0.0001***	−0.0184*	0.0105**		0.2248***	0.4523***		0.1968	0.185	0.211
Germany												
0.5294***	0.6373*	−0.0662	0.0006	−0.0124	0.0058	−0.6053***	0.3063***	0.2063***	−0.1724*	0.4508	0.4402	0.203
0.6948***	1.1608***	−0.066	0.0006	−0.0122	0.005	−0.5937***	0.313***	0.2073***		0.4479	0.4384	0.2034
0.7835***	1.2789***	−0.0739	0.0006	−0.0134	0.008	−0.6133***				0.4238	0.4161	0.2073
0.0241	0.2672	−0.0883**	0.0009	−0.0246	0.0218***		0.1273	0.508***		0.2039	0.1918	0.2439
Greece												
1.2814***	0.7315*	−0.0165***	0.0024***	−0.0502***	−0.0212	−0.7796***	−0.2016	−0.0037	0.0105	0.4517	0.4245	0.1728
1.3098***	0.7189***	−0.014***	0.0024***	−0.0435***	−0.0234*	−0.8139***	−0.2045	0.0135		0.4558	0.4325	0.1725

(*continued*)

Table 3.

Intercept	MTR	BC	Profit	Growth	Size	Risk	Intan	Tan	NOL	R^2	*Adj* R^2	RegrS.E.
1.3423***	0.733***	−0.0142***	0.0023***	−0.0448***	−0.0259**	−0.8148***				0.4529	0.4348	0.1722
0.0835	0.5427*	−0.0167***	0.0035***	−0.0786***	0.0425***		−0.1378	0.0817		0.2468	0.2182	0.2025
Ireland												
0.3168	0.4825	−2.9039*	−0.072	−0.0195	0.0087	−0.4656**	0.2366	0.0573	−0.282	0.4717	0.2604	0.1742
0.6174***	1.2346	−2.6061*	−0.0501	−0.0094	0.0003	−0.5172***	0.3032*	0.0416		0.4584	0.271	0.1729
0.6158***	1.4618*	−2.3859	−0.073	−0.0138	0.0072	−0.484***				0.4263	0.2828	0.1715
0.2845	0.7618	−3.2793*	−0.0652	−0.0261	0.0075		0.2748	0.1635		0.3055	0.0997	0.1922
Italy												
0.9599***	1.3379***	−0.0243	0.1611**	−0.0858*	0.0085	−0.8182***	0.1525	0.1417*	−0.0353	0.5238	0.4948	0.1762
0.9285***	1.2535***	−0.0248	0.1629**	−0.0866*	0.0082	−0.8168***	0.1574	0.1451*		0.5236	0.4976	0.1757
0.8982***	1.2362***	−0.0289	0.1503*	−0.0828*	0.0145	−0.8374***				0.5138	0.4934	0.1765
0.449***	0.7407***	−0.163***	0.234***	−0.2102***	0.0236**		0.1106	0.2317***		0.334	0.3019	0.2072
Luxembourg												
1.4935*	0.2316	−185.0286	0.2693	−0.0005	−0.0671	−0.2452				0.4544	−0.8185	0.3197
1.6931*	0.15	−196.0783	0.5482	−0.0016	−0.0821					0.2847	0.3241	3.8544
Netherlands												
0.441**	0.4046	0.3799	−0.04	−0.0018**	−0.0088	−0.6414***	0.2091*	0.1265	−0.2931*	0.3738	0.3198	0.1882
0.726***	0.2783	0.3888	−0.0284	−0.0022***	−0.0087	−0.6288***	0.1916*	0.0811		0.3608	0.3117	0.1893
0.7039***	0.2977	0.5599	−0.0333	−0.0019***	−0.0034	−0.6162***				0.3515	0.3134	0.1891
0.1712	0.62	−1.7961*	−0.0177	−0.0007	−0.0023		0.0634	0.2214***		0.1201	0.0604	0.2212
Portugal												
1.0117***	0.2062	−2.5772	0.1146***	−0.5589***	0.0044	−0.4191**	0.1384	−0.1107	−0.128	0.6474	0.5438	0.1544
0.911***	0.5779	−2.6546	0.111***	−0.5607***	0.0021	−0.4121**	0.1361	−0.1061		0.6466	0.5557	0.1524
0.917***	0.4985	−3.5224*	0.0879***	−0.5431***	−0.0008	−0.3104*				0.6332	0.5638	0.151
0.8117***	0.631	−5.7634***	0.036***	−0.5672***	0.0031		−0.0473	−0.0567		0.5902	0.4991	0.1618
Spain												
0.413**	0.9329*	−0.8047**	−0.101***	−0.1019***	0.0283***	−0.7495***	−0.135	0.1566**	−0.1761	0.5619	0.5121	0.1351

(*continued*)

Table 3.

Intercept	MTR	BC	Profit	Growth	Size	Risk	Intan	Tan	NOL	R^2	*Adj* R^2	RegrS.E.
0.5991***	1.3403***	−0.8128**	−0.1022***	−0.1081***	0.0262***	−0.7382***	−0.0814	0.1616**		0.5519	0.5066	0.1358
0.5871***	1.1464***	−0.7952**	−0.0955**	−0.1162***	0.0288***	−0.8426***				0.5234	0.4868	0.1385
0.31**	1.0201**	−0.5928*	−0.0885**	−0.1762***	0.0305***		−0.1843	0.2549***		0.4031	0.35	0.1559
Euro area												
0.4473***	0.239**	−0.0204***	0.0003***	−0.0024	−0.0024	−0.5248***	0.177***	0.1791***	−0.2612***	0.3555	0.3523	0.1956
0.6534***	0.4315***	−0.0127*	0.0003**	−0.002	−0.0041	−0.5024***	0.1932***	0.1677***		0.3396	0.3367	0.1981
0.6877***	0.4772***	−0.014*	0.0003***	−0.0023	0.0005	−0.5332***				0.3247	0.3224	0.2003
0.1216***	0.0346	−0.0327***	0.0002*	−0.0052*	0.0122***		0.1302***	0.3584***		0.1292	0.1258	0.2275

Source(s): Author's own work

the amount of debt to be issued. This result clearly fits well with the trade-off theory: an higher volatility increases the probability of financial distress, and, assuming that the volatility of the enterprise value reflects the volatility of earnings, it also reduces the probability of being able to take advantage of the debt tax shield. Both these reasons explain the negative impact of volatility on debt. Compared to the results in previous studies, the addition of asset volatility allows for a large increase in the R^2 of the regression; moreover, its inclusion also affects the significance of other variables in exam. This latter finding may indicate that its omission would create a significant omitted variable bias when performing statistical inference.

We find that, in a number of countries, the marginal tax rate is not statistically significant; the tax variable is significant at the traditional significance levels – and with the expected positive coefficient – in the cases of Austria, Finland (though only for some of the model specifications), France, Germany, Greece, Italy and Spain, as well as on the entire Eurozone sample, but not for the other countries: Belgium, Ireland, Luxembourg, Netherlands and Portugal. It should not be a surprise, though, that the tax rate does not play an important role for countries like Ireland, with very low tax rates, since in such cases the tax advantage of debt becomes quite low. The international dimension of most firms can also explain why, especially for (geographically) smaller economies a marginal tax rate based entirely on the national tax law might produce coefficients that are not statistically significant.

The probability of having net operating losses is significant only for some countries, with the expected negative coefficient: an higher probability of having losses reduces the potential tax advantage of debt, hence firms which have an higher expectation of future losses tend to be more conservative in debt usage. The significance of this variable is often weak, and its inclusion often affects the significance of the MTR, the main variable chosen as a proxy for measuring the effect of the tax benefit of debt financing: considering that this variable and the MTR have a strong correlation, and that the addition of this variable does not improve significantly the fitting of the regression, as measured by the adjusted R^2, a model without this additional variable seems preferable.

Bankruptcy costs are significant when tested on the entire sample of the Euro area, with the expected negative coefficient; they are a significant component also for some countries individually considered: Austria, Belgium, Greece, Ireland and Spain. The significance of this variable often increases when volatility is dropped from the equation: with a restricted model without volatility as a regressor, bankruptcy costs are significant also for Finland, France, Germany, Italy, Netherlands and Portugal.

Profitability is significant only for half of the countries considered: Finland, France, Greece, Italy, Portugal and Spain. When significant, the coefficient is positive, with the exception of Spain. The role of profitability is thus ambiguous: a non-significant coefficient might mean that profitability does not play a key role in determining financing choices, but it might as well mean that the opposite effects of different types of agency costs cancel out, so that for instance the preference for self-financing deriving from the pecking order theory, which would result in lower debt ratios for firms with higher profitability, is compensated by the preference for the use of debt when profitability is high, for the disciplinary role that debt can play with managers' behaviour. The negative coefficient found for Spain can indicate a preference for firms to use self-financing whenever possible, so that more profitable firms who can retain an higher stake of earnings reduce their need of external financing and have lower debt ratios. The positive coefficient, on the other hand, is a sign in favour of the role of debt as an instrument of corporate governance. When tested on the entire Euro area sample, profitability has a positive significant coefficient.

Another variable statistically significant only for part of the sample is growth, which has a negative significant coefficient for Belgium, Finland, France, Greece, Italy, Netherlands, Portugal and Spain. It is not significant, among others, in the case of Germany, and for the Eurozone sample the significance is weak and limited to a few specifications of the model. This may suggest that growth opportunities are a relevant factor in determining assets volatility, hence its effect already captured by that variable. The sign of the coefficient testifies that firms with more opportunities to grow tend to have lower debt ratios, in order to maintain more financial flexibility so that they reduce the risk of getting in the situation of passing up profitable investment opportunities.

We find firm size to be significant in determining financing choices only in some countries; its significance often increases if volatility is omitted from the regression. When significant, it is always positive, suggesting that larger firms tend to have on average higher levels of debt. This supports the existence of a size effect, at least in some countries: larger firms tend to have higher debt ratios. As before, the significance of the size effect diminishes when asset volatility is included; size and volatility are always negatively correlated in the sample, with larger firms having on average a lower volatility. This suggests that the size effect, often found significant in previous studies, may be due to the fact that larger firms can reduce their risk, either through diversification, or by lower informational asymmetries, and, consequently, tolerate higher debt ratios. In this sense, then once again it is volatility (that is, risk) the main driver of financing choices, rather than size itself.

Tangible assets are a statistically significant predictor of debt ratios for Belgium, Finland, France, Germany, Italy, Spain and the Eurozone sample; as one would expect, when significant the coefficient is positive. Firms with an higher level of tangible assets have more assets which can serve as collateral or that can be used in order to recover part of a loan in the event of default, hence reducing the cost of issuing debt: this should explain the positive correlation between debt and tangible assets.

Intangible assets often show a positive relationship with debt, rather than the negative one usually found in previous studies. Austria is the only case where a significant negative coefficient was found; a positive significant coefficient is obtained in the cases of Belgium, France, Germany, Ireland, Netherlands as well as for the overall sample of the Euro area. This positive relationship may be interpreted as a sign that intangibles can be used, just like tangible assets, as collateral or disposed of in order to raise the resources required to repay debt in the event of default. This is consistent with the evolution of secondary markets for intangibles (see, among others, Loumioti (2012) or Odasso *et al.* (2015)).

5.2 Results with book-value debt ratios

Regression results with book values of debt in the dependent variable are reported in Table 4; for most regressors and subsamples, these results do not differ significantly from those reported before.

As before, high values of R^2 are obtained in the various regressions when asset volatility is included, and a large drop in it when asset volatility is not included in the regressors. Asset volatility is always strongly significant, with the expected negative coefficient, indicating that the level of risk of the assets of the firm is a very important determinant of financing choices.

The marginal tax rate is again significant only for some, but not all, of the countries under exam: it is not significant for Belgium, Greece, Ireland, Luxembourg and Portugal. For the other countries, the coefficient for the MTR is significant and has the expected positive sign. The variable Nol probability, though significant in some cases, does not add much to the fitting of the regression; as one would expect, when significant the corresponding coefficient is negative.

Table 4.
Regression results with book debt ratios

Intercept	MTR	BC	Profit	Growth	Size	Risk	Intan	Tan	NOL	R^2	*Adj* R^2	RegrS.E.
Austria												
0.6258*	0.7996**	−2.1909***	0.0495*	0.1179	0.0119	−0.6486***	−1.3536***	−0.2375	−0.4969*	0.5572	0.4518	0.1864
1.1189***	2.0221***	−2.6135**	0.0323	0.1129	0.0053	−0.532***	−1.2552***	−0.1802		0.5295	0.431	0.1899
1.0659***	1.6768**	−2.5471	0.0337	0.0156	−0.0045	−0.5204***				0.4754	0.3938	0.196
0.7235***	2.0106***	−4.7775***	−0.0236	−0.0017	0.026		−1.1926**	0.0418		0.4017	0.2929	0.2117
Belgium												
0.6907***	0.2168	−0.1886	0.0156	−0.2013***	−0.0181	−0.651***	0.7347***	0.2717***	−0.4376***	0.5043	0.4269	0.1839
1.0078***	0.4929	−0.0419	0.0357	−0.2059***	−0.0274**	−0.6439***	0.7491**	0.2777**		0.4453	0.3685	0.1931
1.0071***	0.3784	−0.8421	0.0077	−0.1529***	−0.0201*	−0.633*				0.3274	0.2571	0.2094
0.8035***	0.5987	−0.2744	0.0423	−0.2768***	−0.019*		0.658***	0.4123***		0.3503	0.2716	0.2073
Finland												
0.6402***	1.9175***	0.0617	0.0195	−0.0179	0.0145	−0.4552***	−0.1114	0.2806***	−0.0416	0.459	0.4049	0.1637
0.5995***	1.7959***	0.0627	0.0189	−0.0187	0.0144	−0.455***	−0.1059	0.2849***		0.4594	0.4112	0.1629
0.6778***	1.7637***	0.0571	0.0284**	−0.0248*	0.0187**	−0.575***				0.4052	0.3647	0.1692
0.2701**	0.8016***	−0.0104	0.0215	−0.0648***	0.0098		−0.0943	0.423***		0.3374	0.2854	0.1794
France												
0.5491***	0.5591*	0	0.0002***	−0.0138**	−0.0043	−0.4012***	0.2653***	0.3234***	−0.1989**	0.3351	0.3227	0.2049
0.7373***	1.0123***	0.0077	0.0002***	−0.0133**	−0.0047	−0.3986***	0.2683***	0.3238***		0.3313	0.3202	0.2053
0.7952***	1.0711***	0.0055	0.0003***	−0.0131*	0.0029	−0.4661***				0.292	0.2829	0.2108
0.2875***	0.5211***	−0.0105*	0.0001***	−0.0212*	0.0054		0.2729***	0.4965***		0.1953	0.1834	0.225
Germany												
0.5446***	0.8447**	−0.0639	0.0006	−0.0126	0.003	−0.5786***	0.345***	0.2126***	−0.1679*	0.3927	0.381	0.2152
0.7044***	1.3503***	−0.0636	0.0006	−0.0124	0.0023	−0.5661***	0.3515***	0.2125***		0.3878	0.3773	0.2154
0.7998***	1.4854***	−0.0724	0.0007	−0.0138	0.0054	−0.5821***				0.3595	0.351	0.2199
0.0758	0.5083*	−0.0855**	0.0009	−0.0242	0.0177***		0.1707*	0.5***		0.1721	0.1596	0.2503
Greece												
−0.0609	0.3331	−0.0198***	0.0035***	−0.0498***	0.0761***	−0.4986***	−0.5772**	−0.1046	−0.0072	0.359	0.3264	0.229
−0.0688	0.3234	−0.0191***	0.0035***	−0.0476***	0.0753***	−0.5038***	−0.547**	−0.0642		0.3575	0.329	0.2296

(*continued*)

Table 4.

Intercept	MTR	BC	Profit	Growth	Size	Risk	Intan	Tan	NOL	R^2	*Adj* R^2	RegrS.E.
−0.002	0.3372	−0.019***	0.0033***	−0.0481***	0.0662***	−0.49***				0.3413	0.3188	0.2313
−0.821***	0.2006	−0.0211***	0.004***	−0.0687***	0.115***		−0.5059*	−0.0168		0.3034	0.2761	0.2384
Ireland												
0.2193	0.5875	−2.6291	−0.0924	−0.0158	0.013	−0.4117**	0.2568*	0.0418	−0.2853	0.4342	0.2079	0.1783
0.5205**	1.3524	−2.2617	−0.0616	−0.0055	0.0048	−0.4653**	0.3249**	0.0268		0.4219	0.2217	0.1768
0.5139**	1.5967*	−2.1085	−0.0831	−0.0103	0.012	−0.4208**				0.3832	0.229	0.1759
0.2223	0.9266	−2.8887	−0.0785	−0.0206	0.0111		0.2993	0.136		0.2955	0.0868	0.1915
Italy												
1.1072***	1.6356***	−0.0213	0.142	−0.0689	0.002	−0.8716***	0.15	0.1595*	−0.1002	0.5024	0.4721	0.1858
1.0181***	1.3961***	−0.0227	0.1471*	−0.071	0.0014	−0.8676***	0.1638	0.1691**		0.5009	0.4737	0.1855
0.9857***	1.3721***	−0.0274	0.133	−0.067	0.0083	−0.8935***				0.4894	0.468	0.1865
0.5083***	0.8496***	−0.1693***	0.2213***	−0.2022***	0.0177		0.1137	0.2608***		0.2967	0.2628	0.2196
Luxembourg												
0.5564	0.6364	−59.8589	−1.0981*	0.0024*	−0.0382	0.0002				0.6151	−0.2831	0.2201
0.5563	0.6364	−59.8505	−1.0984*	0.0024*	−0.0382					0.1906	0.1453	8.2259
Netherlands												
0.5691***	0.2048	−0.1451	0.0883***	0.0316	−0.0125	−0.6196***	0.3007***	0.16*	−0.2622	0.3354	0.2776	0.1896
0.8213***	0.8072**	−0.1425	0.0982***	0.0295	−0.0123	−0.6017***	0.2838***	0.12		0.326	0.2737	0.1901
0.7837***	0.8189**	0.1004	0.09**	0.0238	−0.0043	−0.571***				0.2981	0.2565	0.1923
0.3868***	0.0214	−1.6705*	0.0887**	−0.0605*	−0.0056		0.1671	0.2241***		0.1884	0.1329	0.2077
Portugal												
1.0567***	0.0719	−2.6841	0.1282***	−0.5802***	0.0081	−0.4652**	0.0688	−0.2574	−0.1025	0.6563	0.5552	0.1582
0.976***	0.3695	−2.7456	0.1253***	−0.5816***	0.0062	−0.4596**	0.067	−0.2537		0.6562	0.5677	0.1559
0.9753***	0.3249	−3.528*	0.0947***	−0.5559***	−0.0025	−0.3385*				0.6298	0.5598	0.1574
0.8651***	0.4275	−6.2173***	0.0416***	−0.5894***	0.0074		−0.1374	−0.1989		0.5898	0.4987	0.1679
Spain												
0.4809**	1.1831**	−1.0921***	−0.108**	−0.0905**	0.0267***	−0.8058***	−0.1039	0.1412**	−0.1439	0.5152	0.4602	0.1508

(*continued*)

Intercept	MTR	BC	Profit	Growth	Size	Risk	Intan	Tan	NOL	R^2	*Adj* R^2	RegrS.E.
0.633***	1.5165***	−1.099***	−0.1091**	−0.0955**	0.025***	−0.7966***	−0.0601	0.1454**		0.5087	0.459	0.1509
0.6215***	1.351***	−1.0826***	−0.1035**	−0.1022**	0.0276***	−0.8881***				0.4902	0.451	0.152
0.321*	1.1705**	−0.8613***	−0.0942**	−0.169***	0.0296***		−0.1712	0.2459***		0.3563	0.299	0.1718
Euro area												
0.3714***	0.0389	−0.0219***	0.0003**	−0.0053*	−0.0021	−0.4658***	0.1766***	0.1958***	−0.2887***	0.2725	0.2689	0.2191
0.5981***	0.4696***	−0.0143*	0.0003**	−0.0051*	−0.0039	−0.4406***	0.1967***	0.1851***		0.2545	0.2512	0.2217
0.6386***	0.5143***	−0.0155**	0.0004**	−0.0052*	0.0008	−0.4764***				0.2395	0.2369	0.2238
0.135***	0.125	−0.0316***	0.0003*	−0.0093*	0.0103***		0.1414***	0.3535***		0.1102	0.1067	0.2422

Source(s): Author's own work

Table 4.

Bankruptcy costs are a significant predictor of financing choices for Austria, Greece, Spain and the entire Eurozone sample. In the case of France, Germany, Italy, Netherlands and Portugal they are significant only when volatility is not included in the regression.

Results for firm profitability vary across the sample: it is not significant for Austria, Belgium, Finland, Germany and Ireland; a statistically significant, positive coefficient is obtained for France, Greece, Italy, Netherlands, Portugal and the overall Euro area sample; finally, a negative coefficient is obtained in the case of Luxembourg and Spain.

Growth is found to be a significant predictor of debt policies in Belgium, France, Greece, Portugal, Spain and the entire Euro area sample. In the case of Netherlands, growth is a significant predictor only when volatility is not included in the equation. When significant, the coefficient has the expected negative sign.

Belgium, Greece and Spain show a strong significance of the variable size; as in previous studies, the coefficient for size is found to be positive, when statistically significant. In the case of Germany, and for the entire Eurozone sample, size is a significant variable when volatility is excluded from the equation.

The coefficient for tangible assets is significant for Belgium, Finland, France, Germany, Italy, Netherlands, Spain and the Eurozone. As one would expect, when significant the coefficient is always positive. On the other hand, we find again a result in contrast with many previous works on this subject when considering intangibles: the corresponding coefficient is not significant for Finland, Italy, Portugal and Spain, it is negative (in accordance with results of previous researches) in the case of Austria and Greece, while for the remaining countries (Belgium, France, Germany, Ireland, Netherlands and the Eurozone) it is positive.

Results with book values of debt are mostly in line with results obtained before with market values of debt, though not identical. In some cases, variables which were significant before are now not significant, and viceversa. The main difference is that the R^2 generally decreases when using book, rather than market, values of debt; however, even with book values it still takes higher values than the ones obtained in previous studies. Volatility is again the variable which helps the most in explaining financing choices of European firms: a large drop in the R^2 appears any time this variable is not included in the regression, and gives values in line with previous studies. The omission of volatility sometimes affect the results of statistical inference, indicating a possible bias due to an omitted variable when it is not considered.

Overall, the use of book values of debt does not yield much different results to those obtained when using estimated market values of debt; however, the explanatory power of the regressions is lower, and the significance of some variables is sometimes altered. The use of market values is preferable, both because theory always examines financing choices in terms of market values of securities and because market values better represent the true amount of resources invested in a firm. Given the differences in results, book values of debt may not be a good proxy for the true market value of debt and debt ratio.

5.3 Sectoral versus country regressions

Another interesting aspect to consider is whether regressions with firms grouped by sector, rather than by their country of origin, fit the data better or not. Taking into account the previous findings, if risk, measured in terms of asset value volatility, is the main predictor of financing choices, then capital structure decisions may have a close connection with the sector in which a firm operates, under the reasonable assumption that the sector of activity is one of the main determinants of the risk of firms' assets.

Table 5 reports the results for cross-country and cross-sector regressions for the entire euro-area sample, with dummy variables indicating the sector and the nationality of the firms respectively. Benchmark groups are Consumer discretionary and Germany, respectively.

Table 5.
Cross-sector vs cross-country regression

	Constant	MTR	Bankruptcy costs	Profitability	Size	Growth	Volatility	Intangibles	Tangibles
Sector									
Discretionary	0.78***	0.728***	−0.021*	0.002	0.001	−0.003***	−0.592***	0.103	0.025
Energy	−0.017	−0.248	−0.726*	−0.423**	−0.008	0.23	0.036	−0.281	−0.161
Materials	0.283	0.088	−44.025***	−0.121***	−0.024	−0.163***	0.531***	0.102	0.096
Industrials	−0.021	0.504**	−1.004*	−0.003	−0.012	−0.05**	0.069	0.108	0.149*
Staples	−0.416***	0.199	−2.75***	−0.001	0.018*	−0.128***	0.464**	−0.008	0.282**
Healthcare	−0.063	0.234	−0.309	−0.035*	−0.022*	−0.022	0.25***	0.075	0.458***
Real estates	−0.56**	0.538	−0.539***	−0.002	0.022	−0.07***	0.412***	−0.254	0.223***
IT	−0.238*	0.324	0.019	−0.001	−0.001	0.005***	0.127	0.255*	0.115
Utilities	−0.65***	0.966***	0.023*	0.039	0.013	−0.105***	0.456***	0.217	0.182
Diversified	0.172	−0.244	−3.617***	−0.207**	−0.001	−0.075**	−0.165	−0.12	0.007
Miscellaneous	−0.17	0.407	−0.089	0.132**	0.002	−0.047	0.148	0.088	0.023
R-squared			0.4154						
Adjusted R-squared			0.3849						
Standard Error of regression			0.1907						
Country									
Germany	0.698***	1.157***	−0.064*	0.001	0.005	−0.012	−0.589***	0.308***	0.204***
Austria	0.374*	−0.735	−2.655**	0.025	0.007	0.079	0.079	−1.511***	−0.407*
Belgium	0.199	−0.935**	−0.226	0.029	−0.026**	−0.173***	−0.082	0.419	0.021
Finland	−0.232*	0.401	0.056	0.045***	0.01	−0.014	0.175*	−0.444**	−0.01
France	−0.007	0.395	0.072*	0	−0.005	0.002	0.15**	−0.089	0.058
Greece	0.612***	0.437	0.05	0.002***	−0.028*	−0.032*	−0.226**	−0.513***	−0.191**
Ireland	−0.085	−0.072	−2.604*	−0.063	−0.004	0.001	0.082	−0.004	−0.161
Italy	0.231	−0.097	0.038	0.164**	0.004	−0.075	−0.227*	−0.15	−0.059
Luxembourg	−2.548***	−7.057***	239.136***	−2.393***	0.193***	0.011	1.056***	−1.356***	2.167***
Netherlands	0.028	0.88**	0.451	−0.029	−0.013	0.014*	−0.039	−0.117	−0.123
Portugal	0.209	0.724***	−2.686	0.109***	−0.002	−0.555***	0.183	−0.174	−0.312*
Spain	−0.098	0.195	−0.756**	−0.103***	0.022**	−0.096**	−0.151	−0.39**	−0.039
R-squared			0.4629						
Adjusted R-squared			0.433						
Standard Error of regression			0.1832						

Source(s): Author's own work

Cross-countries differences have been already discussed before; it is worth noting how, as before, the variables with more differences across countries are the marginal tax rate, profitability and intangibles.

The adjusted R-squared for the cross-sectors regression is lower than that of the cross-countries regression: this indicates that grouping firms depending on their nationality may better help to explain their debt policy than grouping them based on their sector. The difference, however, is not extreme.

Statistically significant changes in coefficients for the variables considered are more often observed with sector dummies, rather than country dummies; the impact of growth opportunities, asset volatility and bankruptcy costs varies widely across sectors. The intercept of the equation itself is significantly different from the one of the benchmark group for half of the sectors considered.

The marginal tax rate is more important for utilities and for firms in the industrial sector; profitability is negatively correlated with debt for firms in the energy, materials and healthcare sectors, as well as for diversified firms. In the other cases, it is not significantly different from zero. This confirms a common result in testing the pecking order theory: this theory seems to work well for firms where asymmetric information is lower, while it has generally no explanatory power for firms operating in sectors more likely to generate important asymmetries in information about the true firm quality and risk. This may also explain why the pecking order theory does not seem to work when, as before, firms are grouped based on their nationality, rather than on their sector.

Size and intangible assets have a low significance, while tangible assets have some explanatory power for a few sectors.

An additional, interesting analysis would be to investigate how, for each individual country, coefficients vary across sectors, and how such a regression would fit the data. Unfortunately, due to the small sample size, such analysis is feasible only for the two largest national subsamples: France and Germany. Table 6 reports the results. As it can be seen, the sector of activity affects the role played by some of the variables considered as potential determinants of financing choices of firms.

The value of the R-squared is quite high, and higher than the one found earlier in regressions without sector dummies, in both cases. As before, profitability affects financing choices only in some sectors; in the case of France, when it is a significant predictor, profitability is always negatively correlated with debt, in accordance with the pecking order theory. The same is not true for Germany: in some cases profitability has a positive correlation with debt, while sometimes it is negative. In both countries the marginal tax rate plays an important role for firms in some sectors, while its relevance is weaker for others. Bankruptcy costs are significant predictors for most sectors.

The sector of activity thus affects the way various aspects of a firm influence the financing behaviour of a firm, so it is an important factor for determining observed capital structures. This means that the industry sector of a firm does not simply proxy for one or more of the other factors considered in the analysis, like firm size, profitability, growth opportunity and so on, but is an important influence in its own right: debt ratios vary across sectors, and the way the factors considered affect financing choices changes as well.

This implies that, when examining capital structure decisions, we have to consider the sector of activity as one important determinant; moreover, and more important, the data examined suggest that, when comparing companies from different countries inside the Euro area, their location may still affect their capital structure decisions, despite the creation of the common currency.

Table 6. France and Germany: cross-sectors regression

	Constant	MTR	Bankruptcy costs	Profitability	Size	Growth	Volatility	Tangibles	Intangibles
France									
Discretionary	0.872***	0.139	−0.003	0.001	0.008	−0.023*	−0.583***	0.016	0.046
Energy	1.967***	1.003***	−0.988***	−0.697***	−0.041***	0.959***	−1.869***	0.83***	0.697***
Materials	−5.662***	1.166***	−5.773***	−2.646***	−0.499***	−3.999***	−0.33***	15.626***	34.637***
Industrials	0.176	−0.138	−3.277***	−0.004***	−0.022	−0.131***	0.249**	0.535***	0.241
Staples	−0.104	−0.051	−1.676***	0	0.005	−0.033	−0.258	0.218	0.197
Health	0.083	−0.076	−1.741***	0.007	−0.046**	0.105**	0.185	0.734***	0.246
Real estates	−1.181*	2.975**	−11.759**	−0.001	0.011	−0.119	1.009*	0.145	−0.125
Information tech	−0.283	0.395	0.015	0.002*	−0.007	−0.028	0.272*	0.483	0.311
Utilities	0.671***	1.042**	1.439	0.011	−0.034**	−0.161***	0.245**	0.223	0.172
Diversified	0.002	0.464	9.948	−0.176	−0.006	−0.069	−0.235	−0.075	−0.058
Miscellaneous	−0.269	1.158**	−0.136	−0.003	−0.014	0.064	0.003	−0.074	0.175
R-squared		0.5335							
Adjusted R-squared		0.4308							
Standard Error of regression		0.1764							
Germany									
Discretionary	0.847***	0.494**	−0.018***	0.033*	0.006	−0.02	−0.561***	0	0.158
Energy	−0.177	1.368***	−1.154***	−0.759***	−0.018*	0.317***	−1.193***	0.06	−0.539***
Materials	7.341***	1.084***	−3.712***	2.205***	−0.497***	6.561***	−1.842***	0.737***	0.829***
Industrials	−0.042	1.478**	−2.07	−0.033*	−0.027	−0.026	0.011	0.178	0.495
Staples	0.077	−0.496*	−2.077**	−0.056	0.027	−0.068**	−0.414	0.436*	0.267
Healthcare	0.082	−0.048	0.4	−0.126	−0.028	−0.123	0.201	0.748**	0.464
Real estates	−0.679	1.786*	−0.534***	0.002	0.028	−0.1***	0.356	0.036	0.405
Information tech	−0.3	0.214	0.021	−0.033*	0.006	0.018	0.009	0.422**	0.221
Utilities	−1.142	1.372*	1.882	0.141**	0.024	−0.544*	0.652	1.224**	0.938*
Diversified	−0.109	−0.475***	−1.33***	0.774***	0.205***	1.085***	−1.514***	3.091***	−0.685***
Miscellaneous	0.052	0.439	−0.387*	−0.483*	−0.033	0.112	−0.113	0.496	−0.203
R-squared		0.5572							
Adjusted R-squared		0.4584							
Standard Error of regression		0.199							

Source(s): Author's own work

6. Conclusions

In this study we investigate the determinants of financing decisions made by listed non-financial firms located within the Euro area. The choice of this sample is connected with the opportunity provided by the introduction of the common European currency to analyse if different national environments within an integrated financial market may still have an impact on capital structure decisions, focusing in particular on the impact of specific firm characteristics.

In doing so, we also improve the empirical approach by constructing a dataset where we measure the debt ratio at full market values of both equity and debt, instead of the traditional approximation used in the literature where debt is measured at book values. We do so through the application of the Black-Scholes-Merton model to infer the market value of assets – and hence debt – from the market value of equity, instead of using the traditional approximation of measuring debt at book value.

We find that the annual volatility in the market value of assets is the most significant predictor of observed debt ratios in all countries, both when measured at full market values and when book values of debt are used. This result suggests that the risk of the assets is the main determinant of capital structure decisions: the higher the risk, the lower the use of leverage. This gives support to both traditional and agency cost-based trade-off theories of capital structure: higher risk implies an higher probability of default, thus increasing expected bankruptcy costs; higher risk makes the debt overhang and risk shifting issues more relevant, increasing the agency costs of debt due to asymmetric information, hence inducing managers to limit the use of debt when risk is higher. Then, we find that firm size – a factor often found in previous literature to have a positive and significant effect on leverage – is not statistically significant at the traditional levels once asset volatility is included in the regression. This result lends support to the usual interpretation that firm size is a proxy for risk, so that once a better measure of risk is included the significance of firm size vanishes. We find that the sector of activity is also a significant determinant of observed leverage ratios, reinforcing the idea that firms adapt their financing decisions depending on the nature of their assets. All these findings are common across countries.

An important result from our analysis is that the impact of a series of specific firm-level factors on capital structure still depends on the country of incorporation of firms, thus suggesting that the national context still plays a relevant role despite the common currency and the unified financial markets.

In fact, we find that the marginal tax rate is a significant factor affecting financing decisions for the largest European countries in the sample, but not for companies based in smaller countries. This likely reflects, on the one hand, the fact that tax rules present relevant differences across countries, so that the impact of taxes on capital structure may be different; on the other hand, in globalised economies multinational corporations may optimize their tax bill by shifting profits across countries. This impact is likely to be stronger for smaller countries, so for companies located in those countries a marginal tax rate calculated only according to the national tax rules may not be an appropriate proxy of their true tax burden. This area remains open for further research, although it might be limited by the lack of data on the geographical decomposition of earnings that would be required for a more precise estimate of the true marginal tax rate.

Profitability also plays a mixed role, having a positive effect on leverage in some countries, and a negative one in others. In particular, the positive effect appears in less developed countries within the union (Greece, Italy, Portugal), while the opposite is observed in the most developed ones. When looking at sector differences, more profitable firms tend to use less debt when they are in older, more mature sectors, while for firms in sectors traditionally considered as having more growth opportunities the effect is of opposite sign. This reinforces previous findings that showed how the pecking order theory works better in explaining the behaviour of more mature companies, rather than high-growth ones.

Growth opportunities have a negative impact on debt only in countries with less developed financial markets (Greece, Italy, Portugal and Spain), suggesting that firms in these economies may suffer from capital constraints, while in other countries, once we adjust for risk by including asset value volatility, this variable is not statistically significant. This is a clear sign that national factors still affect capital structure decisions, despite the creation of the common currency area. We obtain similar results also for bankruptcy costs. In contrast with previous literature, with the exception of Austria and Greece, in a significant number of countries we find that intangible assets positively, rather than negatively, affect the level of leverage. We find this result consistent with recent increases for the secondary markets for intangible assets, which allows to extract value from intangible assets like brands, licenses, patents, hence making them a valuable asset in a firm balance sheet rather than a potential loss if bankruptcy occurs.

These findings are mostly in line with those reported by Wald (1999) who analysed capital structure decisions in France, Germany, Japan, the United Kingdom and the United States before the introduction of the Euro, suggesting that the common currency hasn't changed, at least in the first years after it s introduction, firms' financing behaviour. This appears partly in contrast with the survey evidence reported by Brounen *et al.* (2004), who instead argue that national differences play a minor role in capital structure decisions. However, this may depend on the fact that they only include Netherlands, Germany and France, which display similar patterns also in our analysis. In fact, Chui *et al.* (2002) reach similar conclusions, by noting how capital structure decisions are similar when considering the most developed countries, like France, Germany or Netherlands, but differences emerge when considering less developed economies, like Portugal or Spain. This indicates that creating a common financial market and a common currency is not sufficient to obtain uniform financial behaviours by firms from different countries.

Overall, we find that nationality is still a relevant factor in determining capital structure. This implies that, despite the long-lasting process of financial integration, regulatory harmonization and the monetary union, country-specific factors and legislations still affect firms' financing decisions, despite the introduction of the Euro. As a result, firms in countries that should eventually join the Euro currency area should not expect to immediately be able to pursue financing policies adopted in other Euro Area countries, as national factors still play a relevant role. Similarly, if other currency unions should emerge in other areas of the world, policy-makers and financial practitioners ought not to expect a rapid harmonization in the financing behaviour of firms, as capital structure decisions may depend on a number of country-specific factors that are not eliminated by the currency change.

Notes

1. The empirical evidence on this approach is, however, mixed. Indeed, although Baker and Wurgler (2002) show how market cycles is a significant predictor of the fluctuations observed in the leverage ratio, Alti (2006) reports that the effect of market timing disappears only after two years. Therefore, other factors must be at play.
2. This method was first proposed by Merton (1974), who showed how the value of corporate debt can be determined by applying the same approach developed by Black and Scholes (1973) for pricing options.
3. Using the standard Black-Scholes formula notation, $d_1 = \frac{\ln\left(\left(A_0 \cdot e^{(r-\delta)T}/F\right)+\left(\sigma^2/2\right)T\right.}{\sigma\sqrt{T}}$ and $d_2 = d_1 - \sigma\sqrt{T}$. $N(\bullet)$ indicates the cumulative standard normal distribution.
4. Measured as the annualized standard deviation in the log of weekly changes of market enterprise value
5. An explanation of the estimation process is given in Appendix 1.
6. Italian corporations also pay another tax in addition to the corporate income tax, the so-called Irap (*Imposta Regionale sulle Attivitá Produttive* - Regional tax on productive activities), which is not

deductible for the calculation of corporate taxable income, and whose taxable basis is different from that of corporate income tax: Irap is computed on the gross margin basis, as shown in the statutory financial statements, at a rate of 4.25%. Moreover, any cost associated with labour, interests and accruals for risk are not deductible. It is not considered in the analysis herein because, being interest expenses not deductible for Irap purposes, there is no effect of debt on Irap.

7. German firms also pay a local tax, the "trade tax", whose rate varies depending on the location inside Germany. Ideally, one would want to include this tax too, however, this tax is ignored because collecting the required data and assigning an exact location for the operations of each company would be a formidable (if not even impossible) task. The same applies to Portugal, where the statutory rate can be subject to a municipal surcharge, which varies depending on the location of the firm.
8. This variable is estimated by assuming, as before, that firm's income follows a random walk with drift process: the probability of having losses in the following period is then given by the probability that the random term $\varepsilon_{j,t}$, which is normally distributed with mean zero and variance equal to the sample variance of changes in firm's income, is smaller than the opposite of the sum of the current income and the drift term (which, as before, is constrained to be non-negative).
9. See Kalaba *et al.* (1984) and Ruback (1984) for a discussion on this.
10. Again, unlike what is found in previous studies, here the ratio is determined by using the market value of assets, as obtained by applying the asset pricing model, rather than its traditional approximation given by the sum of market capitalization and financial debts; this should give a better approximation of the real Tobin's q ratio.
11. As the sample only includes listed firms, its composition does not necessarily reproduce the exact weight of each sector in each national economy
12. In the case of Luxembourg, due to the small sample size, we estimate only restricted versions of the model.
13. Ideally, one should also consider tax credits on foreign income, since firms can receive tax credits on income earned abroad. Also, one should decompose operating income when considering a group of firms rather than a single firm, and calculate the tax payments due in the different states where firms of the group are based. However, these two procedures cannot be performed since Worldscope does not provide the necessary data.
14. Compared to both Shevlin (1990) and Graham (1996b), I reduce, instead of increasing, current income. Given that by issuing debt firms can lower their taxable income, I find this solution more appropriate. However, this is quite unlikely to have any impact on the result of the estimates, except for a few marginal cases.

References

Almeida, H., Campello, M. and Weisbach, M.S. (2011), "Corporate financial and investment policies when future financing is not frictionless", *Journal of Corporate Finance*, Vol. 17 No. 3, pp. 675-693.

Alti, A. (2006), "How persistent is the impact of market timing on capital structure?", *The Journal of Finance*, Vol. LXI No. 4, pp. 1681-1710.

Andrade, G. and Kaplan, S.N. (1998), "How costly is financial (not economic) distress? Evidence from highly leveraged transactions that became distressed", *The Journal of Finance*, Vol. 53 No. 5, pp. 1443-1493.

Baker, M. and Wurgler, J. (2002), "Market timing and capital structure", *The Journal of Finance*, Vol. 57 No. 1, pp. 1-32.

Black, F. and Scholes, M. (1973), "The pricing of options and corporate liabilities", *Journal of Political Economy*, Vol. 81 No. 3, pp. 637-657.

Booth, L., Aivazian, V., Demirguc-Kunt, A. and Maksimovic, V. (2001), "Capital structures in developing countries", *Journal of Finance*, Vol. 56 No. 1, pp. 87-130.

Botta, M. and Colombo, L.V.A. (2022), "Non-linear capital structure dynamics", *Journal of Business Finance and Accounting*, Vol. 49, pp. 1897-1928, doi: 10.1111/jbfa.12596.

Brounen, D., de Jong, A. and Koedijk, K.C.G. (2004), "Corporate finance in Europe: confronting theory with practice", *Financial Management*, Vol. 33 No. 4, pp. 71-101.

Chui, A.C.W., Lloyd, A.E. and Kwok, C.C.Y. (2002), "The determination of capital structure: is national culture a missing piece to the puzzle?", *Journal of International Business Studies*, Vol. 33 No. 1, pp. 99-127.

Çolak, G., Gungoraydinoglu, A. and Öztekin, Ö. (2018), "Global leverage adjustments, uncertainty, and country institutional strength", *Journal of Financial Intermediation*, Vol. 35 February, pp. 41-56.

Demirguc-Kunt, A. and Maksimovic, V. (1996), "Stock market development and financing choices of firms", *The World Bank Economic Review*, Vol. 10 No. 2, pp. 341-369.

Eberhart, A.C. (2005), "A comparison of Merton's option pricing model of corporate debt valuation to the use of book values", *Journal of Corporate Finance*, Vol. 11 Nos 1-2, pp. 401-426.

Faccio, M. and Xu, J. (2015), "Taxes and capital structure", *Journal of Financial and Quantitative Analysis*, Vol. 50 No. 3, pp. 277-300.

Fama, E.F. and French, K.R. (1998), "Taxes, financing decisions, and firm value", *Journal of Finance*, Vol. 53 No. 3, pp. 819-843.

Flannery, M.J. and Rangan, K.P. (2006), "Partial adjustment toward target capital structures", *Journal of Financial Economics*, Vol. 79 No. 3, pp. 469-506.

Frank, M.Z. and Goyal, V.K. (2003), "Testing the pecking order theory of capital structure", *Journal of Financial Economics*, Vol. 67 No. 2, pp. 217-248.

Frank, M.Z. and Goyal, V.K. (2009), "Capital structure decisions: which factors are reliably important?", *Financial Management*, Vol. 38 No. 1, pp. 1-37.

Graham, J.R. (1996a), "Debt and the marginal tax rate", *Journal of Financial Economics*, Vol. 41 No. 1, pp. 41-73.

Graham, J.R. (1996b), "Proxies for the corporate marginal tax rate", *Journal of Financial Economics*, Vol. 42 No. 2, pp. 187-221.

Graham, J.R. (2000), "How big are the tax benefits of debt?", *The Journal of Finance*, Vol. LV No. 5, pp. 1901-1939.

Graham, J.R. and Harvey, C.R. (2001), "The theory and practice of corporate finance: evidence from the field", *Journal of Financial Economics*, Vol. 60 Nos 2-3, pp. 187-243.

Gungoraydinoglu, A. and Öztekin, Ö. (2011), "Firm- and country-level determinants of corporate leverage: some new international evidence", *Journal of Corporate Finance*, Vol. 17 No. 5, pp. 1457-1474.

Gungoraydinoglu, A., Çolak, G. and Öztekin, Ö. (2017), "Political environment, financial intermediation costs, and financing patterns", *Journal of Corporate Finance*, Vol. 44, pp. 167-192.

Harris, M. and Raviv, A. (1991), "The theory of capital structure", *The Journal of Finance*, Vol. 46 No. 1, pp. 297-355.

Jensen, M.C. (1986), "Agency costs of free cash flow, corporate finance, and takeovers", *American Economic Review*, Vol. 76 No. 2, pp. 323-329.

Jensen, M.C. and Meckling, W.H. (1976), "Theory of the firm: managerial behavior, agency costs and ownership structure", *Journal of Financial Economics*, Vol. 3 No. 4, pp. 305-360.

Kalaba, R.E., Langetieg, T.C., Rasakhoo, N. and Weinstein, M.I. (1984), "Estimation of implicit bankruptcy costs", *The Journal of Finance*, Vol. 39 No. 3, pp. 629-642.

Kraus, A. and Litzenberger, R.H. (1973), "A state-preference model of optimal financial leverage", *Journal of Finance*, Vol. 28 No. 4, p. 911.

Leland, H.E. (1998), "Agency costs, risk management, and capital structure", *The Journal of Finance*, Vol. 53 No. 4, pp. 1213-1243.

Leland, H.E. and Pyle, D.H. (1977), "Informational asymmetries, financial structure, and financial intermediation", *The Journal of Finance*, Vol. 32 No. 2, pp. 371-387.

Leland, H.E. and Toft, K.B. (1996), "Optimal capital structure, endogenous bankruptcy, and the term structure of credit spreads", *The Journal of Finance*, Vol. 51 No. 3, p. 987.

Loumioti, M. (2012), "The use of intangible assets as loan collateral", *Doctoral dissertation, Harvard Business School*.

Merton, R.C. (1974), "On the pricing of corporate debt: the risk structure of interest rates", *The Journal of Finance*, Vol. 29 No. 2, p. 449.

Mitton, T. (2008), "Why have debt ratios increased for firms in emerging markets?", *European Financial Management*, Vol. 14 No. 1, pp. 127-151.

Modigliani, F. and Miller, M.H. (1958), "The cost of capital, corporation finance and the theory of investment", *American Economic Review*, Vol. 48 No. 3, pp. 261-297.

Modigliani, F. and Miller, M.H. (1963), "Corporate income taxes and the cost of capital: a correction", *American Economic Review*, Vol. 53 No. 3, pp. 433-443.

Mukherjee, T. and Wang, W. (2013), "Capital structure deviation and speed of adjustment", *Financial Review*, Vol. 48 No. 4, pp. 597-615.

Myers, S.C. (1977), "Determinants of corporate borrowing", *Journal of Financial Economics*, Vol. 5 No. 2, pp. 147-175.

Myers, S.C. (1984), "The capital structure puzzle", *The Journal of Finance*, Vol. 39 No. 3, pp. 574-592.

Myers, S.C. (1993), "Still searching for optimal capital structure", *Journal of Applied Corporate Finance*, Vol. 6 No. 1, pp. 4-14.

Myers, S.C. (2001), "Capital structure", *Journal of Economic Perspectives*, Vol. 15 No. 2, pp. 81-102.

Myers, S.C. and Majluf, N.S. (1984), "Corporate financing and investment decisions when firms have information that investors do not have", *Journal of Financial Economics*, Vol. 13 No. 2, pp. 187-221.

Odasso, C., Scellato, G. and Ughetto, E. (2015), "Selling patents at auction: an empirical analysis of patent value", *Industrial and Corporate Change*, Vol. 24 No. 2, pp. 417-438.

Opler, T.C. and Titman, S. (1994), "Financial distress and corporate performance", *The Journal of Finance*, Vol. 49 No. 3, pp. 1015-1040.

Öztekin, Ö. (2015), "Capital structure decisions around the world: which factors are reliably important?", *Journal of Financial and Quantitative Analysis*, Vol. 50 No. 03, pp. 301-323.

Öztekin, Ö. and Flannery, M.J. (2012), "Institutional determinants of capital structure adjustment speeds", *Journal of Financial Economics*, Vol. 103 No. 1, pp. 88-112.

Pinegar, J.M. and Wilbricht, L. (1989), "What managers think of capital structure theory: a survey", *Financial Management*, Vol. 18 No. 4, p. 82.

Rajan, R. and Zingales, L. (1995), "What do we know about capital structure? Some evidence from international data", *Journal of Finance*, Vol. 50 No. 5, pp. 1421-1460.

Ruback, R. (1984), "Estimation of implicit bankruptcy costs: discussion", *The Journal of Finance*, Vol. 39 No. 3, pp. 643-645.

Scott, J.H. (1977), "Bankruptcy, secured debt, and optimal capital structure", *The Journal of Finance*, Vol. 32 No. 1, pp. 1-19.

Shevlin, T. (1990), "Estimating corporate marginal tax rates with asymmetric tax treatment of gains and losses", *Journal of the American Taxation Association*, Vol. 12, pp. 51-67.

Stiglitz, J.E. (1969), "A re-examination of the Modigliani-Miller theorem", *The American Economic Review*, Vol. 59 No. 5, pp. 784-793.

Stiglitz, J.E. (1972), "Some aspects of the pure theory of corporate finance: bankruptcies and take-overs", *The Bell Journal of Economics and Management Science*, Vol. 3 No. 2, p. 458.

Sweeney, R.J., Warga, A.D. and Winters, D. (1997), "The market value of debt, market versus book value of debt, and returns to assets", *Financial Management*, Vol. 26 No. 1, p. 5.

Titman, S. and Wessels, R. (1988), "The determinants of capital structure choice", *The Journal of Finance*, Vol. 43 No. 1, pp. 1-19.

Wald, J.K. (1999), "How firm characteristics affect capital structure: an international comparison", *Journal of Financial Research*, Vol. 22 No. 2, pp. 161-187.

Appendix 1
Estimation of marginal tax rates

Firm-specific marginal tax rates are calculated following the method proposed by Shevlin (1990) and Graham (1996a): this method requires to simulate marginal tax rates over a forecasted stream of taxable incomes in order to account for the carryforward and carryback tax opportunities deriving from the tax treatment of net operating losses.

More precisely, the marginal tax rate is defined as the present value of current and expected future taxes to be paid on an additional euro of income earned today; its explicit calculation requires to reasonably reproduce the tax code treatment of net operating losses and the minimum tax rules [13].

When calculating its tax bill, a firm first has to determine its taxable income, before credits; if the taxable income is positive, the firm determines its pre-credit tax bill and then adjusts it with the credits it may have. On the other hand, if the taxable income is negative, the firm has a net operating loss: this can be either "carried back" to offset taxable income in the previous years and obtain a tax refund if the tax-bill of those years is lowered or (if the legislation does not allow carrybacks, or if the losses more than offset the total taxable income for the years in which carryback is allowed) it can be "carried forward" and used to offset future taxable income.

In the calculation it is assumed that the option to carry back losses is always used (whenever possible), and losses are carried forward only when the carryback potential has been completely exhausted. This possibility of carrying operating losses backward and forward makes an estimate of a company's marginal tax rate solely based on the current financial statement largely insignificant; a better proxy for the true marginal tax rate can be obtained by simulating a stream of future taxable incomes and then calculating a tax-rules consistent tax bill on such incomes. The length of the time horizon to consider cannot be completely arbitrary, since it has to be consistent with the mechanism underlying the calculation of the tax bills. Some countries allow firms to carry losses forward without any time limit, while the longest explicit limit to loss carryforwards is 10 years. The longest carryback horizon is three years. The chosen horizon is 15 years for all countries: it is longer than the longest carryforward limit, and it is a reasonable length for those countries which do not have any time limit. Given the effect of discounting, the effect of the tax bills to be paid in the periods beyond 15 years on the marginal tax rate on an additional euro of income today is negligible.

To forecast future taxable income, the main model proposed in Shevlin (1990) is used: this model assumes that firm j's taxable income (TI_j) follows a random walk with drift:

$$\Delta TI_{j,t} = \mu_j + \varepsilon_{j,t} \tag{A.1}$$

where $\Delta TI_{j,t}$ is the change in taxable income, μ_j is the sample mean of the change in taxable income and $\varepsilon_{j,t}$ is normally distributed with mean zero and variance equal to that of the change in taxable income over the sample. Taxable income is measured as Ebit from the Worldscope database. Whenever the estimated μ_j is negative, the drift in eq. (A.1) is set equal to zero: as shown in Graham (1996b), this "adjusted" random walk, with the drift constrained to be non-negative, has a better forecasting power than an unconstrained model. The estimate of the marginal tax rate (MTR) proceeds as follows: first of all, forecasts of firm's taxable income for the 15-year period are obtained by drawing 15 random realizations of $\varepsilon_{j,t}$ and using eq. (A.1). Then, the present value of the tax bill for the 15-year period is calculated, taking into account the effects of loss carrybacks and carryforwards and the minimum tax. Future taxes are discounted at the average long-term interest rate paid by non-financial corporations. Next, one-thousand euros are subtracted to current income and the present value of future taxes to be paid is recalculated [14]. The difference between the two tax bills represents the present value of taxes to be saved by reducing current income by one thousand euros.

This procedure is repeated 50 times, by drawing each time a new set of normal random realizations for $\varepsilon_{j,t}$, in order to obtain 50 different single estimates of the MTR; these 50 estimates are then averaged to

obtain the expected MTR for the year. At the end of this procedure, a single MTR for one firm in one year is obtained; the whole process is repeated for each firm in the sample, for the three years 2000, 2001 and 2002.

Appendix 2
Main characteristics of national tax rules

Austria - Statutory rate: 34%. The minimum corporate income tax amounts to EUR 875 for each full quarter of a year. The minimum corporate income tax is credited against future taxable profits. NOL carryforward: unlimited (starting from 2001, for a maximum of 75% of taxable income). NOL carryback: not allowed.

Belgium - Statutory rate: 40.17% (39% ordinary rate + 3% crisis tax). Reduced rates are applied when taxable income does not exceed certain values: EUR 0-25.000 : 28%; EUR 25.001-89.500: 36%; EUR 89.501-322.500: 41%. The 3% crisis tax has to be applied to these rates too. The reform introduced in 2002 reduced the tax rate at 33% and the three lower rates at 24.25%, 31% and 34.50% respectively. The EUR89.500 was moved at EUR 90.000. NOL carryforward: unlimited. NOL carryback: not allowed.

Finland - Statutory rate: 29.00%. NOL carryforward: losses may be carried forward for 10 subsequent years. NOL carryback: not allowed.

France - Statutory rate: 33.33% + 6% of the normal rate (3% from 2004) surtax. NOL carryforward: losses may be carried forward for 5 subsequent years. Starting from 2004, carryforward has no time limit. NOL carryback: not allowed.

Germany - Statutory rate: 25% + 5.5% of the normal rate surcharge (solidarity levy). NOL carryforward: unlimited. Starting from 2004, the loss relief claimable in any one year is limited to EUR1.000.000 plus 60% of current income exceeding that amount. NOL carryback: carryback to the previous year, of max EUR 511.500.

Greece - Statutory rate: 35.00%. NOL carryforward: losses may be carried forward for 5 subsequent years. NOL carryback: not allowed.

Ireland - Statutory rate: 24% (2000); 20% (2001); 16% (2002); 12.5% (2003 and following). NOL carryforward: unlimited. NOL carryback: carryback allowed to the previous year.

Italy - Statutory rate: 37% (2000); 36% (2001); 34% (2003); 33% (2004 and following). NOL carryforward: losses may be carried forward for 5 subsequent years. NOL carryback: not allowed.

Luxembourg - Statutory rate: for years 2000 and 2001 the following tax rates apply (depending on level of taxable income): EUR 0-9.916: 20%; EUR 9.917-14874: EUR1983 + 50% of amount in excess of EUR9.917; EUR14.874+: 30%. In all cases 4% of the above tax is surcharged as a Òsolidarity taxÓ. For years 2002 and following: 22% + 4% of corporate tax is surcharged as a Òsolidarity taxÓ. NOL carryforward: unlimited. NOL carryback: not allowed.

Netherlands - Statutory rate: for years 2000, 2001: 35% (the first EUR 22.689 are taxed at the lower rate of 30%). For years 2002 and following: 34.5% (the first EUR 22.689 are taxed at the lower rate of 29%). NOL carryforward: unlimited. NOL carryback: allowed to the three previous years.

Portugal - Statutory rate: 34% (2000); 32% (2001); 30% (2002, 2003); 25% (2004 and following). NOL carryforward: losses may be carried forward for 6 subsequent years. NOL carryback: not allowed.

Spain - Statutory rate: 35.00%. NOL carryforward: losses may be carried forward for 10 subsequent years (15 years from 2002 onwards). NOL carryback: not allowed.

Corresponding author
Marco Botta can be contacted at: marco.botta@unicatt.it