

Taxes and Capital Structure: Evidence from a Quasi-Natural Experiment

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Abstract

This paper analyses the effects of corporate tax system on companies' capital structure, taking advantage of the quasi-natural experiment provided by a surprise announcement of a corporate tax surcharge on Italian firms operating in oil and energy sectors. The analysis is based on a panel data set covering the period 2006-2010. We find only weak evidence that corporations have reacted to the sharp increase in the tax rate by increasing leverage.

Keywords: corporate taxation, financing decisions, leverage ratio, Robin Hood tax

JEL classification: G32, G38, H25, H32

1. Introduction

This paper studies the effects of corporate tax system on companies' optimal capital structure. The theory of capital structure (Modigliani and Miller, 1963; Miller, 1977) suggests that taxes should play a prominent role in affecting corporate financing decisions. Interest expenses are usually deductible from the corporate tax base, thus reducing the tax burden of a company. The same benefit is not allowed to the opportunity cost of equity finance. This disparity in the tax treatment of debt and equity provides incentive for companies to prefer debt to equity.

A wide number of empirical studies have analyzed the effects of taxes on corporate financial decisions.¹ In the eighties most researchers have found it difficult to uncover a clear evidence of a significant fiscal effect on leverage decisions (see, for example, Myers, 1984, Bradley et al., 1984, Graham 2003, and Smith and Watts, 1992). The focal point of these studies was to find an adequate proxy for company-specific tax status. Statutory tax rates and bases are usually uniform across firms and constant for long periods, which makes it difficult to find sufficient cross-section and time-series variations to identify tax effects. Following Graham (1996a, 1996b, 1999) and Shevlin (1990) the most recent literature has tried to simulate company-specific marginal tax rates on an additional unit of earnings (see for example, Brealey et al., 2014; Scholes et al., 2014) using financial statement data. However, the use of the marginal tax rate has been largely questioned due to potential measurement and identification issues. Several limitations arise from financial statement data to estimate taxable income² (Graham et al., 2004; Hanlon and Heitzman, 2010), from the limited time-series variation in marginal statutory tax rates and from the disregarding of future period tax rates (Barclay et al., 2013).

In order to overcome the problem of finding an adequate proxy for tax status, a more direct way to test for tax effects on capital structure choices is to look at financial policy over time so that identification is based simply on statutory tax changes (Gordon

¹ See Shackelford and Shevlin (2001), Graham (2003), Graham and Leary (2011), and Hanlon and Heitzman (2010) for thorough reviews

² Due to the public unavailability of companies' taxable income, the simulation of marginal tax rate relies on values of taxable income estimated using financial statement data.

and Lee, 2001). In this paper, we take advantage of a change in the marginal statutory tax rate for a subset of Italian companies. Italian companies are subject to a corporate income tax (IRES – Imposta sul Reddito delle Società) with a statutory tax rate equal to 27.5%. In 2008 the government introduced a surtax with a rate equal to 5.5% (increased to 6.5% starting from August 2009), limited to oil and energy companies recording sales higher than 25 euro millions. The announcement of the surtax was a surprise. It was named “Robin Hood tax” since the government justified it as a means to redistribute part of the higher profits due to increasing oil and energy prices to finance poverty related programs.

The Robin Hood tax provides an ideal setting for testing the effect of taxation on companies’ capital structure since it offers a quasi-natural experiment given by the change in the fiscal tax rate applied to only oil and energy companies. We investigate the relationship between tax rates and leverage by comparing companies subject to the Robin Hood tax to those not affected by the surtax using a difference-in-differences approach.

The remainder of this paper is organised as follows. Section 2 discusses the issues related to the Robin Hood tax. Section 3 presents our identification strategy. Section 4 explains our research design and defines the variables used in the empirical analysis, whereas section 5 describes sample construction and presents data. The estimations and the results are discussed in Section 6. The final section provides some concluding remarks.

2. The Italian surtax on companies in the oil and energy sectors

The statutory tax rate of the Italian corporate income tax (IRES) is equal to 27.5%. In June 2008 the government introduced the so called “Robin Hood tax”, a surtax to be applied to companies operating in one or more of the following sectors: liquid and gas hydrocarbons exploration and production; production, refining and trade of oil and natural gas; production, transmission and distribution of electricity; production of biomass; production of solar energy; wind power. The surtax was levied only on firms featuring a turnover higher than 25 euro millions in the previous tax period. The surtax

was initially set equal to 5.5% and then was increased to 6.5% starting from 15th of August 2009.

Table 1 reports the number and the related revenue of firms subject to the Robin Hood tax sorted out according to economic activity. The number of those companies increased from 486 in 2008 to 526 in 2010. Revenue rose strongly from 2008 to 2009 (growing from 117 to 509 euro millions). This increase is due both to the growth of the number of companies subject to the surtax and to the increase of the surtax rate (as said from 5.5% to 6.5%). The economic sectors providing the higher share of the surcharge are “*Electricity, gas, steam and air conditioning supply*” and “*Mining and quarrying*”.

Table 1. Robin Hood tax: number of companies and revenue

Economic sectors	Number of companies subject to the Robin Hood tax			Revenue		
	2008	2009	2010	2008	2009	2010
Mining and quarrying	4	4	7	40,987	23,338	59,077
Manufacturing	41	39	37	19,594	35,715	44,035
Electricity, gas, steam and air conditioning supply	84	187	199	41,045	404,479	394,297
Construction	43	12	22	67	318	1,105
Wholesale and retail trade; repair of motor vehicles and motorcycles	222	212	204	12,819	42,607	29,932
Transportation and storage	9	7	7	91	38	47
Real estate activities	22	11	4	58	40	371
Professional, scientific and technical activities	13	5	8	60	13	25
Administrative and support service activities	22	11	10	199	110	46
Residual activities	26	18	28	2,665	2,375	2,517
Total	486	506	526	117,585	509,033	531,452

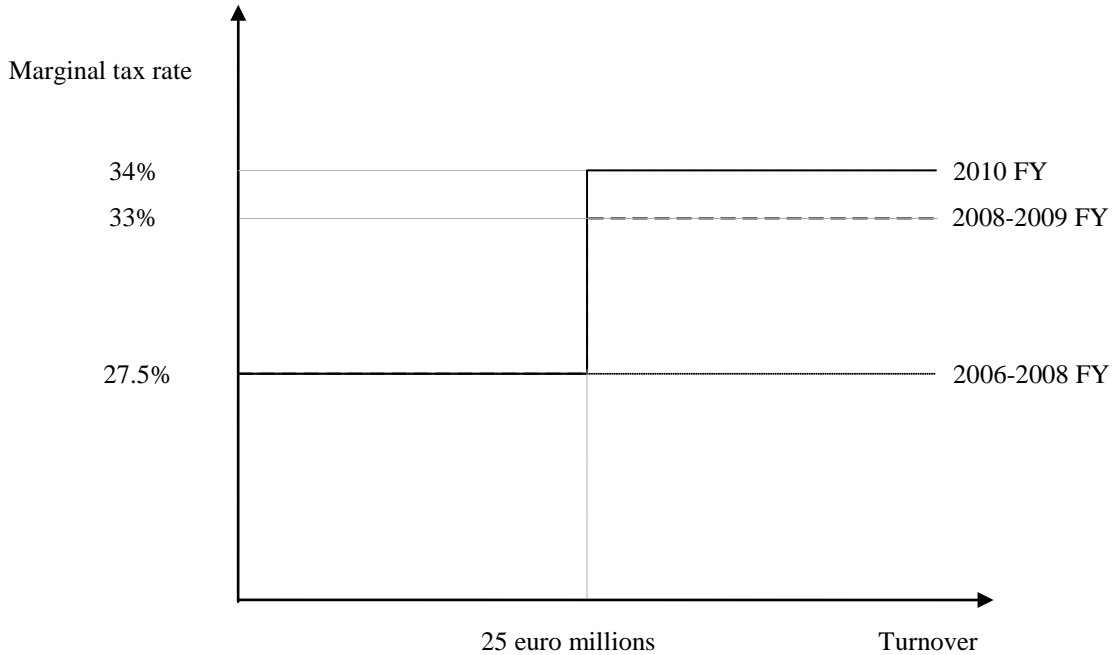
Note: The surcharge data are expressed in euro thousands.

Source: Fiscal data are provided by Italian Ministry of Economy and Finance.

3. Identification strategy

The main innovation of this paper is our identification strategy, which relies on the fact that starting from the 2008 fiscal year a surprise jump occurred in the statutory tax rates of Italian companies subject to the Robin Hood tax while the statutory marginal tax rate of companies not affected by the surtax remained unchanged. Figure 1 shows the evolution of statutory tax rate schedule of oil and energy companies from 2006 to 2010.

Figure 1. Statutory marginal tax rate of oil and energy companies in Italy in years 2006-2010



Note: The figure shows the statutory marginal tax rate of oil and energy companies for different levels of turnover during the fiscal years 2006-2010.

We identified the firms subject to the Robin Hood tax using the data provided by the Italian Regulatory Authority for Electricity Gas and Water (AEEGSI). Such Authority is responsible for monitoring that the companies subject to Robin Hood tax do not shift the additional tax burden to consumers by increasing the prices of their products and services. We include in the treatment group the companies controlled by the AEEGSI in each year between 2008 and 2010. In contrast, the control group includes those companies excluded from AEEGSI monitoring.

4. Research design

We assume that companies subject to the surtax have a higher incentive to finance their investment through debt compared to companies not subject to the Robin Hood tax.

In order to test our hypothesis we estimate the following regression model:

$$Leverage_{it} = \alpha + \beta_1 d_t + \beta_2 d_i^T + \beta_3 d_t \times d_i^T + \gamma X_{it} + \varepsilon_{it} \quad (1)$$

where $Leverage_{it}$ is the leverage ratio, defined as the sum of short and long-term debt divided by total assets; d_t is a dummy variable taking value one for the post Robin Hood tax period (i.e. after 2008 fiscal year) and zero otherwise; d_i^T is a dummy variable taking value one for the treatment group and zero for the control group.

Vector X_{it} includes several factors that may affect companies' financing decisions. For example, the pecking-order theory suggests that companies' profitability may have a negative effect on leverage (e.g. Myers and Majluf, 1984). The trade-off theory predicts that larger and more tangible companies will choose higher leverage (e.g. Bradley et al, 1984). Firms that are experiencing a period of financial distress will find debt more costly. As a consequence a company with a high probability of bankruptcy should be less inclined to increase debt (Alworth and Arachi, 2001). As suggested by De Angelo and Masulis (1980), debt interest competes with other allowable deductions as a tax shelter. Consequently, an increase in non-debt tax shields should reduce debt usage.

The parameter of interest in the difference-in-differences analysis (Rubin, 1974) is β_3 , the coefficient of the interactive term $d_t \times d_i^T$, which captures the treatment effect. A positive and statistically significant β_3 is consistent with the hypothesis that the corporate income tax spurs firms to increase their leverage.

5. Sample construction and data description

In order to construct our sample we merge two different data sets. The first is the confidential list provided by AEEGSI which identify, for each year between 2008 and 2010, those companies subject to the Robin Hood tax. The second is the AIDA data set, which records balance sheet data of Italian companies.

The AIDA database includes 383.989 companies with balance sheet data available for each year during the period 2006-2010. We dropped companies having missing data for some of the balance sheet records needed to compute control variables

or showing inconsistent data³. Furthermore we excluded companies subject to the Robin Hood tax in one or two fiscal years during the 3-year period 2008-2010. Given that the Robin Hood tax is levied on companies with a turnover exceeding 25 euro millions, we dropped companies having a turnover lower than 5 euro millions during the years 2008-2010. We also excluded companies belonging to industries having no one or only one company subject to the Robin Hood tax. Finally, we removed outliers, dropping observations in the top first percentile of the distribution of leverage, profitability and bankruptcy probability.

The final sample consists of 65,880 firm/year observations for 13,176 companies⁴. The assignment of companies to the control group or to the treatment group is based on the confidential information provided by AEEGSI. The treatment group is composed of 292 companies, while 12,884 companies are assigned to the control group.

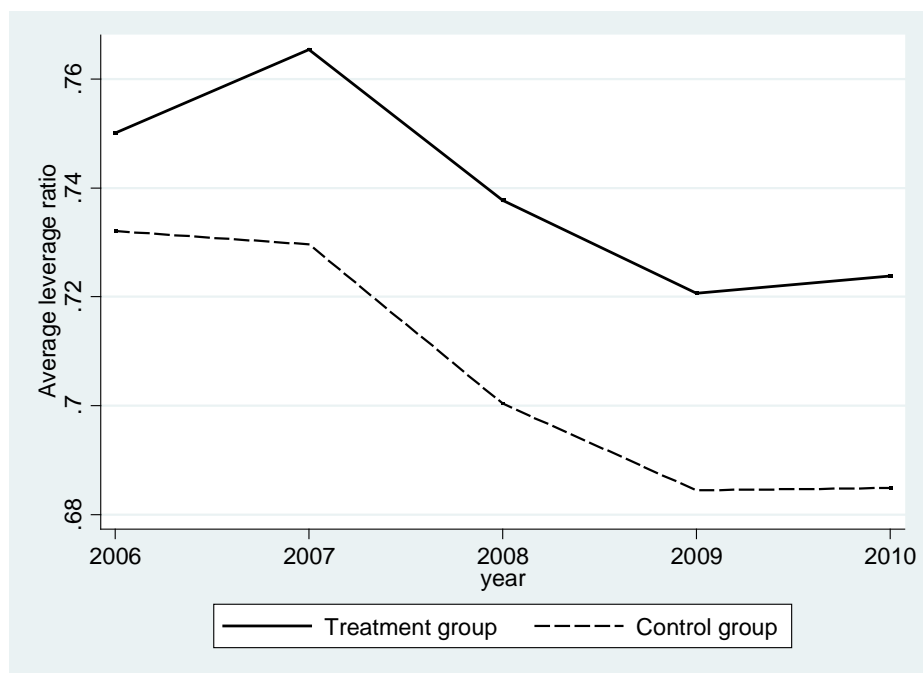
In figure 2 we show the average leverage ratios for the treated and the control groups respectively in the period 2006-2010. On average, firms in the treatment group are more leveraged than firms in the control group in every year. After the introduction of the Robin Hood tax (year 2008) the leverage decreases for both the treatment and the control groups, with the rate of decline being very similar for the two groups. However, we can see a weak divergence of the trends of the two groups since 2010, year when leverage ratio increases slightly for the treatment group, while it remains almost stable for the control group.

Figure 3 plots the distribution of leverage ratio for the period 2006-2010, respectively for the treatment (panel A) and the control groups (panel B); the left panel shows the distribution of leverage ratio before the introduction of the Robin Hood tax (2006-2007) and the right panel refers to the after Robin Hood tax period (2008-2010). These histograms show that the leverage ratio for the treatment group is more concentrated in the top brackets of the distribution than for the control group. This disparity persists also after the introduction of the Robin Hood tax.

³ We consider inconsistent the negative values of total assets, of short-term or long-term debt, of tangible assets or of sales.

⁴ Table A.1 in appendix A describes in detail the sample.

Figure 2. Average leverage ratio

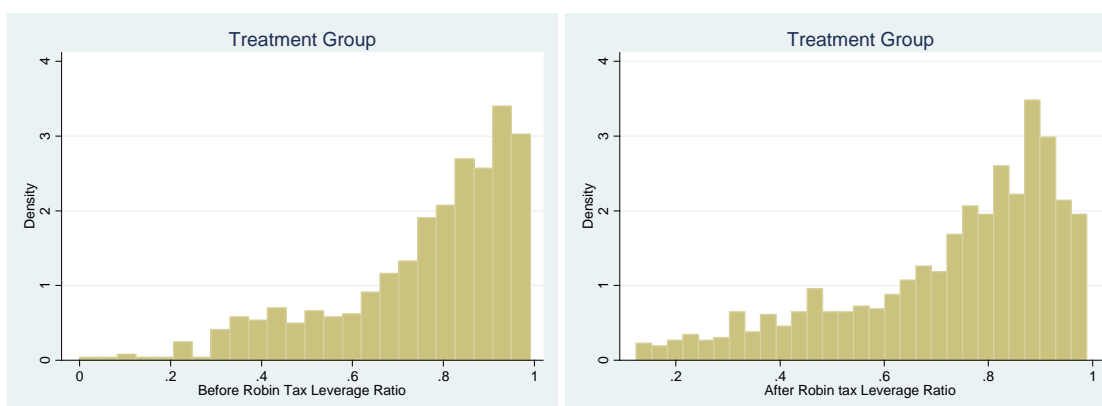


In Table 2, we compare firms in the treatment and in the control group in terms of all the variables included into the empirical model. Profitability is defined as net income (profit/loss) divided by total assets. Tangibility is measured by the ratio of tangible assets to total assets. Size is the logarithm of companies' total sales. Z-score is a variant⁵ of the Altman's (1968) bankruptcy probability. *NDTS* (non-debt tax shields) is the first difference of book depreciation expressed as proportion of total assets of previous fiscal year. Table 2 shows that companies in the treatment group are more profitable, have a higher share of tangible assets, are bigger and have a lower probability of bankruptcy than companies in the control group.

⁵ We modify the standard formulation of Altman's (1968) Z-score by excluding the share of market value of equity to total liabilities, due to the unavailability of data on market value of equity.

Figure 3. Distribution of leverage ratio before and after the Robin Hood tax

Panel A: Treatment Group



Panel B: Control Group

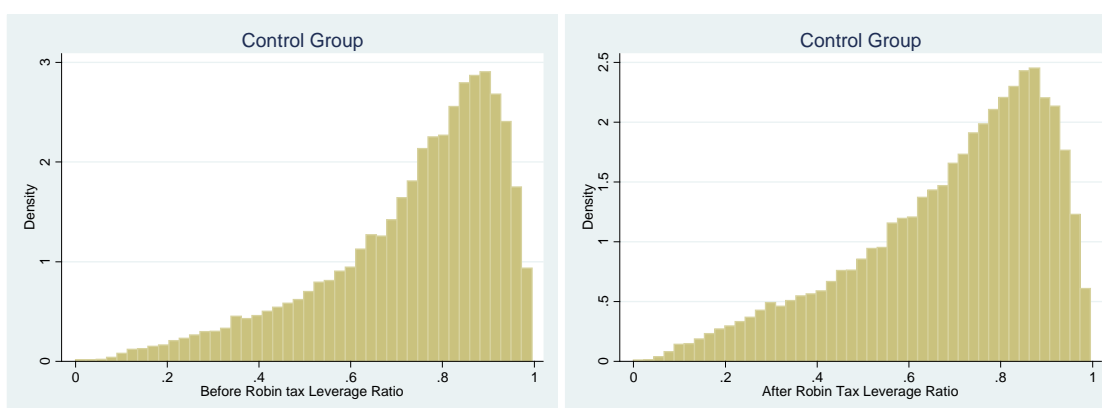


Table 2: Summary Statistics of Key Variables for Treatment and Control Groups

Variable	Obs	Mean	Std. Dev.	Min	Max
<i>Panel A: Treatment Group</i>					
Leverage	1,460	0.740	0.204	0	0.991
Profitability	1,460	0.029	0.048	-0.140	0.468
Tangibility	1,460	0.177	0.229	0	0.917
Size	1,460	10.921	1.587	5.986	18.212
Z-score	1,460	3.248	1.628	-1.381	9.982
Ndts	1,460	0.006	0.077	-0.106	2.770
<i>Panel B: Control Group</i>					
Leverage	64,420	0.706	0.203	0	0.995
Profitability	64,420	0.024	0.052	-0.167	0.858
Tangibility	64,420	0.156	0.176	0	0.992
Size	64,420	9.229	1.179	2.303	18.087
Z-score	64,420	2.407	1.288	-5.604	10.191
Ndts	64,420	0.006	0.607	-0.990	138

Notes: Summary statistics for all variables pooled for years 2006-2010, divided for the treatment group

(Panel A) and the control group (panel B). *Leverage* is the sum of short and long-term debt expressed as proportion of total assets; *Profitability* is the ratio of net income (profit/loss) for the fiscal year expressed as proportion of total assets; *Tangibility* is the ratio of tangible assets to total assets; *Size* is the logarithm of companies' total sales; *Z-score* is a variant of the Altman's (1968) bankruptcy probability; *Ndts* is the first difference of book depreciation expressed as proportion of total assets of previous fiscal year.

6. Empirical analysis

We first estimate equation (1) using the Ordinary Least Square and report the results in table 3. We perform the first regression excluding control variables from the model and focusing exclusively on describing the evolution of average leverage (as measured by the coefficient of the dummy variables) before and after the introduction of the Robin Hood tax. The results (column 1) show that prior to the introduction of the surtax the leverage ratio of the treatment group was 2.7 percentage points higher than the leverage of the companies not subject to the surtax. After 2008 there is evidence of a common decrease in leverage ratio for both groups of companies (4.1 percentage points). The reduction in the leverage ratio of oil and energy companies subject to the Robin Hood tax is 1.1 percentage points lower than the one of the control group. However, this difference is not statistically significant.

When we add the controls variables (columns 2) we find that the difference in the change of leverage ratio between treated and control groups after the introduction of the Robin Hood tax increases to 1.8 percentage points and became statistically significant (albeit at 10% level).

To control for common business cycle effects we add time (column 3) and sector dummies (column 4). The estimated coefficients β_3 remains positive in both the regressions and significant at 10% level.

Table 3. Estimation results

	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.027** (0.008)	0.130*** (0.007)	0.131*** (0.007)	0.128*** (0.007)	0.003 (0.005)	0.125*** (0.008)
Post Robin Hood tax	-0.041*** (0.002)	-0.031*** (0.001)	-0.039*** (0.002)	-0.039*** (0.002)	-0.003* (0.001)	-0.010*** (0.002)
Treatment*Post Robin Hood tax	0.011 (0.011)	0.018* (0.009)	0.018* (0.009)	0.018* (0.009)	-0.005 (0.006)	0.023* (0.010)

Profitability		-1.300***	-1.302***	-1.286***	-0.191***	-1.095***
		(0.019)	(0.019)	(0.019)	(0.008)	(0.018)
Tangibility		-0.371***	-0.371***	-0.359***	0.210***	-0.569***
		(0.004)	(0.004)	(0.004)	(0.003)	(0.004)
Size		-0.036***	-0.036***	-0.035***	0.004***	-0.039***
		(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Brisk		-0.040***	-0.040***	-0.039***	-0.012***	-0.027***
		(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Ndts		0.002***	0.002***	0.002***	0.002**	-0.001
		(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Year dummies			Yes	Yes	Yes	Yes
Sector dummies				Yes	Yes	Yes
Observations	65,880	65,880	65,880	65,880	65,880	65,880
Number of companies	13,176	13,176	13,176	13,176	13,176	13,176
Treatment group	292	292	292	292	292	292

Notes: The empirical model has been estimated using the Ordinary Least Square Estimator. *Leverage* is the sum of short and long-term debt expressed as proportion of total assets; *Profitability* is the ratio of net income (profit/loss) for the fiscal year expressed as proportion of total assets; *Tangibility* is the ratio of tangible assets to total assets; *Size* is the logarithm of companies' total sales; *Z-score* is a variant of the Altman's (1968) bankruptcy probability; *Ndts* is the first difference of book depreciation expressed as proportion of total assets of previous fiscal year. In column (1) we exclude companies' characteristics from the model; in (2) we add companies' characteristics; in (3) we control for year dummies; in (4) we control for year and sector dummies; in (5) use as dependent variable *Long Term Leverage*, defined as the share of long-term debt and total assets; in (6) use as dependent variable *Short Term Leverage*, defined as the share of short-term debt and total assets. Superscript asterisks indicate statistical significance at 0.01 (***), 0.05 (**) and 0.10 (*).

We perform two additional regressions to test whether the increase in the tax rate may have produced different responses on short-term and long-term debt respectively. By one hand, long-term debt can have a smaller tax response than short-term debt, due to the difficulty in adjusting to yearly fluctuations of the statutory marginal tax rate. By the other hand, the fiscal benefit due to long-term debt could be significantly higher than for short-term debt, due to the higher interest deductions (Devereux et al. 2015, Feld et al., 2013). To test whether the fiscal effect depends on debt maturity, in line with Gordon and Lee (2001), we use as dependent variable long-term and short-term leverage respectively. The results in columns (5) and (6) show a greater responsiveness of short-term debt to fiscal considerations than of long-term debt. There is no significant difference in long-term leverage for companies subject to the Robin Hood tax after 2008 fiscal year. On the contrary, when using short-term leverage as dependent variable, we estimate a coefficient β_3 positive and significant (albeit at 10% level).

Robustness checks

In this section we test the robustness of our empirical results. The first robustness check consists in replicating the empirical analysis for a subsample of profitable companies. These companies should face the strongest tax incentive to use debt as they need to minimize taxes in the current year. The results (table 4, column 1) show that, in contrast with our expectation, there is no significant evidence that the tax increase has affected companies' financing decisions (the coefficient estimated β_3 is not statistically significant).

Then, we restrict the sample on the basis of the representativeness of treated companies in different economic sectors. In particular, we exclude those companies belonging to economic sectors having only few treated cases⁶. The estimated coefficient (table 4, column) is only weakly significant (10% level).

In the final robustness check we change the definition of the control group. In particular, we use the propensity score methods (based on observed companies' characteristics) in order to match untreated companies to companies included in the treatment group. We employ a probit model in which the dummy variable for the treated companies is regressed on pre-treatment profitability, tangibility, size, bankruptcy and non-debt tax shields. We perform different matching methods: the nearest neighbour (with and without replacement, in ascending and descending order) and the nearest neighbour within calliper (set equal to 0.01). The results reported in column (3)-(6) of table 4 show that the coefficients for both the post Robin Hood tax period (β_2) and for the interaction between the treatment and the post Robin Hood tax dummies (β_3) cease to be statistically significant. There is no significant difference in leverage level after the introduction of the Robin Hood tax neither for all companies included in the sample nor for treated companies.

⁶ We drop companies in economic sectors having less than 10 companies subject to AEEGSI's controls.

Table 4. Estimation results using different sample specification

	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.123*** (0.009)	0.119*** (0.008)	0.095*** (0.011)	0.101*** (0.010)	0.096*** (0.010)	0.095*** (0.011)
Post Robin Hood tax	-0.040*** (0.003)	-0.045*** (0.003)	-0.019 (0.015)	-0.014 (0.013)	-0.015 (0.013)	-0.019 (0.015)
Treatment*Post Robin Hood tax	0.017 (0.010)	0.022* (0.009)	-0.007 (0.015)	-0.011 (0.013)	-0.010 (0.013)	-0.006 (0.015)
Profitability	-1.489*** (0.026)	-1.370*** (0.023)	-1.436*** (0.082)	-1.417*** (0.078)	-1.437*** (0.078)	-1.441*** (0.083)
Tangibility	-0.389*** (0.005)	-0.332*** (0.005)	-0.493*** (0.019)	-0.473*** (0.016)	-0.478*** (0.016)	-0.493*** (0.019)
Size	-0.033*** (0.001)	-0.033*** (0.001)	-0.008** (0.002)	-0.009*** (0.002)	-0.009*** (0.002)	-0.008*** (0.002)
Brisk	-0.038*** (0.001)	-0.032*** (0.001)	0.000 (0.002)	-0.001 (0.002)	-0.001 (0.002)	0.000 (0.002)
Ndts	0.002*** (0.000)	0.001*** (0.000)	0.015 (0.064)	0.025 (0.073)	0.024 (0.072)	0.015 (0.064)
Year dummies			Yes	Yes	Yes	Yes
Sector dummies				Yes	Yes	Yes
Observations	43,495	44,900	2,435	2,920	2,920	2,425
Number of companies	8,699	8,980	487	584	584	485
Treatment group	225	264	292	292	292	292

Notes: The empirical model has been estimated using the Ordinary Least Square Estimator. *Leverage* is the sum of short and long-term debt expressed as proportion of total assets; *Profitability* is the ratio of net income (profit/loss) for the fiscal year expressed as proportion of total assets; *Tangibility* is the ratio of tangible assets to total assets; *Size* is the logarithm of companies' total sales; *Z-score* is a variant of the Altman's (1968) bankruptcy probability; *Ndts* is the first difference of book depreciation expressed as proportion of total assets of previous fiscal year. In column (1) we focus on profitable companies; in (2) we exclude by the sample companies in ATECO sectors having only few companies subject to the Robin Hood tax; in (3)-(6) we use a sample composed by treated companies and control group, identified performing the propensity score methods. In particular, as matching method we perform in sample used in column (3) the nearest neighbour (with replacement), in column (4) the nearest neighbour (without replacement in ascending order), in column (5) the nearest neighbour (without replacement in descending order) and in column (6) the nearest neighbour within caliper (set equal to 0.01). Superscript asterisks indicate statistical significance at 0.01 (***), 0.05 (***) and 0.10 (*).

7. Conclusions

This paper provides further empirical evidence on the effects of corporate tax system on companies' capital structure. Most of existing literature has evaluated the impact of taxes on leverage decisions using simulated company-specific marginal tax rates.

However, the use of simulated marginal tax rate has been largely questioned, due to its potential measurement and identification issues.

We overcome the problem of finding an adequate proxy for the firms' tax status by taking advantage of the quasi-natural experiment provided by the introduction in 2008 of a surtax levied on Italian companies operating in the oil and energy industrial sectors. The results are somewhat surprising. Despite the tax rate increased by 5,5 percentage point, we find only weak evidence that the treated companies have increased their leverage above the level chosen by other companies not affected by the surtax.

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APPENDIX A – Sample construction

Table A.1. Sample construction

	Observations	Companies
Companies having balance sheet data available for every fiscal year during the period 2006-2010	1,919,945	383,989
Drop companies having missing data for some of the balance sheet numbers needed to compute the model's variable	1,908,300	381,660
Drop companies having negative values of total assets, of short-term or long-term debt, of tangible assets or of sales	1,891,575	378,315
Drop companies subject to the Robin Hood tax only in one or two fiscal years during the period 2008-2010	1,890,995	378,199
Drop companies having a turnover lower than 5 euro millions at least in one fiscal year during the period 2008-2010	185,580	37,116
Drop companies belonging to economic sectors having no one or only one company subject to Robin Hood tax	70,770	14,154
Drop outliers	65,880	13,176