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Classification: G21, G28, G32, H25

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Corporate tax-shields and capital structure: levelling the playing field in debt vs equity finance.*

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Abstract

A common feature within most corporate income tax systems is that the cost of debt is deductible as an expenditure when calculating taxable profits. An unintended consequence of this tax distortion is the creation of under-capitalized firms - raising default risk in the process. Using a difference-in-differences approach, this paper shows that a reduction in tax discrimination between debt and equity finance leads to better capitalized banks. The paper exploits the exogenous variation in the tax treatment of debt and equity created by the introduction of an Allowance for Corporate Equity (ACE) system in Italy, to identify whether an ACE positively impacts banks' capital structure. The results demonstrate that a move to an unbiased corporate tax environment increases bank capital ratios, driven by an increase in equity rather than a reduction in lending activities. The change also leads to a reduction in risk taking for ex-ante low capitalized banks. Overall, these results suggest that the ACE could be a valuable policy instrument for prudential bank regulators.

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1 Introduction

The recent global financial crisis demonstrated that bank capital structure is one of the most important determinants of financial stability, as better capitalized banks tend to be more resilient to economic and financial shocks. Consequently, regulators have significantly focused their attention on banks capital adequacy in order to enhance the stability of the financial system. The realization of this importance has prompted many researchers to try to identify and understand the determinants of bank capital structure. An often overlooked or underestimated determinant is corporate income taxation; interestingly, studies have shown that taxation was one of the possible sources that might have indirectly contributed to the 2008 financial crisis (see for e.g. De Mooij, 2012; Turner, 2010). Yet, there is scarce evidence on the impact of corporate taxation on bank stability, with most of the existing literature focusing on the relationship between taxes and leverage.[1] Previous work on capital structure focuses primarily on bank-specific factors. As a consequence, the question of whether corporate taxes play a crucial role in the capital structure decisions of banks remains largely unanswered.

Schepens (2016) attempts to answer this question by examining the impact of an allowance for corporate equity on banks' capital structure decision making in Belgium. Going beyond Schepens (2016), our paper further contributes to the academic and policy debate in the following two ways. Firstly, we examine the policy impact using the two-way fixed effects (TWFE) model and both the conventional and dynamic difference-in-differences (DiD) approach. Therefore, our methodological approach is more robust than the technique used in Schepens (2016). Secondly, we examine the case of Italy, in comparison with Belgium, where the nature of the Italian banking system and the timing of the introduction of the ACE allow us to study the extent and timing of tax effectiveness, with clear implications for national policy-making. Unlike Belgium, the Italian banking sector suffered from the 2010 government debt crisis - a delayed unfolding of the global financial crisis. Italy's economy also performed poorly in the years preceding the crisis through structurally high non-performing loans and debt-to-GDP ratios. Further, Italy's ACE was implemented only after the global financial crisis whilst Belgium's tax reform was as early as in 2006. These particular features of Italy's banking sector and broader economy provide an ideal opportunity to test the robustness of the ACE as a suitable macroprudential policy tool to help stabilise the banking system and encourage lending during economic downturn, all else being equal.

As Schepens (2016) points out, one particular challenge in empirically analysing the impact of tax shields on bank capital structure is that tax shields are generally constant over time, and marginal tax rates tend to be endogenous. That is, changes to the tax rate are usually part of a broader tax reform, which then makes it difficult to isolate the direct impact of the tax shield. To circumvent this, this study exploits an exogenous change in corporate tax laws in Italy in 2012 that tackled this tax advantage of debt finance by introducing an allowance for corporate equity.[2] The introduction of this ACE allows for examining the direct impact of a tax shield for

[1] See DeAngelo and Masulis (1980), Dwenger and Steiner (2014),Heckemeyer and de Mooij (2017).

[2] The Italian ACE was presented by the government in December 2011 and decreed by the Ministry of Economy

equity on bank capital structure, the implications it has for the risk-taking behaviour of these banks, and finally, the important role this tax shield has to play in the make up of tools available to prudential regulators.

The analysis yields several distinct set of results. First, it finds that treated banks which have been affected by this new tax regulation, increase their capital ratios by approximately 6.1%. The main intuition behind this finding is that the ACE ensures a cut in the effective tax ratio (tax liability on profit), hence freeing up resources. As a result, banks can now rely more on internal or external equity and less on leverage. This result is corroborated by the 'trade-off theory' for capital structure, as the creation of a tax shield for equity reduces the marginal benefit of debt. Second, it finds that this reaction by banks to the tax shield is homogeneous. That is, both high- and low-capitalized banks increase their equity ratios following the implementation of the tax shield.[3] Third, the study examines the main factors influencing this change in the equity ratios. By definition, bank equity ratios can increase either by increasing their equity, or by reducing their assets, or indeed, by a combination of both. The results reveal that the observed increase in equity ratios is as a result of an increase in common equity rather than a reduction in assets.

This result is of paramount importance due to the far reaching implications had it been as a result of a reduction in bank activities. Empirically, it confirms that the increase in equity ratios is due to the exogenous change in corporate tax laws, which reduces the tax debt bias. However, more importantly, it dismisses any concerns about the treatment having any pro-cyclical effect. The recent financial crisis demonstrated that higher capital requirements could potentially harm the real economy if they significantly reduce bank loan provision.[4] This finding can also relax any concern about the observed changes in equity ratios being as a result of a reduction in loan demand, since the ACE was also enforced for non-financial firms (see Célérier et al. 2016).

Finally, with respect to the risk-taking behaviour of banks, this paper documents that not all treated banks react in a similar manner. The reaction depends on how well capitalized the banks are. Only under-capitalized banks reduce their level of riskiness (as measured by a non-performing loans ratio). The study finds that, following the introduction of the ACE, ex-ante high-capitalized banks increase their riskiness. Overall, the results in this paper illustrate that both ex-ante high and low-capitalized banks adjust their capital structure in a similar manner following the introduction of the allowance for corporate equity. However, the risk-taking behaviour is heterogeneous across these bank types, as only ex-ante low-capitalized banks reduce their riskiness.

This study therefore builds on the following strands of the literature. First, it adds to the literature discussing the determinants of banks' capital structure, and capital structure decision

and Finance in March 2012.

[3]Banks are regarded as being highly-capitalized if they have an equity-to-assets ratio that is in the 75th percentile of the size distribution. Those with equity ratios below the median are classified as low-capitalized or financially more constrained.

[4]There is also an extensive literature on the potential pro-cyclical effects of capital requirements. See for e.g. Jokipii and Milne (2008), Coffinet et al. (2012), Shim (2013), Brei and Gambacorta (2016), and Montagnoli et al. (2021).

(see amongst others; Gropp and Heider, 2010; Allen et al., 2015; De Jonghe and Öztekin, 2015). More importantly, it also contributes to the burgeoning literature surrounding the introduction of a tax shield for equity, to reduce the relative tax advantage of debt (see for example; Schepens, 2016; Célérier et al., 2016; Panier et al., 2013). Furthermore, it speaks to the recent debates on optimal regulation of banks and discussions on fiscal tools as complements to existing capital regulations (see for example; Francis and Osborne, 2012; Celerier et al., 2020).

The remainder of the paper is organised as follows. Section 2 gives an overview of the literature. Section 3 describes the Italian ACE system and develops the hypotheses to be tested. Section 4 describes the data and empirical method used. Section 5 discusses the results from the empirical analysis. Section 6 concludes.

2 Literature overview

There is an ongoing debate on the role taxes play in the capital structure decision of institutions. In the mid-1970s, the general academic view was that the optimal capital structure involves balancing the tax advantage of debt against the present value of bankruptcy costs. Miller (1977) presented a new challenge by showing that under certain conditions there is a trade-off in tax advantage between the firm and household. That is, the tax advantage gained by firms through debt finance is exactly offset by the tax disadvantage of debt at the household level. Since then, studies have sought to reconcile Miller's finding with that of the balancing theory. Beyond this, a number of studies have attempted to explain the role taxes play in determining capital structure.

In an early paper, Fischer et al. (1989) use a continuous-time framework to measure capital structure choice. The model derives closed-form solutions for the value of a firm's debt and equity as a function of its dynamic recapitalization decisions. The results from the model highlight the risks of viewing observed debt ratios as "optimal", and as such use the range over which the firm allows its debt ratio to vary as the measure of capital structure relevance instead. In doing so, the model then provides distinct predictions relating firm-specific properties to the range of optimal leverage ratios. Smaller, riskier, lower-tax, lower-bankruptcy-cost firms will exhibit wider swings in their debt ratios over time. Other earlier studies that contribute to this debate include, among others, DeAngelo and Masulis (1980); Ang and Peterson (1986); Titman and Wessels (1988); Graham (1996a) and Graham (1996b).

Within the banking literature, most studies on capital structure mainly focus on the bank-specific factors that affect bank capital structure (see for e.g. Flannery and Rangan, 2008; Berger et al., 2008; Gropp and Heider, 2010; Antoniou et al., 2008). Interestingly, Gropp and Heider (2010) find that unobserved time-invariant bank fixed effects are the most important determinants of banks' capital structures and that mispriced deposit insurance and capital regulation were not as important in determining the capital structure of large U.S. and European banks. Octavia and Brown (2010) on the other hand argue that the standard determinants of capital structure do provide explanatory power with regards to the variation in both bank and market

capital above the minimum requirement. Adding that when asset risk is controlled for, the overall significance of the standard determinants of bank capital structure choice is unchanged. However, the study focused solely on 10 selected developing countries.

Diamond and Rajan (2000) argue that in order to truly understand the determinants of bank capital structure, it is important to firstly model the essential functions that banks perform, and then ask what role capital plays. This approach demonstrates that a bank's capital structure affects both its ability to create liquidity and credit, and also its stability.

Other studies within the literature tend to focus on how banks make capital structure adjustment. To assess the cyclical behaviour of European bank capital buffers, Jokipii and Milne (2008) rely on the 'standard' determinants of bank capital. That is, they control for banks' risk behaviour, size, and profitability - and then demonstrate that banks tend to reduce capital in business cycle expansions and increase capital in recessions. Lepetit et al. (2015) use similar bank-specific controls along with market discipline and ownership to test whether banks' capital ratios are affected by the degree to which control rights are exercised by owners in pyramids. The finding suggests that banks' decisions on how to move to target capital ratios vary according to the presence or absence of excess control rights. In the absence of excess control rights, banks build their capital ratios by issuing equity and by readjusting their assets without curtailing lending. In fact, these banks reduce their capital ratios by repurchasing equity and lowering retained earnings and by expanding their assets, particularly through lending. On the other hand, in the presence of excess control rights, banks adjust by repurchasing equity when they are above the target capital ratio. Of note, Lepetit et al. (2015) point out that instead of issuing equity, these controlled banks increase their capital ratio by pulling on earnings and by reducing their assets, particularly, their lending.

Using a partial adjustment framework with bank-specific and time-varying targets to model bank capital ratios, De Jonghe and Öztekin (2015) present some distinctive findings regarding how banks adjust their capital. They show that these adjustment decisions not only reflect the characteristics of the bank, but also the environment in which it operates. They find that speed of capital structure adjustment is heterogeneous across countries. Specifically, in countries where there are more developed capital markets, stringent capital requirements and supervisory monitoring, and high inflation, banks tend to make faster capital structure adjustments. Also, banks make capital structure adjustments significantly faster during crisis periods.

Contributing to the debate on the design and calibration of international capital standards, Francis and Osborne (2012) find that capital requirements that include firm-specific, time-varying add-ons set by supervisors affect banks' desired capital ratios. They argue that as a result of this, the adjustments to capital and lending depend on the gap between actual and target ratios. More importantly, their results suggest that the impact of countercyclical capital requirements may be dampened in trying to slow credit activity when banks can readily satisfy them with lower-quality capital elements versus higher-quality common equity. In a similar study, Memmel and Raupach (2010) find that there is a high level of variation in capital ratios across banks, but less so across non-financial firms. Further, they find that private commercial

banks and banks with a high degree of proprietary trading tend to make tighter adjustments to their regulatory capital ratios.

While there is a wide range of work on capital structure adjustments, the impact of corporate tax rates on these adjustments is far less researched. The existing literature on tax rates and leverage mainly looks at the correlation between the two on a cross-country level. Keen and de Mooij (2012) explore the impact of corporate tax bias on bank leverage and regulatory capital ratios for a panel of over 14,000 commercial banks across 82 countries over the nine year period 2001-2009. They explore various forms of heterogeneity by estimating a second-order polynomial with interactions of bank characteristics and the tax effect on leverage. Their findings suggest that responses differ only by bank size. They find that large banks (usually more highly leveraged), are less responsive to tax than small banks. This finding concurs with the 'too-big-to-fail' hypothesis. Large banks being less responsive to tax changes than smaller banks highlights their status that lowers their cost of debt finance, inducing them to become more highly leveraged and leaving less scope for tax effects. In a related study, De Mooij et al. (2013) show the implications of corporate tax systems favouring debt finance over equity finance. They argue that greater tax bias is associated with significantly higher aggregate bank leverage, and this then translates to greater risk of crisis.

Horváth (2013) uses a generalized method of moments (GMM) approach to estimate the effect of corporate income taxation on bank capital structure and risk. Consistent with the literature, he finds that an increase in the tax rate leads to an increase in the leverage ratio and a reduction in average risk-weighted assets. Similar to Keen and de Mooij (2012), Gu et al. (2015) find that banks that are subject to more stringent capital requirements are less responsive to tax. More specifically, they find that there are two channels through which a bank's leverage depends on corporate income taxes. The first is the 'the traditional debt bias', which is measured by the debt impact of the local tax level in the host country of a subsidiary. The second is via 'international debt shifting', which measures the debt impact of the cross-border tax difference vis-a-vis other bank subsidiaries in the same multinational group. The study shows that the impact of the tax effect is significant via both channels. However, the international debt shifting effect is stronger. Thus, they suggest that tax policies worldwide induce a large share of international debt structure changes through their impact on multinational bank behaviour.

Adding to this body of literature also is Hemmelgarn and Teichmann (2014), whose findings are largely consistent with previous studies. The authors examine the effect of tax rate changes on leverage, dividend policies and earnings management of banks, with results suggesting a significant impact on all three. Most importantly, they find that leverage increases with the corporate income tax (CIT) reform within the first three months of its implementation. They cite as the main reason, the fact that a higher tax rate increases incentives to use debt finance when interest payments are deductible from the CIT base.

An exception to the cross-country study is Schandlbauer (2017). He adopts the difference-in-differences methodology to show that the impact of changes in local state corporate tax rates in the United States affect banks' financing as well as their operating choice. His study

exploits U.S. bank holding companies that were subject to 13 distinct state tax increases between 2000-2011. He finds that as a result of the tax increase, banks significantly increase their non-depository leverage ratio, pointing to the fact that they benefit from an enlarged tax shield which prevails due to the higher tax rate. Another interesting finding, and one that is consistent with Keen and de Mooij (2012) and Gu et al. (2015), is that it is predominantly the better-capitalized banks that have the financial flexibility to increase their debt, while those with less capital only partially increase their short-term debt. Finally, Schandlbauer (2017) finds that these adjustments by better-capitalized banks are only in reaction to income and franchise tax increases, with surcharge tax increases having no significant effect.

Another U.S. focused study is Ashcraft (2008), which highlights the positive cross-sectional relationship between the state tax rate and banks' leverage ratio in the U.S. The paper finds that banks facing higher state income tax rates tend to have more debt in their capital structure.

Evidence points toward a strong bias toward debt funding in corporate finance. Furthermore, no compelling reason has been put forward to explain this tax advantage of debt finance in many countries. This bias not only creates significant inequities but also causes economic distortions. One possible solution is to introduce an allowance for corporate equity. This is one of the main motivations of this paper, as it exploits the introduction of the ACE in Italy in 2012.

The closest work to this current paper is Schepens (2016), which exploits the introduction of the tax shield for equity in Belgium in 2006. In the paper, the author shows that tax shields significantly impacts the capital structure of banks. The author uses a difference-in-differences approach to compare the capital adjustment of Belgian banks that were subject to the tax treatment and a group of matched European banks that did not experience this treatment. The results suggest that, on average, a reduction in the tax bias towards debt relative to equity increases the equity ratio of treated banks. In other words, a more balanced treatment of equity and debt funding increases bank capital ratios, fuelled by movements in common equity. The study further highlights that balancing the debt-equity bias also significantly reduces the level of risk-taking by ex-ante low capitalized banks. Kestens et al. (2012) test whether the notional interest deduction (NID) introduced in Belgium in 2006 impacted the debt ratios of small and medium enterprises. They find significant declines in tax rate and leverage ratios as a result of the reform.

Using German and French firms as controls against 'treated' Belgian firms, Princen (2012) finds a significant negative effect on the financial leverage of a company following the introduction of the 2006 equity tax shield. Panier et al. (2013) confirm these results using a broader and better defined control group. They use firm-level data on Belgium's neighbouring countries as a credible counterfactual. In deciding the control group, they argue that firms in Germany, France, Netherlands and Luxembourg are geographically close, economically integrated and use the same currency as Belgian firms. As such, they are likely to be exposed to common aggregate shocks. However, these countries did not introduce a reform for equity deductions. The study documents four major findings. First, the introduction of the ACE leads to higher capitalization rates in Belgium. Next, both incumbent and new Belgian firms significantly increase their equity

ratios. Third, large firms react more to the new tax incentive, consistent with the notion that smaller firms may face major refinancing cost. Finally, the increase in equity ratios of Belgian firms is explained by a significant increase in the levels of equity and not due to a reduction in the value of non-equity liabilities. Contrary to these findings, Van Campenhout and Van Caneghem (2013) show that NID had no impact on the financial decision making of a group of small firms.

To the best of our knowledge, this paper will be the first to examine the impact of the ACE on banks' capital structure in Italy. Previous studies have focused their attention on non-financial firms. A study by Panteghini et al. (2012) looks at the 2012 ACE in Italy, and its impact on a firm's leverage. They find a negative correlation between the ACE treatment and firms' leverage, with the caveat that this also depends on location, size, and the sector in which the firms operate. The ACE benefit thus allows firms to reduce their tax burden and leverage, and inevitably cut system risk.

Staderini et al. (2001) use company-level data on capital structure to analyse the reaction of Italian firms to the business tax reform of 1997-98. This tax reform, termed the Dual Income Tax (DIT) system, was introduced as a relief for equity finance. It reduced the tax rate on profits with the abolition of the ILOR tax.[5] By reducing the bias against equity capital, this was seen as an initial step to eliminate the bias in capital structure decision. Staderini et al. (2001) find that firms reduce their leverage in reaction to the introduction of the partial ACE. They also look at the composition of firms that benefited from the reform. The finding highlights that it is mainly the profitable firms and those with high investment rates that benefited and issued new equity, while less profitable companies were not fully incentivised by the improved tax status of equity. However, the authors acknowledge the fact that the paper only considers data up to 1998, and as such, might miss out on delayed effects of the reform. A similar paper by Santoro (2005), with data up to 2000, also finds the expected negative impact of Italy's partial ACE on firms' leverage. More interestingly, he provides two possible arguments for the different reaction of smaller (less-profitable) firms. The first argument, cited in Bordignon et al. (1999), says smaller firms or firms located in the southern regions of Italy were just slower to adjust to the changing tax environment due to short-run asymmetries of information that would not exist in the long-run. The alternative argument is that it is in the nature of smaller firms to favour debt finance since they have a family based property structure which sets upper boundaries to both internal and external equity. Santoro (2005) argues that in this case, even if the Italian partial ACE was not abolished, it would have had the same adverse distributional impact, i.e., smaller firms would never obtain tax reductions, with only the larger firms benefiting. Oropallo et al. (2005) show that following the repeal of the tax reform, average tax burden significantly increased.

An assessment of the impact of the ACE and the comprehensive business income tax (CBIT) reveals that both are attractive propositions for European countries. The CBIT, like the ACE, is aimed at mitigating the differential treatment of debt and equity. De Mooij and Devereux (2011) find that if governments adjust statutory corporate tax rates to balance budgets, profit

[5]The ILOR or Imposta Locale sul Reddito, is a local tax on income in Italy.

shifting and discrete location make CBIT a more attractive option for most individual European countries. However, in a system of coordination, a joint ACE becomes more efficient than a joint CBIT. A combination of both improves welfare overall.

Another aspect of the introduction of these tax reforms is how they affect bank lending. While this paper will not directly focus on banks' subsequent lending behaviour, such actions could have implications for regulators and policy makers. Célérier et al. (2016) use loan level data from the German credit register to assess the impact on lending in Germany by banks that were subject to tax reforms in Italy (2000) and Belgium (2006). They find that implementing a tax shield on equity leads to a significant increase in bank lending. The large magnitude of the effect also implies a great degree of sensitivity between bank lending and the cost of equity.

3 The Italian ACE system and hypothesis development

The key source of identification in this study is the reform of corporate tax laws in Italy in 2012. Standard corporate income tax systems favour the choice of debt financing over equity financing as interest payments are tax deductible. Moreover, Albert and Expert (2008) highlight that Italian firms are more exposed to debt than other European companies, a claim echoed by IMF (2009) policy paper. This excessive debt exposure has been favoured by existing corporate tax laws. By guaranteeing the deductibility of interest on debt, many tax systems encourage debt finance, thus creating under-capitalization and increasing the probability of default risk. This discrimination against equity finance violates the Modigliani Miller theorem.[6] However, in the presence of market imperfections, this adjustment may be slower or even impossible to follow (see for e.g., Almeida et al., 2004). To reduce this tax distortion in favour of debt financing, the Italian government introduced an Allowance for Corporate Equity instrument, to be applied to both financial and non-financial firms. The ACE allows for a notional return on equity, which, like the cost of debt, can be deducted from taxable income, thus contributing to the strengthening of firms' capitalization.

Italy's new ACE system shares some similarities with its previous Dual Income Tax system, which was in force from 1998 to 2003. For example, profit is divided into two components (ordinary and above-normal income) under both regimes. However, whereas ordinary income (which refers to the opportunity cost of new equity capital) is taxed at a lower rate under the DIT system, it is completely exempted under the new ACE system.[7] A key feature in both systems is that the ACE benefit is applied only to new equity. De Mooij and Devereux (2011) point out that if the ACE benefits were applied to the whole net internal equity, then its cost would be about 0.5% of GNP. Hence, he proposes a gradual approach aimed at ensuring that ACE benefits only new wealth. Klemm (2007) further explains that the introduction of an ACE narrows the tax base. To account for this potential loss in revenue, the government could increase corporate income taxes. This, he explains, would put the country introducing the ACE

[6] In frictionless capital markets, firms would have the necessary conditions to access the equity market and adjust their capital structure when needed (Modigliani and Miller, 1958)

[7] See Bordignon et al. (1999) and Bordignon et al. (2001) for more details on the Italian DIT.

at a disadvantage, given a globalized world where capital is internationally mobile. As such, applying the ACE to only new equity would be a more efficient approach. This is the approach that was adopted by the Italian government with the introduction of the ACE tax reform.

The role of taxes in determining the capital structure of firms have always been quite significant. The main reason for this is the cost of debt is usually deductible as an expenditure, while payments to equity holders are not. Introducing an ACE would provide tax relief on the costs associated with using equity to finance investment. The desired effect of the introduction of an ACE is to reduce the debt tax bias, which in turn should lead to better capitalized banks. This is under the assumption that banks will now rely more on internal or external equity and less on leverage. Against this background, the study tests two hypotheses:

Hypothesis 1. The introduction of a tax shield for equity increases bank equity ratios.

The marginal benefit of debt is now reduced, allowing banks to free up resources and rely more on equity.

Hypothesis 2. The allowance for corporate equity will cause banks to reduce their riskiness.

4 Data and empirical design

The principal data source for the bank-specific data used in the empirical setup is Bureau van Dijk's Bankscope database. The sample is drawn from all EU-28 countries.[8] We select commercial, savings, cooperative and bank holding companies that have available data for each year from 2008 to 2013 on all the key variables used in the empirical analysis. This period coincides with four years before the introduction of the ACE and two years whilst it was in place. The treatment period is restricted to two years to reduce the possibility of capturing the impact of any other shocks that could affect bank equity ratios.[9] This selection resulted in a sample of 65 Italian banks and 643 other banks from the European Union.

The main variable of interest is bank equity ratio, which is defined as the ratio of total equity to total assets.[10] Following Schepens (2016), our bank-specific controls include: profitability - proxied by return on assets; bank size - defined as the log of total assets; loan ratio, and bank diversification - proxied by the ratio of non-interest income to total income. In order to analyze the underlying drivers of equity ratio changes, the study looks at total loans and banks' retained earnings. As it relates to banks' risk behaviour and stability, we focus on their non-performing loan ratios and Z-score. To capture differences in the level of economic development in each country, the study considers three macroeconomic controls from the World Development Indicators database. These are: total GDP, the CPI rate and also the growth rate of GDP.

Table 1 provides summary statistics for the main variables used in the analysis. As it shows, the equity ratio for the treated and control group is 14.61% and 14.60% respectively in the

[8] We exclude Belgium from the sample given that they were subject to an identical tax treatment in 2006. Also, despite the UK formally leaving the EU in February 2020, they were still a part of the Union during the period examined in the study - hence "EU-28".

[9] Consolidated data is used for most banks. Where this is not available, the aggregated data is used.

[10] Table A1 provides a description of the variables used throughout the analysis.

pre-treatment period, which suggests that the average capital positions of the two groups of banks were close prior to the treatment. However, the difference is significantly enlarged in the post-treatment period - the mean of the equity ratio for the treated and control group become 20.77% and 15.49%, respectively. These numbers imply that the treated banks might have increased their capital position in the post-treatment period relative to the control group as a response to the implementation of ACE in Italy, and this potential impact is formally tested in the subsequent sections with rigorous econometric tools.

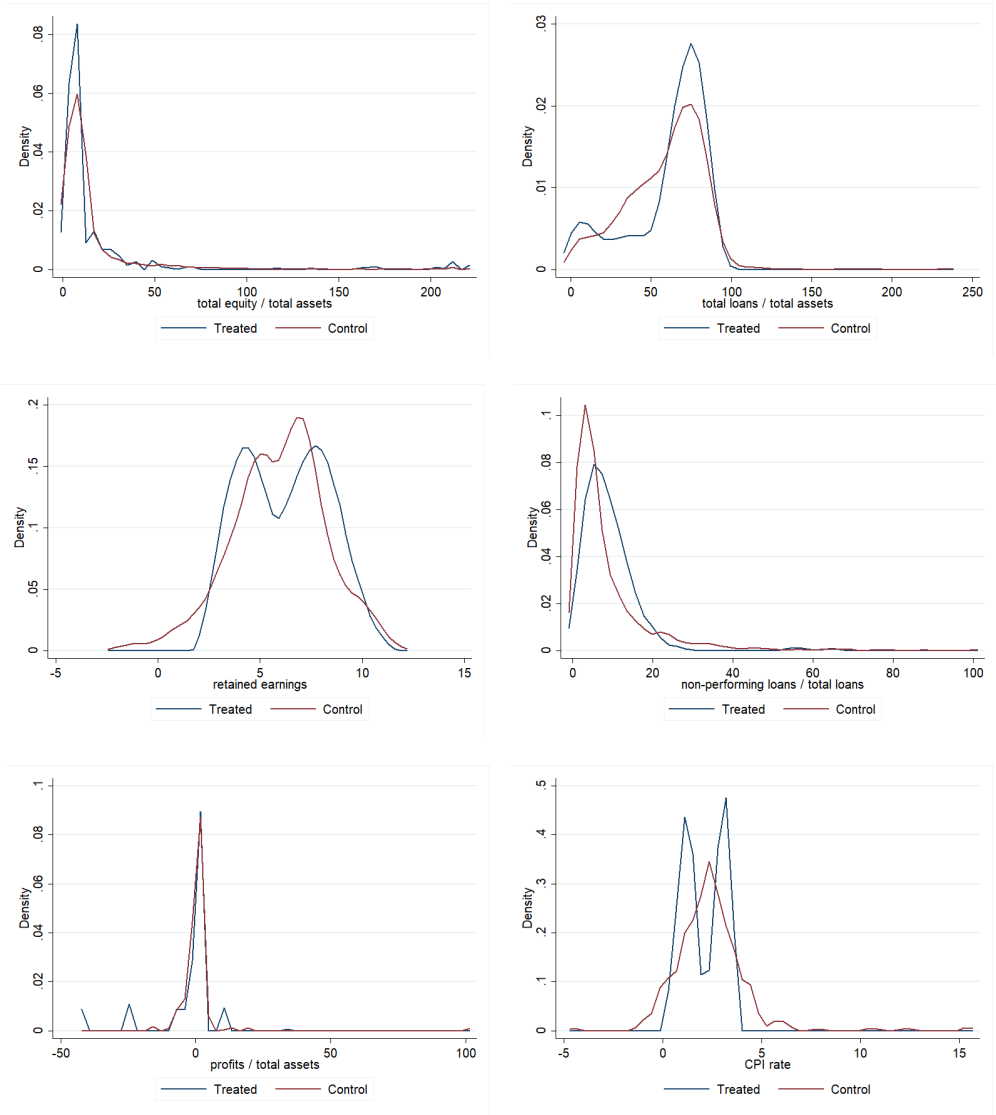
Moreover, the summary statistics for the treated and control groups overall suggest that the characteristics of the banks in both groups are similar and comparable in the pre-treatment period. We conduct further tests to examine the similarity between the treated and control group prior to the treatment. Figure 1 depicts the kernel density estimates for the treated and control groups and highlights the similarities. The figure highlights the similarities in bank characteristics for both groups. Moreover, Table 2 provides further evidence that the treated and control groups display similar characteristics prior to the introduction of the ACE in Italy.

Table 1: Summary statistics

Variable	Group	2008-11 (Pre-period)			2012-13 (Post-period)		
		N	Mean	St.D.	N	Mean	St.D.
Equity ratio	Treated	202	14.606	28.419	116	20.773	46.133
	Control	1911	14.601	25.346	1089	15.486	28.195
Return on assets	Treated	201	0.450	1.765	116	-0.036	2.354
	Control	1910	0.243	1.775	1088	0.134	2.073
ln(Total assets)	Treated	202	9.370	2.058	116	9.217	2.243
	Control	1911	9.502	2.223	1089	9.366	2.222
Loan ratio	Treated	192	64.834	22.304	112	54.144	26.779
	Control	1880	58.709	23.198	1075	58.149	24.676
Non-interest income share	Treated	200	39.866	74.865	116	54.833	29.929
	Control	1898	39.968	38.375	1084	42.506	33.257
Risk	Treated	170	7.046	5.716	93	12.462	8.722
	Control	1237	7.069	8.336	810	9.974	11.796
ln(Z-score)	Treated	200	3.109	0.897	112	2.935	1.041
	Control	1873	2.987	1.332	1035	3.176	1.424
ln(Equity)	Treated	202	6.749	1.053	116	6.676	1.056
	Control	1911	6.760	1.060	1089	6.675	1.092
ln(Retained earnings)	Treated	41	6.459	1.952	14	5.618	2.034
	Control	1342	5.899	2.268	789	5.960	2.314
ln(Loans)	Treated	192	8.805	2.397	112	8.253	2.910
	Control	1880	8.817	2.375	1074	8.626	2.461
Macro controls							
CPI rate	Treated	260	2.102	1.023	130	2.131	0.914
	Control	2572	2.563	2.100	1286	1.953	0.983
ln(GDP)	Treated	260	10.497	0.023	130	10.445	0.015
	Control	2572	10.413	0.544	1286	10.417	0.534
GDP growth	Treated	260	-1.459	2.806	130	-2.981	0.100
	Control	2572	-0.389	3.584	1286	-0.084	1.931

Notes: This table provides summary statistics for the variables which are used throughout the analysis. The treated group refers to banks which experience a change in their tax system, and the control group depicts the banks whose tax system does not change. All variables are defined in Table A1.

Figure 1: Kernel Density Functions



Notes: To highlight similarities between treated and control groups, the plots display the main kernel density estimates for the different bank characteristics for the two groups. The treated group refers to banks which experience a tax reform, and the control group depicts the banks whose tax environment does not change.

The parallel trends assumption suggests that in the absence of a treatment, on average, the treated and control group should exhibit similar trends in their characteristics over time (Roberts and Whited, 2013). Satisfying this important assumption is key to obtaining reliable difference-in-differences estimates. As such, we examine the growth rates of the main variables used in the estimation in the pre-treatment period. Table 2 displays the paired t-test and the

Table 2: Parallel trend assumption

	t-test	Wilcoxon test
Growth rate of equity/assets	0.10	0.00
Growth rate of ROA	0.76	0.08
Growth rate of NPLs/total loans	0.50	0.07
Growth rate of retained earnings	0.91	0.98
Growth rate of size	0.00	0.00
Growth rate of equity	0.60	0.56
Growth rate of loans/assets	0.73	0.25
Growth rate of non-interest income share	0.39	0.00

Notes: This table compares the growth rates of the main bank characteristics between the treated and control group. Growth rates are calculated for the years prior to the introduction of the ACE (2008-2011). The second column provides the p-values of a t-test of differences of the means. The null hypothesis for this test is that the difference in the means of the two groups are not statistically different to zero. The third column shows the p-values of the Wilcoxon rank-sum test. The Wilcoxon test tests the hypothesis that the two independent samples are from populations with the same distribution.

Wilcoxon rank-sum test of differences. The bank characteristics of both groups appear to display a common trend prior to the change in the tax environment for Italian banks.[11]

4.1 Empirical design

The study employs a difference-in-differences (DiD) estimation approach to examine how a tax reform influences the capital structure of banks. Specifically, the study employs this technique to compare capital structure changes of Italian banks with that of a similar group of European banks that did not experience such a change in their tax environment. The study exploits the introduction of an Allowance for Corporate Equity in Italy in 2012.

The conventional DiD framework consists of identifying a specific intervention or *treatment*. It then requires comparing the difference in outcomes after and before the intervention for groups affected by the intervention to the same difference for unaffected groups. In other words, you test the difference in the difference between the treated group and the control group in the two periods. Therefore, a significant difference in difference would suggest a significant treatment effect. DiD estimations have become an increasingly popular way in the banking literature to estimate causal relationships due to its simplicity as well as its potential to circumvent endogeneity problems that typically exist when making comparisons between heterogeneous individuals (see e.g. Cao et al., 2018; De Marco, 2019; Cao and Chou, 2022).

We follow Schepens (2016) for the DiD setting in our study. The treated group in the DiD analysis are Italian banks that were exposed to the tax shield for equity. The control group is represented by other banks in EU that did not experience such a change. Since the ACE was introduced in 2012, the study uses 2012 and 2013 as the treatment period. The treated group consists of 65 Italian banks and there are 643 banks represented in the control group. A

[11]The growth rate of bank size shows a dissimilar trend in both tests, whilst the growth rates of the equity ratio and non-interest income share show a dissimilar trend in the Wilcoxon rank sum test. Further examination of these variables are carried out in the regression analysis.

specification of the regression model is illustrated by the equation below.

$$ETA_{i,c,t} = \alpha_1 + \alpha_2 Treat_c + \alpha_3 Post_t + \beta Treat_c \times Post_t + \mathbf{X}'_{i,c,t-1}\gamma + \delta_i + \delta_t + \epsilon_{i,c,t} \tag{1}$$

where i represents each bank in the sample; c stands for each sample country; t denotes each sample period, spanning 2008 to 2013; $ETA_{i,c,t}$ is the equity ratio of bank i from country c in period t; $Treat_c$ is a dummy variable that takes the value one for all Italian banks in the sample (treatment indicator); $Post_t$ is a dummy taking the value one in the treatment period (2012-2013); $X_{i,c,t}$ contains the previously mentioned bank-specific and country-level macroeconomic controls; δ_i and δ_t stands for bank and year fixed effects respectively; $\epsilon_{i,t}$ is the error term for bank i at time t. The main parameter of interest is the coefficient on the variable β. It will highlight the actual impact of the implemented ACE: a positive and significant estimate would imply that the ACE policy is effective in strengthening bank capital position. Using a difference-in-differences method ensures that the estimates will not be biased by any permanent differences between the treated and control group.

Dynamic DiD method is also implemented as a further check for the common trend assumption of the DiD method. The specification for the dynamic DiD analysis is specified as below:

$$ETA_{i,c,t} = \alpha_1 + \alpha_2 Treat_c + \sum_{m=08}^{11} \beta_m Treat_c \times Year_m + \sum_{n=12}^{13} \beta_n Treat_c \times Year_n + \mathbf{X}'_{i,c,t-1}\gamma + \delta_i + \delta_t + \varepsilon_{i,c,t} \tag{2}$$

where m denotes the pre-ACE years (i.e. 2008-2011) while n denotes the post-ACE years (i.e. 2012-2013); $Year_m$ and $Year_n$ are the dummy variables equal to 1 if an observation is from year m or n. $Year_{11}$ is normalised to zero to set up a benchmark for the pre-ACE level of capital position in this dynamic DiD analysis. For the common trend assumption to hold, one would expect that the coefficients on the pre-ACE DiD terms, β_m, are consistently estimated to be insignificant. Positive and significant estimates of β_n would in turn indicate the effectiveness of the ACE policy in strengthening bank capital position.

5 Results

This section analyses the difference in equity ratios between the treated and control group of banks. Here, the interest is on the impact of the ACE on the capital structure of Italian banks. Table 3 reports the results obtained from the difference-in-differences estimation of (1). The models include country and bank fixed effects. Clustering of standard errors are at bank level, unless otherwise stated. The first column of Table 3 reports a specification with no country or bank fixed effects. Furthermore, it excludes all the bank specific and macro controls, and simply

regresses the equity ratio on the Post, Treated, and interaction dummies. The coefficient on the variable of interest (DiD), which captures the impact of the introduction of the tax shield, is positive but statistically insignificant in this case. Column II in Table 3 presents the regression results where bank-level fixed effects are included. The coefficient on the DiD term is estimated to be negative but still statistically insignificant.

In the next setup, we add a set of bank and country-specific controls to the regression. Specifically, we add proxies for bank profitability (ROA), bank size (natural log of total assets), bank diversification, asset structure (loan ratio), CPI rate, and the log of GDP. The interaction variable (DiD) now carries a positive and significant coefficient of 2.668. This indicates that, on average, equity ratios for Italian banks increased following the implementation of the tax shield on equity. The results in column IV indicate this corresponds with an increase of 6.1% for the average bank in the sample.[12] Overall, the results in Table 3 indicate that the tax policy reform brought about the desired effect. That is, the introduction of the ACE that reduces the tax bias between debt and equity, has a significantly large impact on banks' capital structure. Italian banks markedly increased their capital following the treatment, relative to what would be expected without the ACE.

This finding is largely in-line with previous studies. Schepens (2016) shows that such a reduction in the tax discrimination leads to a significant improvement in the capitalization of banks. He shows that, following the introduction of an ACE in 2006, Belgian banks increased their equity ratios by approximately 13%. Panier et al. (2013) document that non-financial firms have become better capitalized in response to the reduction in the tax bias towards debt. Similarly, Panteghini et al. (2012) show that, for non-financial firms, the implementation of the ACE reform in Italy reduces but does not completely eliminate the financial distortion due to interest dedcutibility. They show that despite the permanence of a tax advantage toward debt, the ACE relief is estimated to significantly reduce leverage. Klemm (2007) finds slightly contrasting results when studying an ACE system in Brazil. He finds that, despite the reduction in the tax preference for debt finance, there was no significant change in capital structures. Instead, it led to higher dividends and an increase in debt-equity ratios. However, this might be attributed to peculiarities within Brazil's corporate tax system. In column V, the standard errors are now clustered at country level. This is done because the treatment varies at the country level. The result is broadly consistent with the findings in the previous columns.

The next step is to identify whether the observed change in equity ratios are being driven by the ACE, which reduces the tax bias, or by a decrease in bank assets. This is done by examining

[12] The correct interpretation of a log-linear equation with a binary dependent variable is derived by Kennedy et al. (1981). He derives it as: $g^* = exp[\hat{c} - 1/2\hat{V}(\hat{c})] - 1$, where g^* is the percentage change in the dependent variable given a change in the dummy variable from zero to one, $\hat{c}$ is the estimated coefficient on the dummy variable, and $\hat{V}(\hat{c})$ is the estimated variance for this coefficient. This transformed coefficient is used throughout the paper.

Table 3: Difference-in-differences regression

	I	II	III	IV	V
VARIABLES	ETA	ETA	ETA	ln(ETA)	ln(ETA)
DiD	5.282	-0.985	2.668***	0.061**	0.061**
	(4.154)	(1.291)	(0.945)	(0.032)	(0.029)
Post	3.392	-0.052	-0.635*	0.020	0.020
	(1.090)	(0.789)	(0.382)	(0.016)	(0.016)
Treated	0.013	-	-	-	-
	(2.905)				
ROA			0.136	0.023***	0.023***
			(0.100)	(0.008)	(0.012)
ln(totalassets)			-17.732***	-0.782***	-0.782***
			(2.709)	(0.043)	(0.043)
Diversification			-0.017**	0.000	0.000
			(0.007)	(0.000)	(0.000)
Loan ratio			0.005	0.002	0.002
			(0.049)	(0.001)	(0.002)
GDP			11.120*	1.171***	1.171***
			(6.390)	(0.275)	(0.411)
CPI rate			-0.831***	0.002	0.002
			(0.200)	(0.005)	(0.006)
Constant	12.738***	14.889***	68.068	-2.990	-2.990
	(0.985)	(0.493)	(69.932)	(2.907)	(3.783)
Observations	3,318	3,318	2,144	2,144	2,144
R-squared	0.003	0.014	0.356	0.696	0.696
Year FE	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	Yes	Yes	Yes
Cluster level	Bank	Bank	Bank	Bank	Country

Notes: This table analyzes the impact of the change in tax regulation in a difference-in-differences setup. The sample period is 2008 - 2013. The first column shows the regression of the equity ratio (ETA) on a post-event dummy that equals one in 2012 - 2013 (Post), a dummy indicating whether the bank is an Italian bank (Treated) and an interaction term (DiD) between both dummies that captures the actual impact of the tax change. In the first column, the model is estimated using OLS. In the second column, bank fixed effects are added, which make the Treated dummy obsolete, as it does not change within a bank. In the third column, the dependent variable is the natural logarithm of the equity ratio. Column 4 is similar to Column 3, but standard errors are clustered at the country level instead of at the bank level. For the regressions in which the dependent variable is in logs, note that, while the coefficient for a continuous variable in a log-linear equation can be directly interpreted as the percentage effect of that variable on the dependent variable, this is not the case for dummy variables. The appropriate transformation to get a similar interpretation for dummies is derived by Kennedy et al. (1981) : $g^* = exp[\hat{c} - 1/2\hat{V}(\hat{c})] - 1$, where g^* is the percentage change in the dependent variable given a change in the dummy variable from zero to one, $\hat{c}$ is the estimated coefficient on the dummy variable, and $\hat{V}(\hat{c}$ is the estimated variance for this coefficient. It is this transformed variable that is always discussed in the text. Standard errors are clustered at the bank level, with the exception of Column 4, in which they are clustered at the country level. ***, ** and * denote $p < 0.01$, $p < 0.05$ and $p < 0.1$ respectively.

Table 4: Equity ratio components

	I	II	III	IV	V	VI
VARIABLES	ln(ETA)	ln(Equity)	ln(Total assets)	ln(Loans)	ln(Retained earnings)	ln(Retained earnings)
DiD	0.061**	0.061**	0.052	0.089**	0.703***	1.001***
	(0.029)	(0.029)	(0.031)	(0.036)	(0.081)	(0.100)
Post	0.020	-0.020	0.050*	0.030	0.221**	0.183
	(0.016)	(0.016)	(0.029)	(0.040)	(0.102)	(0.150)
Constant	-2.990	-7.596*	2.471	-2.898	19.956	33.437**
	(3.784)	(3.783)	(3.546)	(5.548)	(14.835)	(15.432)
Observations	2,144	2,144	2,144	2,144	1,833	1,088
R-squared	0.696	0.370	0.534	0.416	0.081	0.037
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster level	Country	Country	Country	Country	Country	Country

Notes: This table analyses the underlying drivers of the equity ratio after the introduction of the notional interest rate deduction. The sample period is 2008 to 2013. The Post dummy equals one in 2012 to 2013, the Treated dummy equals one for the Italian banks. Control variables remain the same as reported in Table 3. The first column retakes the baseline result from Table 2 . Columns 2 and 5 analyse the impact on equity and one of its sub-components, while Columns 3 and 4 look at the impact on the asset side. All left hand side variables are in natural logarithms. Retained income share is the ratio of retained income over after-tax profits. All regressions include bank-fixed effects, standard errors are clustered at the bank level. ***, ** and * denote $p < 0.01$, $p < 0.05$ and $p < 0.1$, respectively.

the components of the equity ratio. Table 4 provides the findings on the drivers of the equity ratio. The first column merely repeats the main finding of Table 3, which shows that average equity ratios for Italian banks increased by approximately 6.1% after the introduction of the ACE. In column II, the equity ratio is replaced by the natural log of equity as the dependent variable.[13] The positive and significant coefficient indicates that the change in equity ratios is indeed being driven by an increase in equity. Furthermore, this finding is consolidated by examining the change in bank assets and loans, in columns III and IV. The results reveal that there is no significant decrease in the evolution of total assets and loans between Italian banks and other European banks from the control group. In other words, there is no evidence to suggest that there was a reduction in bank activities following the implementation of the ACE in 2012.

Furthermore, the results in columns III and IV also suggest that the Italian banks were reallocating their asset portfolio towards loans as a response to the ACE reform, which is largely consistent with the model prediction and empirical evidence in Celerier et al. (2020). This finding carries crucial policy implications as it suggests that the tax reform is estimated to be effective in encouraging banks to build up capital position and increase their lending to the real sector at the same time during economic downturns.

In column V in Table 4, we attempt to identify whether banks are using their retained earnings to build this capital buffer. The positive and significant estimate on the DID term shows that the treated banks' retained earnings rose significantly in response to the ACE policy in Italy, which is consistent with the findings from Schepens (2016). It implies that the increase in capital is mainly driven by an increase in retained earnings. Furthermore, as different types of banks have different options available to build up their capital position (see e.g. Kim and McKillop, 2019), we conduct a further test on the retained earnings in column VI where only

[13] Control variables remain the same as reported in Table 3.

observations for commercial banks are included in the sample. As it shows, the size of the estimated coefficient on the DiD term increased from 0.703 in column V to 1.001 in column VI with the same level of significance, which suggests that the positive impact of the ACE reform is mainly driven by the commercial banks.

Overall, the findings reported in Table 4 show that the increase in equity ratios, following the reduction in the tax bias, is being driven by an increase in bank equity via retained earnings, rather than a decline in bank activities. Other non-retained earnings factors (e.g. shareholder capital and other reserves) could also be fuelling this increase. However, the data set used in the study did not allow for further breakdowns to capture the impact of these variables. Nonetheless, the key finding of increases in equity rather than decline in assets limits the scope for any negative externalities to bank activities. That is, it minimizes the incentive to significantly reduce lending during downturns or to increase lending during credit booms.

Table 5: Heterogeneity in the treatment effect and bank risk behaviour

	Low-capital banks	High-capital banks	Low-capital banks	High-capital banks
VARIABLES	ln(ETA)	ln(ETA)	Risk	Risk
DiD	0.116***	0.073**	-0.152*	0.756*
	(0.040)	(0.033)	(0.089)	(0.434)
Post	-0.036**	-0.010	0.335***	0.149
	(0.017)	(0.017)	(0.041)	(0.100)
Constant	-1.263	4.238	66.355***	28.416*
	(3.217)	(2.955)	(7.985)	(14.558)
Observations	1,369	503	1,243	420
R-squared	0.445	0.756	0.356	0.194
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster level	Bank	Bank	Bank	Bank

This table illustrates the difference in the impact of the ACE on high and low capitalized banks. The sample period is again 2008 to 2013. The Post dummy equals one in 2012 to 2013, the Treated dummy takes the value of one for the Italian banks. The first two columns show the the impact of the ACE on (ex-ante) high and low capitalized banks. we classify high capitalized banks as those whose equity ratio fall in the fourth quartile of the size distribution, and low capitalized banks as those that fall in the first and second quartile of the size distribution. In the third and fourth column, we examine the ex ante risk-taking behaviour of these high and low capitalized banks. we use the ratio of non-performing loans to total loans as the left hand side variable. All regressions include bank fixed effects, standard errors are clustered at the level. ***, **, and * denote the $p < 0.01$, $p < 0.05$ and $p < 0.1$, respectively.

The analysis so far points to significant increases in bank equity ratios following the implementation of the ACE. Yet, regulators might be interested to know whether different types of banks react in a similar manner to this policy reform. Schepens (2016) argues that if it were only the highly capitalized banks that react to this policy change, then regulators might view the policy as less appealing compared to a situation in which ex ante low capitalized banks are also impacted. As such, Table 5 attempts to analyze the difference in behaviour of ex ante high and low capitalized banks in reaction to the reduction in the tax bias. For this analysis, we classify high capitalized banks as those with equity ratios that fall in the upper quartile, and low capitalized banks as those that fall in the first and second quartile, of the size distribution.

I also examine the ex ante risk taking behaviour of these banks in Table 5. There is an extensive literature on the relationship between capital and risk taking. In theory, an unregulated

bank will take excessive portfolio and leverage risks in order to maximize its shareholder value at the expense of the deposit insurance (see Benston, 1986; Furlong and Keeley, 1989; Keeley and Furlong, 1990). These moral hazard incentives can be reduced by capital requirements if shareholders are forced to absorb a substantial portion of the losses, thereby decreasing the value of the deposit insurance put option. If the level of risk-taking is minimised, coupled with higher capital levels, then it is expected that there will be lower probability of default. However, the view that capital requirements reduce risks, thereby strengthening banking system resilience has been challenged in many quarters. Koehn and Santomero (1980), Kim and Santomero (1988) and Rochet (1992) find that the bank's expected return will be diminished by a forced reduction in leverage if capital is relatively expensive. Consequently, the owners of the bank may opt for a higher point on the efficiency frontier, which is associated with greater returns and more risk. The increase in the level of riskiness by the bank overcompensates the increase in capital and translates to a greater probability of default.

Table 5 presents the findings on these relationships. The first column indicates that low capitalized banks increase their equity ratio following the reduction in the tax bias. The coefficient on the interaction term suggests that average equity ratios are approximately 12.2% higher for Italian banks, compared to those in the control group. Similarly, highly capitalized banks increase their equity ratio by approximately 7.6% (see column 2) in response to the tax treatment. These results indicate a degree of homogeneity across banks' response and might satisfy regulators as to the effectiveness of the policy.

Next, the study turns attention to bank risk-taking behaviour in columns III and IV, where the dependent variable is the ratio of non-performing loans to total loans. The negative coefficient on the interaction term, in column III, suggests that banks with relatively lower capital levels tend to reduce their level of risk-taking. On the other hand, the results differ for highly capitalized banks. The positive coefficient on the variable of interest, in column IV, points to higher levels of risk-taking by these banks, following the reduction in the tax bias. This heterogeneous finding in bank risk-taking behaviour is not unexpected. Shrieves and Dahl (1992) posit that the relationship between risk and capital in banks is not strictly the result of regulatory influence. They argue that it rather reflects the view that risk-taking behaviour tends to be constrained by bank owners' or managers' private incentives. They find that this is consistent with the leverage and risk-related cost avoidance and managerial risk aversion theories of capital structure and risk-taking behaviour in commercial banks.

Overall, the results in Table 5 indicate that both high and low capitalized banks increase their equity ratios after the implementation of the tax shield for equity. However, only low capitalized banks decrease their riskiness after the implementation of the ACE. High capitalized banks instead increase their levels of riskiness. This finding is similar to that of Schepens (2016), who argues that a potential explanation for this behaviour by high capitalized banks is that there are diminishing returns to the screening and monitoring of borrowers. This view is in line with the work of Besanko and Kanatas (1993) and Carletti (2004) on convex cost functions of bank monitoring, which argues that it is increasingly difficult for a bank to discover more and more

about a firm.

5.1 Robustness

To gauge the reliability of the results, a series of robustness checks are carried out. The first is to ensure that the results do not suffer from a sample selection bias. Estimations are done to see whether the results are being driven by outliers. In addition, a placebo test is performed to confirm that the results do not hold under a false treatment date. A placebo test is also done using one of the control group countries as the country that received treatment.[14] The results from these additional tests will serve to buttress the main findings.

Table 6: Robustness checks

	Control countries (GIPS)	Outliers	Outliers	Placebo (year)	Placebo (Spain)
VARIABLES	ln(ETA)	ln(ETA)	ln(ETA)	ln(ETA)	ln(ETA)
DiD	0.106*	0.074**	0.079**	-0.025	-0.057
	(0.060)	(0.032)	(0.035)	(0.022)	(0.084)
Post	-0.059	-0.018	-0.015	0.059***	-0.015
	(0.059)	(0.011)	(0.011)	(0.016)	(0.012)
Constant	-5.986	-2.401	-3.300	-5.182*	-2.040
	(5.961)	(2.239)	(2.281)	(3.133)	(2.428)
Observations	560	2,143	2,104	1,543	2,113
R-squared	0.357	0.451	0.437	0.454	0.451
Bank FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Cluster level	Bank	Bank	Bank	Bank	Bank

This table provides five robustness checks for the difference-in-differences results. For each robustness check, the dependent variable is the natural logarithm of the equity ratio. All the regressions include the same set of control variables as used in the main setup in Table 2, column 3. Standard errors are again clustered at the bank level. The sample period is once again 2008 to 2013. For the first robustness check, in column 1, we restrict the countries from which the control group of banks are selected to four countries (Greece, Ireland, Portugal and Spain) with similar macroeconomic environment. In the second column, we remove the 10% of Italian banks that had the highest growth in equity ratios after the introduction of the ACE. In the third column, we then remove the 10% of control group banks that had the lowest growth in equity ratios after the the introduction of the ACE. In column 4, we perform a placebo test where we assume the treatment took place in 2010 instead of 2012. In the final column, we perform another placebo test where we assume the ACE was introduced in Spain instead of Italy. ***, **, and * denote p <0.01, p < 0.05 and p < 0.1, respectively.

The results of the above-mentioned robustness checks are presented in Table 6. The first column tests whether the main findings are being driven by sample selection. To do this, the number of countries from which the control group of banks are selected is restricted to a set of countries with a similar macroeconomic environment. Specifically, the study uses the remaining members of the so called GIIPS countries (Greece, Ireland, Portugal and Spain). This group of countries experienced similar economic climate before and after the crisis. The GIIPS countries were among the European countries most severely affected by the global financial crisis. All five countries experienced similar banking sector problems, credit crunches, and government debt crises. Similarly, in the decade prior to the crisis, all five countries experienced rapid economic growth, stable inflation and rapidly growing domestic credit. As such, limiting the control

[14]For completeness, this exercise is repeated using each of the remaining control group banks, in turn. The results are available upon request.

group to these set of countries helps to control better for the common macroeconomic factors in the treated and the control group.[15] The result of this test is shown in the first column. The coefficient on the interaction term remains positive and significant. The finding suggests that the introduction of the ACE, on average, increases the equity ratios of Italian banks by approximately 11%.

The second and third columns of Table 6 tests whether the main results are being driven by extreme outliers. In the first instance, the 10% of Italian banks that had the highest growth in equity ratios after the implementation of the ACE are removed. In doing so, the idea that the overall growth in equity ratios is being driven by only a few Italian banks can be dismissed. The 10% of control group banks that had the lowest growth in equity ratios following the introduction of the ACE were then removed. The results for these two scenarios are shown in columns II and III, respectively. The coefficients on the difference-in-differences variable in both columns are consistent with the main results.

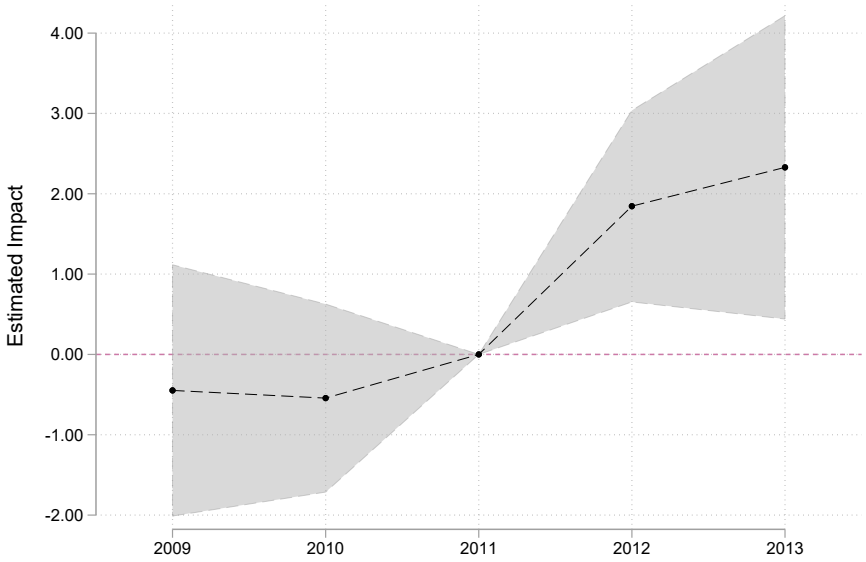
In the next column of Table 6, a placebo test is performed under the assumption that the ACE was introduced in 2010 instead of 2012. Under this assumption, the treatment effect should not be significantly different from zero. If it is, this would suggest that the difference-in-differences strategy might be picking up other unobservable differences between the treated and control group. In such an event, estimations of the impact of the implementation of the ACE on equity ratios would be biased. However, the result of this test, as shown in column IV, dismisses this possibility. This test finds no significant evidence to suggest that banks increase their equity ratio following the false treatment. The final column of Table 6 presents another placebo test, this time assuming that the country that received the treatment is Spain instead of Italy.[16] Again, this returns no significant evidence that would suggest that these banks increase their equity ratios. These findings validate the setup of the difference-in-differences model used.

We also perform the dynamic DiD setting specified by equation 2. The point estimates on the coefficients β_m and β_n in equation 2 are graphically presented in Figure 2. It shows that the coefficients β_m are consistently estimated to be insignificant for the pre-treatment period, indicating that the difference between the control and treatment group regarding the capital structure are not statistically significant before the ACE policy is implemented in Italy, which in turn confirms the common trend assumption as required by the DiD setting. Moreover, the coefficients estimated on the DiD terms for the post treatment period - the year 2012 and 2013 are positive and significant. This dynamic DiD result further confirms our previous finding that the Italian banks improved their capital position in response to the ACE policy.

[15] In addition, we repeat the tests in Table 2 to examine the parallel trend between the Italian banks and those from other GIIPS countries. The results suggest that the characteristics of the banks in the treated and control group are indeed similar and comparable. Therefore, this DiD setting with banks from other GIIPS countries as the control group is validated.

[16] For this estimation, Italy is removed from the sample in order to avoid any offsetting effect.

Figure 2: Dynamic DiD Results - ACE and Bank Capital



Notes: This figure graphically presents the point estimates of the dynamic DiD regression as specified by equation 2. $Year_{11}$ is normalised to zero to serve as a benchmark for the pre-treatment capital position. Please refer to column IV in Table 3 for the full model specification. Standard errors are clustered at country level and the 90% confidence band is depicted by the shaded area. It shows that there is no significant difference between the control group and the treated group regarding the capital position during the pre-treatment period, which confirms the common trend assumption of the DiD setting. It further confirms our main finding that banks that the ACE policy is helpful in strengthening bank capital positions.

6 Conclusion

In the wake of the recent financial crisis, the debate surrounding bank capital regulation has come under increasing attention. Indeed, capital requirements have become one of the key instruments of modern day banking regulation, providing both a cushion during adverse economic conditions and a mechanism for preventing excessive risk taking ex ante. Nonetheless, the discussion surrounding bank capital regulation quite often ignores the tax deductibility of interest expenses on debt. A tax-induced debt bias may contribute to the heavy reliance on debt finance - which has the potential to severely impair macroeconomic stability and growth. As such, this paper explores a potential avenue to level the playing field in debt versus equity finance, by documenting the impact of a tax shield on bank capital structure. The study exploits the exogenous variation in the tax treatment of debt and equity due to the implementation of an allowance for corporate equity instrument in Italy.

The ACE is anticipated to reduce the relative tax advantage of debt and thus encourage bank capitalization. Using a difference-in-differences approach this paper compares the change in capital structure of Italian banks with that of a similar group of European banks that did not experience a similar change in their corporate tax system. The results suggest that, following the introduction of the ACE, the equity ratio of the average Italian bank increases by approximately

8.5%. Since the ACE is a tax shield for equity, equity funding becomes more attractive and banks increase their equity ratio. It is important to highlight that the ACE does not increase banks' equity ratios by merely reducing lending activities, which would have a negative spin off effect on the real sector. Indeed, the results provide evidence that the increase in equity ratios is being driven by an increase in bank equity rather than a reduction in any loan activity by banks. Additionally, the study finds that this tax relief for equity reduces risk taking for weakly capitalized banks.

Overall, this paper contributes to the debate on bank capital regulation, corporate tax policy and financial regulation by investigating the effects of an ACE on banks' capital structure. The study highlights the important role that an ACE instrument can play in macroprudential regulation. While it is generally acknowledged that the implementation of an ACE system can be challenging, it can bring about great advances in the economy. The prevailing debt bias of taxation distorts regulatory efforts made to reduce leverage. On the other hand, ACE systems support capital regulations in their pursuit of a well-functioning stable financial system.

Therefore, this study strongly recommends that an ACE system, that eliminates or significantly reduces the tax-induced distortions in banks, should be on the agenda of macroprudential policymakers. The reduction in the tax discrimination not only leads to better capitalized banks, but it also decreases the risk-taking behaviour for weakly capitalized banks, who are usually targeted by regulators. Furthermore, a reform that is centred around the debt tax bias might have positive externalities, since a better legal and regulatory system is positively associated with financial development and economic growth (Levine, 1999).

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Table A1: Description of variables

Variable	Description	Source
Bank-specific variables		
Equity ratio	Total equity over total assets	Bankscope
Return on assets	Profits over total assets	Bankscope
Risk	Ratio of non-performing loans to total loans	Bankscope
Diversification	Non-interest income over gross revenue	Bankscope
Loan ratio	Total loans over total assets	Bankscope
Total assets	Total assets (in millions of US dollars)	Bankscope
Loans	Total loans (in millions of US dollars)	Bankscope
Equity	Total equity	Bankscope
Z-score	Ratio of equity plus return on assets over std. dev.(ROA)	Bankscope
Retained earnings	Retained income over post-tax profit	Bankscope
Country-specific variables		
GDP growth	Growth in gross domestic product per capita	WDI
CPI rate	Change in consumer price index	WDI