Taxes and bank capital structure

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October 2013

Abstract

This paper shows that a reduction in the tax discrimination between debt and equity funding leads to better capitalized financial institutions. In many countries, the cost of debt is tax-deductible whereas the remuneration for equity (dividends) is not deductible. Theoretically, this unequal tax treatment gives a bank - as any other firm - an extra incentive to take on more debt. I make use of a fiscal change in Belgium in 2006 that affected the relative tax advantage of debt funding to gain a more profound understanding of the causal impact of tax deductibility on bank capital levels. This natural experiment confirms that a more equal treatment of debt and equity significantly increases bank capital ratios. When focusing on the heterogeneity in the impact of this change in the relative tax advantage, I find that more profitable banks are more sensitive to this change, as they have a stronger incentive to take advantage of the tax discrimination between debt and equity. Furthermore, while both high and low capitalized banks react to the allowance for corporate equity, the latter profit more of it in terms of overall risk reduction, which suggests that the tax discrimination between debt and equity could potentially be an interesting regulatory policy tool.

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1 Introduction

In this paper, I investigate whether changing the relative tax cost of debt and equity can be a valuable addition to existing financial stability regulation. Although tax legislation may at first sight have little to do with financial stability, both existing theoretical and empirical research stress the potential role of tax incentives on corporate capital structures, and thus ultimately - in the specific case of financial institutions - on financial stability. Therefore, I analyze the impact of the unequal treatment of debt and equity on bank capital levels by exploiting an exogenous shock to the tax treatment of debt and equity. This unequal treatment stems from the fact that in many countries, the cost of debt is tax-deductible whereas the remuneration for equity (dividends) is not, which gives banks an incentive to take on more debt. If banks would be forced to reduce their debt funding, for example due to higher regulatory capital standards, the tax shield associated with the interest payments on debt would be an important channel through which higher funding costs could materialize (see, e.g., Admati, DeMarzo, Hellwig, and Pleiderer (2011), Poole (2009)). Building further on this argument, Poole (2009) suggests that phasing out the deductibility of interest on business tax returns would change the incentives under which firms operate and could be an important step towards a less leveraged financial system, even without explicit higher capital requirements.

I consider a fiscal change in Belgium in 2006 that affected the relative tax advantage of debt funding. This exogenous change allows me to better identify the direct impact of the unequal treatment of debt and equity on bank capital levels. First, I show that the equity ratio of Belgian banks are significantly higher after reducing the relative tax advantage of debt. Second, by comparing the change in equity ratios at Belgian financial institutions before and after the change in tax treatment with a matched group of European financial institutions that were not exposed to the change in tax treatment, I measure the causal impact of these tax frictions on bank capital structure. This difference-in-difference setup indicates that a more equal treatment of debt and equity in terms of tax deductibility significantly increases bank capital ratios. More

specifically, reducing the tax discrimination of equity funding vis-a-vis debt funding by allowing banks to deduct a fictitious interest rate on equity capital equal to the average return on a 10-year Belgian government bond increases the equity ratio of the average Belgian bank in the baseline setup with around 0.9 percentage points, which corresponds with an increase of more than 10 percent for the average bank in the sample. I subject this result to a battery of robustness checks to ensure that the positive impact of the reduction in inequality is not driven by the matching procedure, the selection of the banks, potential omitted variables and confounding events such as the simultaneous increase in the ECB policy rates.

Next, I show that the impact of this change in tax treatment varies depending on bank profitability, which corroborates existing theories on the impact of a tax shield on leverage, as loss-making banks have a lower incentive to shield from taxes. Similarly, my results also indicate that there is a direct impact of the new deduction on effective tax rates. This confirms that banks are making use of this deduction, which is a necessary condition when arguing that the deduction has an impact on equity ratios. Finally, my results also shed more light on the impact of the notional interest deduction on the risk behavior of financial institutions. If banks simultaneously increase equity ratios and take on more risk, the increase in equity ratios will not lead to more stable banks, which could make it a less interesting policy tool. My results suggest that the introduction of an allowance for corporate equity increases bank stability more for low capitalized banks, which indicates that reducing the unequal tax treatment of debt and equity can not only be an attractive regulatory measure to enhance bank capital levels, but could potentially also increase the overall stability of low capitalized banks.

Tax deductibility of debt funding is an often overlooked factor in the regulatory debate on bank capital. Most studies tend to mention it as an important friction when explaining why the Modigliani-Miller theorem does not hold, but it is seldom seen as a potential policy instrument. My results suggest that a reduction of these tax frictions could be an important part of a regulatory incentive scheme that should lead to a better capitalized and more stable banking system.

2 Allowance for corporate equity in practice: The Belgian notional interest deduction

The main source of identification for this paper is the notional interest deduction in Belgium, which is a tax reform that was introduced in Belgium in 2006. A feature that is common among most corporate income tax systems is that interest on debt is deductible as an expenditure when calculating taxable profits, while this is not the case for dividends (Klemm (2006)). This discrimination against equity financing is a textbook example of a friction which can violate the Modigliani Miller theorem. If we would live in a frictionless Modigliani-Miller world, the cost of funding should be unaffected by the capital structure composition (Modigliani and Miller, 1958). An increase in the proportion of equity, which will always be more expensive than debt, would be exactly offset by a decrease in the costs per unit of both debt and equity in recognition of the lower risk of insolvency. However, there are a number of reasons why this theorem is not likely to hold in the real world, one of them being the existence of a tax shield for interest expenses on debt. To overcome this friction, Devereux and Freeman (1991) propose to introduce an Allowance for Corporate Equity (ACE). Such an ACE allows firms to deduct a notional interest rate on their equity, which should –in the ideal case- make firms indifferent in their choice between debt and equity, at least in terms of corporate tax implications.

In Belgium, an allowance for corporate equity came into practice through the introduction of the notional interest deduction. From 2006 onwards, Belgian firms were allowed to deduct a notional return of their book value of equity. The reason for introducing this deduction goes back to a ruling of the European Commission in 2003, which prohibited the existence of coordination centers. Between 1982 and 2003, Belgium had an advantageous tax legislation for subsidiaries (so-called coordination centers) of multinational firms whose only purpose was to provide financial and accounting services to their parent companies. The taxable income for these centers was not based on profits but on expenses less financial and salary costs. This, combined with

a low tax rate for these subsidiaries, made Belgium a popular tax destination for a lot of multinational firms. The ruling of the European Commission, however, prohibited this advantageous scheme, as it discriminated between multinationals and Belgian firms. This lead to the introduction of the notional interest deduction allowance, which partly replaced the tax benefit for the multinational coordination centers with an allowance on corporate equity which is applicable to all firms incorporated in Belgium.

The deduction equals the calculated average 10-year government bond rate of the year preceding the current fiscal year by two years, with a maximum set at 6.5 percent and with the restriction that the rate cannot change by more than one percentage point year over year.[1] Hence, not the actual equity cost, i.e. the return to shareholders, but an estimated equity cost is tax deductible. The new law came into practice on the first of January 2006, for both Belgian companies and foreign companies permanently established in Belgium. Only one other country tried out a similar tax regime before Belgium, being Croatia between 1994 and 2000.[2] Three other countries tried out a partial ACE system before, being Italy (1997-2003), Austria (2000-2004) and Brazil (1996 up until today).

As the introduction of the allowance for corporate equity exogenously changes the relative cost of debt and equity, it provides an ideal setting to investigate the impact of tax shields on bank capital structures.

3 Literature

This paper relates to an extensive strand of capital structure research that focuses on the impact of corporate income taxes on firm capital structures. Following up on the seminal work of Modigliani and Miller (1958), Stiglitz (1973) and King (1974) theoretically show that tax discrimination between different forms of funding will have an impact on the cost of funding and hence on the capital structure of a firm. Empirical evidence on this subject, however, is mixed. Titman and Wessels (1988), for example, use balance

[1] During the first three years, for example, the rate was equal to 3.44, 3.78 and 4.31 percent.

[2] The interest was called the 'protective interest': the deductible rate there was set to 5% plus the inflation rate

sheet based measures such as the ratio of investment tax credits over total assets to proxy the impact of tax deduction possibilities on a firm‘s capital structure. They find no significant relation between these proxies and various measures of leverage. Other early studies such as Fisher, Heinkel, and Zechner (1989), Ang and Peterson (1986), and Long and Malitz (1985) reach similar conclusions. A first paper that did find clear evidence of substantial tax effects on the choice between issuing debt or equity is MacKie-Mason (1990). This study focuses on incremental financing decisions using discrete choice analysis and finds a sizable impact of tax deduction options on a firm's financing choice. Graham (1996) reaches similar conclusions when considering the impact of simulated firm-specific marginal tax rates on the use of debt. Heider and Ljungqvist (2012) use a natural experiment in the form of staggered changes in corporate income tax rates across U.S. states to show that tax considerations are a first-order determinant of firm capital structure. Four existing papers also use this event to study the impact of an allowance for corporate equity on capital structures of non-financial firms, albeit finding mixed results. Kestens, Van Cauwenberge, and Christiaens (2011) use a simulation study to analyze the impact of the tax change on small and medium enterprises and find a significant reduction in leverage ratios. Princen (2012) addresses the impact of the change in tax treatment in Belgium on non-financial firms by comparing their reaction with a match group of non-treated French and German firms, and finds that there is a sizable impact on firm leverage. Panier, Perez-Gonzalez, and Villanueva (2012) confirm these findings when using a broader control group and while also focusing on differences,in terms of size, ownership and so on, within the treatment group.Van Campenhout and Van Caneghem (2013), however, find that the allowance for corporate equity had no effect on firm leverage.

This paper differentiates from these existing studies by focusing on financial institutions and the potential regulatory consequences, for example in terms of changes in risk taking behavior, of the change in tax treatment and by documenting heterogeneity in the impact of the tax change across banks with different profitability levels.

Papers focusing on the impact of corporate tax rates on bank leverage are scarce. De Mooij and Keen

(2012) analyze the impact of corporate taxes on bank leverage for a worldwide sample of banks located in 82 different countries. They conclude that favorable corporate tax treatment of debt finance does lead banks to be more highly leveraged. Additionally, De Mooij and Keen (2012) also show that banks holding smaller equity buffers and larger banks are noticeably less sensitive to tax changes. In a follow-up paper, Gu, De Mooij, and Poghosyan (2012) focus on international debt shifting in multinational banks due to corporate tax differences. Their results imply that that tax policy induces significant international spillovers through its impact on multinational bank behavior. Finally, De Mooij (2012) advocates the use of an allowance for corporate equity to reduce the social cost of the debt bias in the financial sector.

I build further on De Mooij and Keen (2012) by analyzing the impact of an allowance for corporate equity in Belgium, which leads to a better understanding of the causal impact of tax rates on bank capital structures. To the best of my knowledge, I'm the first to exploit the introduction of an allowance for corporate equity to learn more about the impact of the tax shield of debt on bank capital structures. Furthermore, I also exploit bank characteristics that could lead to heterogeneity in the response to changes in the tax discrimination of equity.

4 Impact of the allowance for corporate Equity in Belgium

To better understand the underlying relationship between corporate tax rates, interest deductibility and bank capital structures, I analyze the introduction of an allowance for corporate equity in Belgium in 2006. This fiscal change exogenously affected the relative marginal cost of debt and equity, which allows me to study the direct impact of tax discrimination between debt and equity on bank capital ratios. I first analyze whether Belgian capital ratios increased after the introduction of the allowance for corporate equity. Next, I focus on the difference-in-difference strategy and the matching procedure that are used to come to consistent estimates of the impact of the change in tax treatment. The last part of this section discusses the results of the difference-in-difference analysis.

The bank-specific data used for the empirical analysis is retrieved from the bureau van Dijk Bankscope database. I select all banks that have data available for each year between 2003 and 2007 on all variables used throughout the analysis, as I will mainly focus on this period throughout the paper. This period corresponds with three years before the implementation of the tax treatment and two years when the treatment was in place. For the main analysis, I limit the post-treatment period to two years, as this should reduce the possibility that I am measuring the impact of other shocks that have an impact on bank equity ratios. For the introductory analysis in part 4.1, I also use data for this same group of banks for the period 2000-2003 and for 2008. This selection leaves us with a sample of 35 Belgian banks and 2,579 other European banks,for which I collect data between 2000 and 2009. All macro-economic variables used throughout the analysis are downloaded from the World Development Indicators database at the World Bank. Summary statistics for all variables used throughout the paper for the 2003-2007 period can be found in table 1.

4.1 Belgian capital ratios after the allowance for corporate equity

In this part, I analyze the evolution of the equity ratios of Belgian banks over time. As the allowance for corporate equity reduced the tax discrimination between debt and equity funding, I expect an increase in equity ratios from the moment that banks are allowed to deduct their equity costs.

Figure 1 illustrates the evolution of the average equity ratio for our sample of Belgian banks between 2000 and 2008. The graph shows a sharp increase in the average equity ratio from 2006 onwards, which is also the year when the allowance for corporate equity came into effect. While the average equity ratio from 2000 until 2005 ranges between 7 and 8 percent with an average equal to 7.5 percent, the ratio climbs up to around 8.9 percent in 2008. The graph thus gives a first indication that there was a positive impact of the reduction in tax discrimination of equity on bank equity ratios. The regression results in table 2 are in line with this observation. In column 1 to 3 of table 2 I regress the equity ratio of a sample of Belgian banks on two dummies that are equal to one either for the first year of the introduction of the allowance for

corporate equity (2006) or equal to one during the second year (2007). I leave out observations for later years as the equity ratio from 2008 onwards is most probably also influenced by the onset of the financial crisis. Similarly, in the first two columns I also leave out the observations before 2003 to limit the possibility that other events are driving the results. All regressions also include bank fixed effects.

The results in the first column of table 2 indicate that the equity ratio for the Belgian banks gradually increased in 2006 and 2007, leading to an equity ratio that was 0.11 percentage points higher in 2006 and 0.68 percentage points higher in 2007 compared to the average equity ratio in 2003-2005 period.

In the second column, I add a group of bank-specific control variables to the regression. Previous bank capital structure research (see, e.g., Gropp and Heider (2010),Berger, DeYoung, Flannery, Lee, and Oztekin (2008), Flannery and Rangan (2006),De Jonghe and Oztekin (2010)) has shown that although bank fixed effects explain the majority of the variation in bank equity ratios, there are still some bank-specific characteristics that potentially have an impact on the equity ratio. Therefore, I add one period lagged proxies for bank size (the logarithm of total assets), bank profitability (return on assets), risk (standard deviation of returns and the ratio of non-performing loans over total assets), asset composition (total loans over total assets) and income structure (non-interest income over total income) to the regression. Adding these control variables strongly increases the coefficients on the 2006 and 2007 dummies: the coefficients respectively rise from 0.11 and 0.68 to 0.32 and 1.17, indicating that the results in the first column are underestimating the growth in the equity ratio in 2006 and 2007 due to an omitted variable bias. The outcome for the control variables also point in this direction. More specifically, the results show that bank size has a strong and negative impact on the equity ratio. At the same time, Belgian banks significantly grew over the sample period: total assets of the median bank in the sample during the 2003-2005 period was around 1.1 billion euros, while the median size for the 2006-2007 period equals 1.5 billion (real 2005 values). Thus, the combination of a negative relation between size and the equity ratio and relatively larger banks during the 2006-2007 period biased the initial estimation downwards. Furthermore, unreported regressions where I

only include bank size as a control variable confirm that bank size is most likely the most important omitted variable, as these regressions lead to estimates for the 2006-2007 dummies that are very close (respectively 0.39 and 1.19) to the ones reported.

In the third column of table 2, I expand the sample by also including the observations between 2000 and 2002 as a further robustness check. The results indicate that the significant results in the previous columns are not driven by the choice of the period prior to the introduction of the notional interest deduction. In fact, including the pre-2003 observations only increases the difference in the equity ratio between the 2006-2007 period and the period when there was no allowance for corporate equity. However, as mentioned above, the analysis of the impact of the tax treatment change in the remainder of this paper will focus on the 2003-2007 sample, as I want to limit the potential impact of other events during the analyzed period.

The last three columns of table 2 also incorporate observations from other EU-27 countries. Similar to the first three columns, the regressions confirm a gradual rise in the equity ratio for Belgian banks in 2006 and 2007. Overall, the evolution of the equity ratio for Belgian banks presented in figure 1 together with the regression results in this table are a first indication that there was an increase in the equity ratio for Belgian banks after the introduction of the allowance for corporate equity.

4.2 Difference-in-difference setup

In this part, I estimate the impact of the allowance for corporate equity on bank capital ratios by comparing the change in the equity ratio at the Belgian banks with a group of European control banks. As described above, I use data for a sample of 35 Belgian banks and 2,579 other EU-27 banks between 2003 and 2007. To analyze the impact of the allowance for corporate equity, I apply a difference in difference estimator, which compares the change in capital structure of the Belgian banks with the change in capital structure of a similar group of European banks for whom the fiscal treatment did not change. More precisely, the baseline difference-in-difference setup looks as follows:

$$ETA_{i,t} = \alpha + \beta_1 * Treated_i + \beta_2 * Post_t + \beta_3 * Treated_i * Post_t + \varepsilon_{i,t} \quad (1)$$

Where $ETA_{i,t}$ is the equity ratio of bank i at time t, defined as equity over total assets, $Treated_i$ is a dummy which equals one for all Belgian banks in the sample (treatment group indicator) and $Post_t$ is a dummy indicator equal to one in the post-treatment period (2006-2007). Including the $Treated_i$ dummy controls for any permanent, time-invariant differences between the treated and the control group, whereas the $Post_t$ dummy controls for trends that are common to both groups. The actual coefficient of interest is the coefficient for the interaction variable (β_3), as this coefficient shows the actual impact of the treatment. Analyzing an exogenous shock to the tax treatment of debt and equity in this setup is not enough to make sure that we are actually measuring the causal impact of the change in tax treatment. The difference-in-difference approach ensures that the estimates will not be biased by permanent differences between the treatment and the control group or by shared trends. There are, however, some other issues that have to be taken into account.

First, the key identifying assumption which is essential for obtaining reliable difference-in-difference estimates is the common trend assumption. This assumption states that, in the absence of treatment, the average outcomes for the treated and control groups would have followed parallel paths over time, which is something that is hard to verify. I try to meet this assumption by taking two steps. First, the assumption implies that the equity ratio has a similar trend for both groups in the pre-treatment period (See e.g. Angrist and Krueger (1999), Roberts and Whited (2012)). Thus, I make the choice of the control group dependent on a common trend in the equity ratio in the pre-treatment period. Furthermore, the assumption of a common trend is less plausible if pre-treatment characteristics that are thought to be associated with the dynamics of the outcome variable are unbalanced between the treated and the control group (see, e.g. Abadie (2003)). Therefore, I add the actual equity ratio and bank size as extra matching variables. Bank size is chosen as the analysis in table 2 showed that it is an important determinant of the equity ratio. By doing this, I make

sure that the treatment and control group are more balanced, i.e. that they are relatively similar along these dimensions, limiting the possibility that the measured change in equity ratio is due to other factors.

A second potential problem could be that there may have been changes in the economic environment of the Belgian banks contemporaneous with the change in the tax treatment. To counter this, I add two macro-economic variables to the matching procedure, which should help in ensuring that both the banks in the treatment and the control group are facing similar economic environments. Additionally, I analyze the economic growth, inflation and growth in non-performing loans over the full sample period for the different countries in our matched sample, to confirm that there are no macro-economic shock that confounded with the policy change. Furthermore, in an additional robustness test I also add a group of macro-economic control variables to the difference-in-difference model.

Finally, I devote special attention to a particular contemporaneous event that effected all banks in the Euro zone during the 2006-2007 period, being the increase in the monetary policy rate. From December 2005 onwards, the policy rate of the ECB gradually rose from 1.00 percent up to 3.25 percent in July 2008. Previous work on the monetary transmission mechanism in the Eurozone has shown that the transmission of policy rates into the actual rates that banks charge can vary for different countries and different types of banks (see, e.g., Van Leuvensteijn, Kok, Bikker, and Van Rixtel (2013), Kok and Werner (2006), De Graeve, De Jonghe, and Vander Vennet (2007)). Higher policy rates are expected to have a negative impact on loan growth, and lower loan growth could reduce overall growth in total assets, and this will normally happen at a different speed in different countries. Thus, the rising policy rate can potentially change the denominator of the equity ratio differently across the countries in our sample, leading to different equity ratios due to changes in monetary policy. Therefore, I perform a list of robustness checks to ensure that the estimated impact of change in tax treatment is not biased by the contemporaneous change in the monetary policy rate. I show that the change in equity ratios after the introduction of the allowance for corporate equity is not linked to one of the most important drivers of heterogeneity in monetary policy transmission, being bank market

power. Previous studies have shown that banks operating in more concentrated markets or banks with more market power adjust their interest rates slower than other banks. The results indicate that - within the group of Belgian banks - market power has no impact on the change in equity ratios after 2005. Furthermore, a placebo study for the year 2000, when the ECB policy rate also rose from 2 percent up to 3.75 percent, reveals that there was no link between the increase in policy rates and changes in equity ratios of Belgian banks (again relative to a control group) during that period, making it less likely that the 2006-2007 increase in equity ratios is driven by changes in monetary policy.

Choice of control group

For the difference-in-difference analysis I construct a matched control group of European banks when analyzing the impact of the tax change in Belgium. For the choice of the control group, I follow a similar approach as Lemmon, Roberts, and Zender (2008). I apply a propensity score matching procedure to select banks for the control group. This matching procedure ensures that the treatment and control group are relatively similar along observable dimensions, which should also reduce the probability that they differ along unobservables that could have an impact on the treatment effect.

The matching procedure is a nearest neighbor matching of propensity scores, as first proposed by Rosenbaum and Rubin (1983). I start the matching procedure by running a probit regression for the full EU-27 sample in 2005 of a dummy indicating whether a bank is a Belgian bank on the trend in the capital ratio during the pre-treatment period, the actual equity ratio in the pre-treatment period and bank size. I include both the lagged and the contemporaneous growth rates of the capital ratio in the pre-treatment period to make it more likely that we fulfill the parallel trends assumption for the difference-in-difference model that is used in the following step (see e.g. Angrist and Krueger (1999), Roberts and Whited (2012)). Furthermore, I also include proxies for the state of the economy to the matching procedure. The macro-economic variables that are included are GDP per capita growth and a consumer price index.

The results for the probit regression are shown in the first column of table 3. The results confirm that the common trend assumption is most likely violated, as the growth in the equity ratios in the pre-treatment period is significantly lower for the Belgian banks. Furthermore, banks operating in Belgium are on average larger, and have significantly different equity ratios during the pre-treatment period. The differences between the Belgian and the other EU-27 banks make it impossible to use the full sample of European banks as a control group. Instead, to make sure that the common trend assumption holds, I select a control group by using a propensity score matching procedure. I use the predicted probabilities of the probit model in the first column of table 3 to match each Belgian bank with its three nearest non-Belgian neighbors.[3] The matching is done with replacement, which means that each non-Belgian bank can be used as a neighbor for multiple Belgian banks. Smith and Todd (2005) indicate that this should improve the accuracy of the matching procedure. The matching procedure leaves us with 35 treated Belgian banks and 105 control group banks.[4]

The probit regression in column 2 of table 3 illustrates the accuracy of the matching procedure. The regression is similar to the one in the first column of table 3, but only includes the treated banks and the matched control banks. The results indicate that it is not possible to differentiate between the control and the treatment group based on the bank and macro characteristics in the matched sample. There is no statistical difference between the equity ratio and the size of the Belgian banks and the banks in the control group. Most importantly, the probit regression confirms that the growth of the equity ratio in the pre-treatment period does not differ between both groups, which is a necessary condition for the common trend assumption to hold. This observation is also confirmed when looking at the summary statistics for the 2003-2005 period reported in table 4. The table shows summary statistics for the Belgian banks, the full sample of non-Belgian banks and the banks in the control group group. It also reports whether the bank characteristics for the Belgian

[3] Additional robustness checks show that the results are not sensitive to changing the number of matched banks, see table 9.

[4] The banks in the control group are headquartered in 12 European countries, being Austria,Denmark, France, Germany, Greece, Italy, Luxembourg, Portugal, Romania, Spain , The Netherlands, United Kingdom. More information on the distribution of the banks over the different countries can be found in table 11.

banks are significantly different from those in the two non-Belgian samples. The table shows that, after the matching process, the difference between the Belgian banks and the control group banks in terms of matching variables is statistically not different from zero. Furthermore, the summary statistics also indicate that our matching procedure also equalized a lot of other differences between the Belgian and non-Belgian banks. Whereas bank characteristics such as market share and bank risk are statistically different when comparing the Belgian banks with the full sample of EU-27 banks, this does not hold when comparing the Belgian banks with the matched control group.

Next, I use the matched sample above to analyze the difference in capital ratios between treated and non-treated banks. I am interested in the impact of the change in tax treatment in Belgium on bank capital structures. The matching exercise allows me to make sure that I have two comparable groups of banks. By using a difference-in-difference approach, I can also control for unobserved (non-time varying) differences between both groups and for confounding time trends.

4.2.1 Difference-in-difference - Results

I start the difference-in-difference analysis with a univariate difference-in-difference test. This test compares the difference in the capital ratio between the treated and the control group both before and after the fiscal treatment. Table 5 shows the results for this univariate test. The first and the second column of the first row show the average equity ratio for the Belgian banks (treatment group) before and after the change in tax policy (treatment). The difference between both is shown in the third column, with the corresponding p-value in the last column. Although there is a positive change over time in the equity ratio of the Belgian banks, it is not significantly different from zero. The problem with this strategy is that it does not allow to control for trends that affect the capital ratio in both periods other than the actual treatment. Put differently, the ratios could have changed over the period of observation even without the change in tax treatment, for example due to another, unobserved change in the banking environment that caused banks to change

their capital ratios, which could lead to a biased estimate of the impact of the change in tax treatment. The columns of table 5 compare the capital ratio of the treatment group with the capital ratio of the control group, both for the pre-treatment (first column) and for the post-treatment period (second column). When looking at the post-treatment differences, we see that the average capital ratio for the treatment group is higher than the average capital ratio for the control group (respectively 7.8 and 7.48). However, this comparison could again be biased if there is a permanent difference between the treatment and the control group that already existed before the treatment took place.

To overcome the difficulties related to the two approaches described above, we can combine them and look at the difference-in-difference estimate. The time-invariant difference between the treatment and control groups is differenced away by comparing the two groups within each time period. Second, any common trend that could affect the treatment and control group is eliminated by comparing two time periods. To the extent that the Belgian and the matched group of European banks face similar capital structure decisions, the contemporaneous change in capital ratios of the control group gives an unbiased estimate of how the capital ratio of the Belgian banks would have evolved without the change in tax treatment.

The result for this univariate difference-in-difference exercise is shown in the two last columns of the third row in table 5. The highly significant and positive difference of 0.91 indicates that the average equity ratio for Belgian banks after the reduction in inequality of tax treatment of debt and equity increased significantly compared to what one would expect without the change in tax treatment. In other words, the introduction of an allowance for corporate equity gave the Belgian banks an incentive to increase their equity ratios. The allowance leads to an equity ratio that is on average 0.91 percentage points higher than when their would not have been such an allowance. The impact is also economically large. Given that the average pre-treatment equity ratio in Belgium was 7.41, the change corresponds with an increase in equity ratios of approximately 12 percent.

Table 6 shows similar results when doing the above analysis in a panel regression setup for the period

2003-2007. All standard errors are clustered at the bank level, unless mentioned otherwise. In the first column of table 6, I report the baseline result by reproducing the univariate result in a regression context. I regress the equity ratio on a post-treatment dummy, a dummy equal to one for the Belgian banks and an interaction term between the post-treatment dummy and the Belgium dummy. The variable of interest is the interaction term, as it indicates the actual impact of the fiscal change.

In the second column, I incorporate a bank fixed effect, which makes the treated dummy redundant, as it does not vary within the same bank. The third regression is very similar to the second one, the only difference being that we now cluster our standard errors at the country level. Keep in mind, however, that there are only thirteen countries in our sample, which is a rather low number of groups for clustering, which could potentially bias these results. In column 4 I employ country fixed effects instead of bank fixed effects. As expected, these first four regressions give a similar impact of the fiscal change, with a highly significant coefficient for the interaction variable equal to 0.91. As such, these four models confirm the outcome of the univariate analysis.

For the regression in column five of table 6, I first collapse the data sample into pre- and post-treatment averages at the bank level. More specifically, I take the 2004-2005 average and the 2006-2007 average for each bank in our sample. In previous regressions, I controlled for correlations in the error term by clustering the error terms at the bank or country level. The setup in column five allows to control for similar problems through averaging, which should also lead to correct standard errors (see Bertrand, Duflo, and Mullainathan (2004)). Using this approach, the impact of the change in tax treatment remains positive and highly significant, with a point estimate of 0.84.

Finally, the last column of table 6 illustrates the impact of the allowance for corporate equity on the effective tax rate. If the change in equity ratio is driven by the change in the tax environment due to the introduction of the notional interest rate deduction, I expect to see that the effective tax ratio substantially decreased for the Belgian banks in the post-treatment period. The results confirm this hypothesis as they

show that the effective tax rate for Belgian banks is 7.4 percentage points lower than expected. This strengthens the argument that the the increase in equity ratios during the 2006-2007 period is effectively driven by tax concerns.

Overall, the results in table 6 confirm the findings from the univariate analysis. The reduction of the unequal tax treatment of debt and equity has a significant and economically large impact on the capital structure of banks. On average, the equity ratio increases between 0.83 and 0.91 percentage points for the average Belgian bank in our sample. This finding indicates that - as for non-financial firms - the favorable tax treatment of debt also has an impact on banks. This suggests that reducing the relative tax advantage of debt financing could be used to incentivize bank to build up their capital buffers. The average impact, however, does not tell us whether there is heterogeneity in the impact of the tax treatment across different banks. The following part further explores this issue.

4.3 Heterogeneity in the treatment effect

In this part, I investigate the heterogeneity of the impact of the change in tax treatment across Belgian banks. More specifically, I focus on differences in the impact of the change in tax treatment for banks with different profitability levels, investments in connected firms and market share. I do this by extending the baseline regressions from table 6 with an interaction term between the variable of interest and the indicator that measures the actual impact of the treatment. The results show that the impact of the tax treatment varies over profits and investments in other firms. The difference in reaction across banks with different profitability levels relates back to the idea that loss-making firms will not have an incentive to shield from taxes. If bank capital structure depends - among other factors - on the deductibility of the cost of debt of pre-tax profits, one expects to observe that more profitable firms react stronger to changes in the tax treatment. The underlying idea is that banks that are more profitable have a stronger incentive to decrease their equity ratio in order to profit from the tax shield. However, once the tax discrimination between debt and equity is

lowered through the introduction of the notional interest deduction, these banks will potentially have a larger incentive to adjust their equity ratios, as the tax shield was a more important determinant of their equity ratio compared to banks that had limited profitability. Therefore, I expect that the impact of the change in tax treatment will be stronger for more profitable banks. The variation over banks with different levels of investments in other firms is expected due to the fact that the notional deduction should be calculated based on a 'corrected' equity level, meaning that firms have to subtract investments in connected firms from their equity before being allowed to calculate the deduction. This rule was added to the legislation to prevent that conglomerates could deduct invested money in other firms twice. Thus, I expect to see a stronger increase in equity ratios at banks with a smaller portion of investments in related firms.

The results in the second and the third column of table 7 corroborate these two hypotheses. In the first regression, I interact the difference-in-difference dummies from the baseline model with the pre-tax profits (measured as pre-tax return on assets) of the banks. The rows in the lower part of table 7 show the marginal impact of the tax treatment at the 10th, 25th, 50th , 75th and 90th decile of the variable of interest. The results confirm that the change in tax treatment is indeed stronger for more profitable banks. There is no significant effect on banks in the lowest decile of profit distribution, whereas the impact becomes significant for banks at the second decile. From there onwards, the impact is always positive and significant. For example, while banks at the 10th percentile of the profit distribution on average increase their equity ratios with 0.09 percentage points, banks at the 75th percentile increase their equity ratios with 1.07 percentage points. This result is in line with Heider and Ljungqvist (2012), who show, for a sample of US non-financial firms, that only profitable firms increase their leverage when corporate taxes rise. Next, I examine the impact of differences in the equity investments in connected firms of banks. The notional deduction should be calculated based on a 'corrected' equity level, meaning that firms have to subtract investments in connected firms from their equity before being allowed to calculate the deduction. Thus, I expect to see a stronger increase in equity ratios at banks with a smaller portion of investments in other firms. To test this, I interact

the treatment and post dummies with the ratio of total equity minus equity investments over total equity. If the notional interest rate deduction has an impact on bank capitalization, I expect that banks with a higher ratio will react stronger to the new tax regulation. The results in the third column confirm this. While the impact for a bank at the 10th percentile of the distribution of the investment ratio is 0.55 and insignificant, it becomes significant for banks above the median and increases up to 2.12 for banks at the 90th percentile. This corroborates the idea that the notional interest deduction has a substantial impact on the capital structure of the banks that can make use of it.

The last column of table 7 show the impact of differences in market share on the reaction of the equity ratio to the change in tax treatment. This can be seen as a robustness check for the potential impact of changes in monetary policy. As mentioned above, previous work on the monetary transmission mechanism in the Eurozone has shown that the transmission of policy rates to the actual rates that banks charge can vary for different countries and different types of banks (see, e.g., Van Leuvensteijn, Kok, Bikker, and Van Rixtel (2013) , Kok and Werner (2006), De Graeve, De Jonghe, and Vander Vennet (2007)). Higher policy rates are expected to have a negative impact on loan growth, and lower loan growth could reduce overall growth in total assets, and this will normally happen at a different speed in different countries. Thus, the rising policy rate can potentially change the denominator of the equity ratio, leading to changes in equity ratios due to changes in monetary policy. As the policy rate rose during the period when an allowance for corporate equity was allowed (‘06-‘07), it could be biasing the results. If this would be true, one would expect that banks that have a larger market share adjust their capital ratios more slowly, as bank market power has been shown to have a significant impact on the monetary transmission process (see, e.g. Van Leuvensteijn, Kok, Bikker, and Van Rixtel (2013), De Graeve, De Jonghe, and Vander Vennet (2007)). The results in the last column of table 7, however, indicate that there is no significant difference in the impact of the tax treatment for banks with a high market share vis-a-vis banks with a low market share. Furthermore, unreported results show that bank market concentration (measured by the Herfindahl Hirschman index of total assets) is significantly

higher in the Belgian market compared to the average concentration in the countries in the control group. Thus, if concentration decreases the speed of monetary policy transmission, the increase in interest rates should decrease total assets faster in the control group. This means that, if monetary policy does play a role here, my estimates are rather on the conservative side. This results indicates that it is rather unlikely that the increase in Belgian equity ratios in 2006 and 2007 is driven by changes in monetary policy.

4.4 Impact on bank risk behavior

This part sheds more light on the impact of the notional interest deduction on the risk behavior of financial institutions. The analysis above already indicated that the introduction of an allowance for corporate equity significantly increases the equity ratio of financial institutions, and thus improves the cushion that banks have to absorb future losses. It could thus potentially be an interesting policy tool to incentivize banks to deleverage and reduce overall risk. However, if banks simultaneously take on more risk, the increase in equity ratios will not lead to more stable banks. The regressions in table 8 analyze the relationship between the introduction of the allowance for corporate equity and bank risk.

The first column retakes the baseline result, while the second column shows that there is no difference between high and low capitalized banks in how they react to the allowance for corporate equity. More specifically, the regression in the second column includes interaction terms between the treated and post dummy and a dummy equal to one for banks that have an average equity ratio during the pre-treatment period which is above the pre-treatment median. The treated x post dummy thus shows the impact for low capitalized banks, while the interaction of this dummy with the high-equity dummy indicates the difference between the high and the low group. Unreported regressions show similar results when using a high and low group based on the Z-score (calculated as the ratio of equity plus return on assets over the 3-year standard deviation of returns) or the standard deviation of return on assets. This indicates that the impact of the notional interest rate deduction does not differ between banks that are ex ante more or less risky.

The following two columns focus on the impact of the allowance on the Z-score. On average, I find no significant impact of the introduction of the allowance on the Z-score. However, this overall impact contains some interesting underlying heterogeneity, as the impact is different for high and low capitalized banks. More specifically, the Z-score significantly increases for banks in the low equity group, while this impact disappears for the high group, indicating that low capitalized banks profit more from the increase in equity ratios in terms of risk reduction. The impact is also economically significant for the low equity group. Given that the average Z-score in the sample is 3.53 and that the notional deduction increases the Z-score on average with 0.7 percentage points, this result implies an increase of about 20 percent. The last four columns further explain why low capitalized banks benefit more - in terms of bank stability - from a similar increase in bank capital compared to the high capitalized banks. The results in column six indicate that the latter group tends to increase the riskiness of their asset portfolio, proxied by the 3-year standard deviation of the return on assets. The results in column 8 suggest that at least part of this increase in riskiness is driven by a more risky loan portfolio, as the amount of non-performing loans increased more for the group of banks that ex-ante had higher equity ratios, although this effect is only significant at the 15 percent level. Overall, the results in table 8 suggest that the introduction of an allowance for corporate equity increases bank stability more for low capitalized banks, which indicates that reducing the unequal tax treatment of debt and equity can be an attractive regulatory measure to enhance bank capital levels and could potentially also increase the stability of low capitalized banks.

4.5 Robustness

In this part, I employ several robustness tests to ensure that the main result is not dependent on the specific matching procedure, not biased by potential omitted variables and is not impacted by events taking place at the same time as the actual change in tax treatment. I make use of several different matching setups, I analyze trends in different macro-economic and bank related variables at the the country level that could

indicate a potential contemporaneous shock in the economic environment of the bank, I make sure that the results are not driven by sample selection issues and I also perform placebo studies which indicate that the results do not hold when using a false treatment date. All this lends further support to the viability of the initial empirical setup.

Matching - Robustness

The robustness tests in table 9 confirm that the strong and significant impact of the change in tax treatment does not depend on our matching procedure. For each robustness test, I report results for both the fixed effect setup (similar to column 2 in table 6) and for the setup using pre- and post-treatment averages (similar to column 5 in table 6).

In the first four columns of table 9, I change the number of matched banks. In the baseline setup, I match each Belgian bank with 3 other EU-27 banks. Column 1 to column 4 of table 9 show that the results are not sensitive to changing the number of matches, as they indicate a positive and significant impact of the tax change on the equity ratio. More specifically, using either 4 matches for each bank (column 3 and 4) or only 2 matches for each bank (column 1 and 2) again leads to a positive impact of the tax treatment, ranging between 0.97 and 1.05 percentage points.

For the regressions in column 5 and 6 of table 9, I expand the set of matching variables. In the baseline setup, I use the growth rate of the equity ratio, the equity ratio, bank size and a group of macro-economic indicators as matching variables. Here, I expand this set of variables with a group of bank-specific characteristics, being bank profitability (return on assets ratio), bank risk (standard deviation of returns and loan loss provisions), non-interest income share and a loan ratio (total loans over total assets). The regression results show that expanding the group of control variables has no significant impact on the initial result: the impact of the tax treatment now ranges between 0.96 and 1.12 percentage points, which is similar to the initial result of 0.91 percentage points.

In the next four columns of table 9, I redo the difference-in-difference analysis while falsely assuming

that the change in the treatment law came into effect either in 2003 or 2000 instead of in 2006. As the change in tax discrimination did not take place in these years, the estimated treatment effect should not be significantly different from zero. If not, then the difference-in-difference strategy is most likely picking up other unobservable differences between the treatment and the control group, and the estimation of the impact of the change in tax discrimination will be potentially biased. For each false treatment date, I rerun the matching analysis based on the observations the year before the false treatment date, which is similar to the procedure used in our initial analysis. I again require that all banks in our sample have data available for 3 years before the treatment and 2 years after, similar to the baseline setup. The results in the last four columns of table 9 indicate that there is no significant impact of the false treatments on the equity ratio, which lends further support to the viability of the difference-in-difference setup. Especially the 2000 placebo study is interesting, as the evolution of the ECB policy rate in 2000 was very similar the one in during the actual event period in 2006-2007. More specifically, the ECB policy rate rose from 2 percent up to 3.75 percent between November 1999 and October 2000, which is similar to the increase from 1.00 percent up to 3.25 percent in 2006-2007. As mentioned above, previous work on the monetary transmission mechanism in the Eurozone has shown that the transmission of policy rates to the actual rates that banks charge can vary for different countries and different types of banks (see, e.g., Van Leuvensteijn, Kok, Bikker, and Van Rixtel (2013) , Kok and Werner (2006), De Graeve, De Jonghe, and Vander Vennet (2007)). Higher policy rates are expected to have a negative impact on loan growth, and lower loan growth could reduce overall growth in total assets, and this will normally happen at a different speed in different countries. Thus, the rising policy rate can potentially increase the denominator of the equity ratio, leading to higher equity ratios due to changes in monetary policy. The fact that I do not find a significant rise in the capital ratios of Belgian banks during a period with a similar change in monetary policy rates makes it less likely that the increase in equity ratios is driven by changes in monetary policy rates. Finally, the regressions in the last two columns of table 9 is similar to the baseline regression, but includes a larger sample of banks. For the baseline analysis in this

paper, I require that the bank has data available for each year between 2003 and 2007. For this robustness check, I relax this assumption and only require that there is data available for at least 3 years, which increases the number of avaible banks from 35 to 44. The results show that the positive impact of the notional interest rate deduction also hold in this broader sample.

Expectations, outliers and confounding events - Robustness

Throughout the empirical analysis, I take several steps to ensure that I am identifying the causal effect of the change in the tax environment on bank capital structures, i.e. that the treatment is not correlated with unobserved determinants of bank capital structures. The difference-in-difference approach allows me to control for unobserved differences between the banks in the treatment and the control group that do not vary over time and also allows me to control for different trends in both groups. The matching exercise allows me to construct a balanced control group with similar bank-specific characteristics as the banks in the treatment group. As I already matched the treatment and the control group based on - among other factors - the equity ratio, I did not further control for potential determinants of the equity ratio in the difference-in-difference setup. In the first column of table 10, I do add a group of bank-specific control variables to the difference-in-difference setup. I add proxies for bank profitability (return on assets), bank size (log of total assets), risk (standard deviation of return and loan loss provisions), income and asset structure (non-interest income ratio and loans over total assets ratio) and market power (market share in terms of total assets). In this way, I make sure that potential shocks in one of the bank-specific determinants that occurred at the same time as the tax change (or during the post-treatment period) are not driving the results. The positive and significant coefficient on the interaction term of 0.87 in the first column of table 10 indicates that our main result also holds when further controlling for these determinants.

Another type of omitted variable that could be causing problems is one that varies at the same level as the tax treatment, i.e. the country-year level. For example, if there would have been a general bank run on

the deposits of Belgian banks that confounded with the change in the tax code, it could be that the coefficient on the variable of interest is driven by the strong deterioration of the deposits at Belgian banks instead of the actual change in tax treatment, which would make it impossible to come up with a reliable estimate of the impact of the tax change. Unfortunately, as the variable of interest only varies at the country-year level, I cannot simply add country-year fixed effects to neutralize the impact of all confounding events at the country-year level. Instead, I employ two alternative robustness checks.

First, I add a group of macro-economic and country-specific control variables (GDP growth, the inflation rate and GDP per capita) to the difference-in-difference regression. In this way, I reduce the probability that potential shocks in the macro-economic environment that occurred at the same time as the tax change (or during the post-treatment period) are driving the main result. The second column in table 9 shows the impact of including both bank and country-specific control variables to the initial setup. The positive and significant coefficient for the interaction term indicates that the baseline result is not affected by taking into account changes at the macro level.

Second, I provide additional descriptive evidence that there were no particular shocks to the overall economic environment in Belgium that could have had a similar impact on the capital structure as the introduction of the allowance for corporate equity. The graphs in figure 2 indicate that both the economic growth, inflation and growth in non-performing loans did not experience a particular shock in Belgium during the post-treatment. The figures also indicate that these three economic indicators evolved quite similar for all countries in our matched sample. This confirms that there was no particular macro-economic shock that confounded with the policy change in Belgium during the post-treatment period. Furthermore, there were- to the best of our knowledge - no big institutional changes in Belgium that happened at the same time as tax change. In addition, figure 3(d) indicates that the difference-in-difference results are not driven by a simultaneous increase in tax rates in the control group countries. If anything, tax rates decreased in the countries in the control group, potentially making my results on the conservative side. Overall, these graphs

show that it is unlikely that the estimates are biased due to confounding events at the country-year level.

As a final robustness check, column 3 and 4 of table 10 show that the main result is not driven by potential changes during the last year before the treatment or by a group of outliers. More specifically, in the third column of table 10 I remove the observations for 2005, as they could already be impacted by the announcement of the tax change taking place from 2006 onwards. In the second column, I ensure that the result is not driven by outliers - in terms of equity growth- in the treatment. To do this, I remove the banks with the 5 percent highest growth rates between the pre-treatment and the post-treatment period from the treatment group. Doing this should make the estimate of the treatment effect more conservative, as I reduce the possibility that the positive impact of the treatment is purely driven by the fastest growing banks -in terms of equity ratios- in the treatment group. The regression result shows that result still holds when removing these outliers. The treatment now leads to 0.80 percentage points higher equity ratio, compared to a growth of 0.91 percentage points in our baseline setup.

5 Conclusion

This paper documents the impact of the tax discrimination between debt and equity funding on bank capital structures. The analysis of an exogenous shock to the tax treatment of debt and equity in Belgium indicates that reducing the relative tax advantage of debt has a substantial positive impact on bank capital ratios.

First, I show that introduction of an allowance for corporate equity in Belgium in 2006, which is a fiscal change that affected the relative marginal cost of debt and equity, significantly increased the capital ratios of a group of Belgian banks. To gain a more profound understanding of the causal impact of tax deductibility on bank capital levels, I employ a difference-in-difference strategy where I compare the impact of the change in tax treatment on Belgian banks with the evolution of capital ratios at a group of matched European control banks. I find that a reduction of the the unequal tax treatment of debt and equity has a

significant impact on the capital structure of banks. On average, the capital ratio increases between with 0.91 percentage points for the average Belgian bank in our sample. The impact is also economically large. Given that the average pre-treatment equity ratio in Belgium was 7.4, the change corresponds with an increase in equity ratios of approximately 12 percent.This suggests that reducing the relative tax advantage of debt financing could be used to incentivize bank to build up their capital buffers. Furthermore, my results reveal that more profitable banks respond stronger to changes in the relative tax advantage of debt financing, which corroborates existing theories on the impact of a tax shield on leverage, as loss-making banks have a lower incentive to shield from taxes. Similarly, my results also indicate that there is a direct impact of the new deduction on effective tax rates. This confirms that banks are making use of this deduction, which is a necessary condition when arguing that the deduction has an impact on equity ratios. Finally, my results also shed more light on the impact of the notional interest deduction on the risk behavior of financial institutions. If banks simultaneously increase equity ratios and take on more risk, the increase in equity ratios will not lead to more stable banks, which could make it a less interesting policy tool. My results suggest that the introduction of an allowance for corporate equity increases bank stability more for low capitalized banks, which indicates that reducing the unequal tax treatment of debt and equity can not only be an attractive regulatory measure to enhance bank capital levels, but could potentially also increase the overall stability of low capitalized banks.

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Table 1: Full sample summary statistics - 2003-2007

This table shows the summary statistics for the bank-specific variables and macro-variables used throughout the paper for the sample period 2003-2007. The bank-specific data is retrieved from the Bureau van Dijk Bankscope database, macro-economic variables are downloaded from the World Development Indicators database at the World Bank. Exact definitions of all variables can be found in table 12. The summary statistics for the bank-specific variables are based on bank-year observations, whereas the summary statistics for the macro-economic variables are based on country-year observations, which explains the difference in observations between both categories of variables.

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**N**
Equity ratio	8.949	7.351	0.26	95.33	14105
Size	6.879	1.685	1.932	13.867	14105
Profits	0.619	1.138	-16.9	23.08	14105
Loan ratio	0.578	0.202	0	0.989	14105
Non-interest income share	0.307	0.161	0	0.991	14105
Non-performing loans	0.285	0.354	0	5.432	14071
Risk	0.252	0.448	0	5.431	13776
Market share	0.007	0.033	0	0.666	14105
GDP per capita - growth	3.824	2.971	-1.621	12.849	135
CPI rate	3.399	2.487	-1.34	14.14	135

Table 2: Evolution of Belgian capital ratios

This table documents the change in capital ratios in Belgium in 2006 and 2007, i.e. after the introduction of the allowance for corporate equity. The dependent variable in each regression is the equity ratio (total equity over total assets). The first three columns focus on a sample of Belgian banks. In the first column, the equity ratio is regressed on two dummies that are equal to one for Belgian banks in either 2006 (Belgium-2006) or 2007 (Belgium-2007). The sample period for this regression is 2003-2007. In the second column, I add a group of bank-specific control variables to the regression. In the third column I expand the sample period by starting in 2000. In the last three columns I look at a broader sample of EU-27 banks and perform a similar analysis as for the Belgian sample, while now also including time fixed effects and country-specific characteristics. All regression include bank fixed effects, standard errors are clustered at the bank level.

	(1) ETA	(2) ETA	(3) ETA	(4) ETA	(5) ETA	(6) ETA
Belgium-2006	0.107	0.323	1.078**	0.321	0.415	0.472
	(0.276)	(0.295)	(0.496)	(0.392)	(0.408)	(0.388)
Belgium-2007	0.681*	1.166**	2.063***	0.932*	1.100*	1.163**
	(0.379)	(0.475)	(0.651)	(0.562)	(0.570)	(0.538)
Size		-1.424**	-2.804**	-3.762***	-3.758***	-3.095***
		(0.586)	(1.169)	(0.851)	(0.897)	(0.429)
Profits		0.259	0.0949	0.0290	0.0318	0.0550
		(0.184)	(0.325)	(0.168)	(0.168)	(0.125)
Risk		0.584*	0.695	0.149	0.144	0.436*
		(0.306)	(0.544)	(0.320)	(0.320)	(0.224)
Non-performing loans		-1.871	2.559**	0.334	0.298	1.298
		(1.314)	(1.192)	(0.910)	(0.919)	(0.858)
Non-interest income share		-3.093	-4.524**	0.423	0.494	0.477
		(3.351)	(1.729)	(0.838)	(0.840)	(0.564)
Loans over total assets		2.939	5.488	-0.875	-0.873	-1.554**
		(5.526)	(6.949)	(1.141)	(1.168)	(0.766)
CPI rate					0.124	0.218***
					(0.0848)	(0.0708)
GDP per capita - growth					-0.00250	0.0647
					(0.0901)	(0.0610)
HHI					4.043**	2.045
					(1.669)	(1.555)
Constant	7.409***	19.22***	27.72***	33.48***	32.95***	27.56***
	(0.114)	(3.980)	(6.732)	(5.775)	(6.122)	(2.947)
Observations	175	159	241	13,359	13,359	19,895
Number of bankid	35					
Adjusted R-squared	0.918	0.920	0.870	0.896	0.896	0.878
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	Yes	Yes	Yes
Clusterlevel	Bank	Bank	Bank	Bank	Bank	Bank
Sample	Belgium '03-'07	Belgium '03-'07	Belgium '00-'07	EU-27 '03-'07	EU-27 '03-'07	EU-27 '00-'07

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Matching procedure - Probit regression

This table shows the regression results for the probit regression used in the matching procedure and for the same probit regression on the matched sample. The first column shows the results for the full sample probit regression of a dummy discriminating between Belgian and other EU-27 banks. The regression is done on 2005 data for all EU-27 banks that have the required data available between 2003 and 2007. The second column shows the results for the same regression when only using the banks in the matched sample.

	(1) Pre-Matching	(2) Post-Matching
Equity ratio - Growth	-0.0186**	-0.00775
	(0.00738)	(0.0105)
Equity ratio - Growth (t-1)	-0.0195**	-0.0166
	(0.00866)	(0.0124)
Equity ratio	0.0523	0.0690
	(0.0397)	(0.102)
Equity ratio(t-1)	0.117*	0.120
	(0.0630)	(0.0895)
Equity ratio(t-2)	-0.210***	-0.222
	(0.0780)	(0.150)
Ln(Total assets)	0.0918*	-0.0389
	(0.0499)	(0.0710)
Commercial banks	0.505**	-0.198
	(0.220)	(0.390)
Bank holding company	1.242**	-0.0262
	(0.575)	(0.662)
Savings bank	-0.0685	-0.162
	(0.283)	(0.510)
CPI rate	0.569***	0.0330
	(0.0931)	(0.148)
GDP per capita - Growth	-0.474***	-0.0642
	(0.116)	(0.204)
Constant	-3.581***	0.0376
	(0.448)	(0.762)
Observations	2,821	140
Pseudo R-squared	0.282	0.0234

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Summary statistics - '03-'05

This table reports summary statistics for the pre-treatment period (2003-2005) for the bank-specific variables used throughout the paper. The table consists of three panels. The first panel shows the summary statistics for the Belgian banks, the second panel focuses on the full sample of non-Belgian banks and the last panel shows information for the non-Belgian banks selected for the control group. The last column of the second and the third panel reports the p-value for a t-test which respectively checks whether the average for the full sample of non-Belgian banks or for the banks in the control group is significantly different from the average value for the Belgian banks.

	Belgian Banks			Non-Belgian Banks							
	Treatment Group			Full Sample				Control Group			
Variables	N	Mean	St. Dev.	N	Mean	St. Dev.	P-value	N	Mean	St. Dev.	P-value
Equity ratio - Growth	105	-2.03	24.07	8251	2.84	20.99	0.04	315	-2.70	19.59	0.80
Equity ratio	105	7.41	7.16	8358	8.93	7.51	0.03	315	8.00	4.62	0.43
Profits	105	0.64	1.55	8358	0.58	1.16	0.71	315	0.71	1.03	0.65
Market share	105	0.03	0.06	8358	0.01	0.03	0.00	315	0.02	0.06	0.65
Size	105	8.40	2.23	8358	6.76	1.65	0.00	315	8.35	1.94	0.84
Loan ratio	105	0.37	0.22	8358	0.58	0.20	0.00	315	0.59	0.23	0.00
Non-interest income share	105	0.31	0.24	8358	0.30	0.16	0.71	315	0.32	0.15	0.54
Non-performing loans	105	0.34	0.35	8340	0.30	0.36	0.21	315	0.34	0.25	0.91
Risk	96	0.49	0.79	8038	0.24	0.44	0.00	315	0.36	0.48	0.11

Table 5: Univariate difference-in-difference

The difference-in-difference in this table is based on a group of Belgian banks (treatment group) for which we have data available between 2003 and 2007 and a group of matched banks from other EU-27 countries (control group) for the same time period. Matching was done using a nearest neighborhood match procedure based on 2005 data, which is the last year before the tax regulation was changed. The table shows the averages for both groups during the pre-treatment (2003-2006) and the post-treatment period (2006-2007). We assess the significance of the differences in means based on a t-test. The table reports the p-values of these t-tests in the last column and the row of the table.

	Pre-Treatment	Post-Treatment	Difference	Difference - P-value
Treated	7.41	7.80	0.39	0.73
Untreated	8.00	7.48	-0.52	0.18
Difference	-0.59	0.32		
Difference - P-value	0.43	0.74	0.91	0.00

Table 6: Difference-in-difference regressions

This table analyzes the impact of the change in tax regulation in a regression setup. We include all observations on banks in the treatment and the control group over the period 2003-2007. In the first column,we regress the equity ratio on a post-event dummy which equals one in 2006-2007 (‘Post‘), a dummy indicating whether the bank is a Belgian bank (‘Treated‘)and an interaction term between both dummies that captures the actual impact of the tax change. In the first column, we estimate this model using standard OLS. In the second and the third column, we also include bank fixed effects, which make the Treated dummy obsolete, as it does not change within a bank. The difference between the results in the second and the third column is the clustering level. The error terms in the second regression are clustered at the bank level, whereas we cluster at the country level in the third column. The fourth column is similar to the second column, but we now control for country fixed effects instead of bank fixed effects. In the fifth column, we compare the difference in the average equity ratio over the 2004-2005 period with the average ratio over the 2006-2007 period between the treatment and the control group. The last column illustrates the direct impact of the allowance for corporate equity on the effective tax rate, calculated as the ratio of payed taxes over pre-tax profits.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ETA	ETA	ETA	ETA	Average ETA	Effective tax rate
Treated	-0.590					
	(1.237)					
Post	-0.516**	-0.516*	-0.516	-0.516**	-0.361	-0.349
	(0.257)	(0.286)	(0.309)	(0.259)	(0.241)	(3.386)
Treated x Post	0.910**	0.910**	0.910**	0.910**	0.838**	-7.400*
	(0.380)	(0.424)	(0.309)	(0.383)	(0.346)	(4.389)
Constant	7.998***	7.851***	7.851***	7.851***	7.714***	24.13***
	(0.427)	(0.0915)	(0.0928)	(0.401)	(0.135)	(1.056)
Observations	700	700	700	700	280	698
Adjusted R-squared	-0.002	0.842	0.842	0.113	0.901	0.082
Bank FE	No	Yes	Yes	No	Yes	Yes
Clusterlevel	Bank	Bank	Country	Bank	Bank	Bank
Country FE				Yes		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Heterogeneity in the treatment effect

The regressions in this table control for heterogeneity in the response to the notional interest deduction across Belgian banks. Each column shows the result for a regression of the equity ratio on a dummy equal to one during the post-treatment period (Post), a dummy equal to one for the treated Belgian banks during the post-treatment period (Post x Treated) and an interaction term between the latter dummy and a bank-specific variable (Post x Treated x Variable). The bank-specific variables of interest are the investments on connected firms, (pre-tax) return on assets and market share in terms of total assets. All regressions include bank-fixed effects, standard errors are clustered at the bank level.

	(1) Baseline	(2) Profits	(3) Connected firms	(4) Market Share
Post	-0.516*	0.254	-0.416	-0.449
	(0.286)	(0.387)	(0.787)	(0.322)
Treated x Post	0.910**	0.273	0.489	0.889*
	(0.424)	(0.523)	(0.863)	(0.490)
Variable		0.741	1.154	-0.0671
		(0.475)	(0.763)	(0.136)
Treated x Variable		-0.837	-1.468*	-0.203
		(1.039)	(0.864)	(0.201)
Post x Variable		-0.917*	-0.201	-0.0217
		(0.470)	(0.811)	(0.0662)
Treated x Post x Variable		0.804	0.567	-0.0104
		(0.744)	(0.839)	(0.0750)
Constant	7.851***	6.846***	7.131***	8.155***
	(0.0915)	(0.289)	(0.531)	(0.281)
Observations	700	548	700	700
Adjusted R-squared	0.842	0.893	0.860	0.842
Bank FE	Yes	Yes	Yes	Yes
Clusterlevel	Bank	Bank	Bank	Bank
10th Percentile		0.0970	0.546	0.889
P-value		0.881	0.489	0.0630
25th Percentile		0.852	0.658	0.889
P-value		0.0440	0.313	0.0720
Median		1.034	0.811	0.888
P-value		0.0420	0.100	0.0720
75th Percentile		1.071	1.186	0.884
P-value		0.0460	0.0130	0.0700
90th		1.077	2.128	0.763
90th P-value		0.0470	0.214	0.326

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Heterogeneity in the treatment effect - Pre-treatment Equity ratio

This table illustrates the difference in impact of the allowance for corporate equity between banks that were either low or high capitalized during the pre-treatment period. The table shows the impact of the allowance for corporate equity on the equity ratio (ETA) the Z-score, the standard deviation of the return on assets and Non-Performing Loans (NPL). For each variable, the table shows the average impact of the allowance on the specific variable (column 1, 3, 5 and 7) and the difference in impact for the high and the low equity group (column 2, 4, 6 and 8). The regressions in column 2, 4, 6 and 8 include interactions between the treatment and post dummy and a high equity dummy which equals one for banks that have an average equity ratio during the pre-treatment period which is above the pre-treatment median. The Z-score is the ratio of the sum of the equity ratio and return on assets over the standard deviation of the returns. The standard deviation of the returns is calculated over a three year period. All regressions include bank fixed effects, standard errors are clustered at the bank level.

VARIABLES	(1) ETA	(2) ETA	(3) Z-score	(4) Z-score	(5) $\sigma(ROA)$	(6) $\sigma(ROA)$	(7) NPL	(8) NPL
Post	-0.516*	-0.386*	0.0350	-0.112	-0.0758**	-0.0278	-0.0295*	0.00182
	(0.286)	(0.233)	(0.105)	(0.160)	(0.0383)	(0.0539)	(0.0177)	(0.0297)
Treated x Post	0.910**	0.823*	0.157	0.689*	0.0502	-0.191	0.0866	-0.00836
	(0.424)	(0.432)	(0.299)	(0.369)	(0.142)	(0.130)	(0.0657)	(0.0350)
Post x ETA-high		-0.263		0.303		-0.0988		-0.0629*
		(0.577)		(0.206)		(0.0760)		(0.0348)
Treated x Post x ETA-high		0.175		-1.058*		0.476*		0.194
		(0.856)		(0.578)		(0.272)		(0.133)
Constant	7.851***	7.851***	3.712***	3.709***	0.389***	0.390***	0.343***	0.343***
	(0.0915)	(0.0915)	(0.0440)	(0.0428)	(0.0186)	(0.0179)	(0.00828)	(0.00814)
Observations	700	700	670	670	672	672	697	697
Adjusted R-squared	0.842	0.842	0.469	0.478	0.491	0.500	0.744	0.748
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusterlevel	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Robustness - Matching, placebo tests and sample selection

This table includes further robustness checks for the difference-in-difference results. We perform 4 robustness checks and we report the results for a setup similar to column two of table 6 and column 5 of table 6.The former includes bank-year observation for the 2003-2007 period and is estimated using bank fixed effects, while the latter includes compares 2003-2005 averages with 2006-2007 averages. For the first robustness check (column 1 to 4) we match each bank in the treatment group with either 2 or 4 non-treated banks instead of 3. For the second robustness check (column 5 and 6) we use a broader set of matching variables. In column 7 to 10, we perform two placebo studies where we assume that the treatment took place in 2000 or 2003 instead of in 2006. For the regressions in the last two columns the data availability restrictions made when selecting the sample are relaxed, which leads to a larger sample of 44 banks instead of 35.

	2 Matches		4 Matches		Match Variables		'03 Placebo		'00 Placebo		Unrestricted Sample	
	ETA	Average ETA	ETA	Average ETA	ETA	Average ETA	ETA	Average ETA	ETA	Average ETA	ETA	Average ETA
Post	-0.651***	-0.490***	-0.526**	-0.426**	-0.725**	-0.481**	0.543**	0.784***	-0.0137	-0.150	-0.834***	-0.757***
	(0.245)	(0.183)	(0.230)	(0.201)	(0.300)	(0.239)	(0.252)	(0.235)	(0.301)	(0.260)	(0.272)	(0.231)
Treated x Post	1.045***	0.966***	0.919**	0.903***	1.119**	0.957***	0.300	0.193	0.162	0.328	1.486***	1.284***
	(0.398)	(0.309)	(0.388)	(0.319)	(0.433)	(0.345)	(0.807)	(0.701)	(0.439)	(0.379)	(0.545)	(0.398)
Constant	7.497***	7.362***	7.994***	7.898***	7.865***	7.662***	8.134***	7.920***	9.479***	9.574***	12.13***	12.00***
	(0.0776)	(0.104)	(0.0776)	(0.119)	(0.0952)	(0.134)	(0.108)	(0.171)	(0.0958)	(0.146)	(0.0923)	(0.131)
Observations	525	210	875	350	700	280	840	336	900	360	867	339
Adjusted R-squared	0.895	0.956	0.876	0.920	0.858	0.913	0.926	0.931	0.903	0.957	0.950	0.973
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusterlevel	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Robustness - omitted variables, sample period and outliers

This table includes further robustness checks for the difference-in-difference results. In the first two columns, we add an additional set of bank (first and second column) and country-specific control variables (second column) to the the initial setup. The third column is similar to the second column in table 7, the only difference being that we exclude 2005 observations, as these might already be influenced by the announcement of the treatment. In the fourth column, we exclude treatment banks that have a very high growth - meaning higher 95th percentile - in the equity ratio in the post-treatment period. All regressions include bank fixed effects. Standard errors are clustered at the bank level.

	(1)	(2)	(3)	(4)
	ETA	ETA	ETA	ETA
Post	0.0693	-0.238	-0.781**	-0.516*
	(0.226)	(0.273)	(0.378)	(0.287)
Treated x Post	0.858*	0.807*	0.928*	0.801*
	(0.459)	(0.463)	(0.539)	(0.425)
Constant	26.06***	21.95***	8.111***	7.904***
	(6.391)	(4.660)	(0.150)	(0.0922)
Observations	648	648	560	690
Adjusted R-squared	0.855	0.858	0.832	0.846
Bank FE	Yes	Yes	Yes	Yes
Clusterlevel	Bank	Bank	Bank	Bank
Bank control variables	Yes	Yes	No	No
Country control variables	No	Yes	No	No

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Country list

This table shows descriptive information for the corporate tax rate and the equity ratio for the matched countries included in the difference-in-difference approach. For each country, we report the number of banks included in the analysis, the average equity ratio and the average tax rate over the sample period (2003-2007).

Country	N	Equity ratio	Corporate tax rate
Austria	2	4.72	29.05
Belgium	35	7.56	34.93
Denmark	1	11.37	29.00
France	6	5.39	33.91
Germany	9	5.39	38.54
Greece	4	8.70	31.83
Italy	32	8.37	37.89
Luxembourg	2	4.62	29.73
Portugal	5	10.73	27.58
Romania	10	12.56	21.33
Spain	13	7.15	34.58
The Netherlands	1	2.34	31.43
United Kingdom	4	5.90	30.83

Table 12: Variable definitions

ratio	description	source
	Bank-specific variables	
Equity ratio	total equity over total assets	Bankscope
Effective tax rate	pre-tax profits minus profits over pre-tax profits	Bankscope
Size	Ln(Total assets)	Bankscope
Profits	Return on assets	Bankscope
Risk	standard deviation of the return on assets over the past three years	Bankscope
Loan loss provisions	loan loss provisions over total assets	Bankscope
Non-interest income	non-interest income over total income	Bankscope
Loan ratio	total loans over total assets	Bankscope
	Country-specific variables	
GDP per capita growth	Growth in GDP per capita	World Development Indicat
CPI	Growth in the consumer price index	World Development Indicat
GDP per capita	GDP per capita	World Development Indicat
Corporate tax rate	Corporate tax rate	KPMG - Corporate and Indi

Figure 1: Evolution of the equity ratio for the Belgian banks in our sample

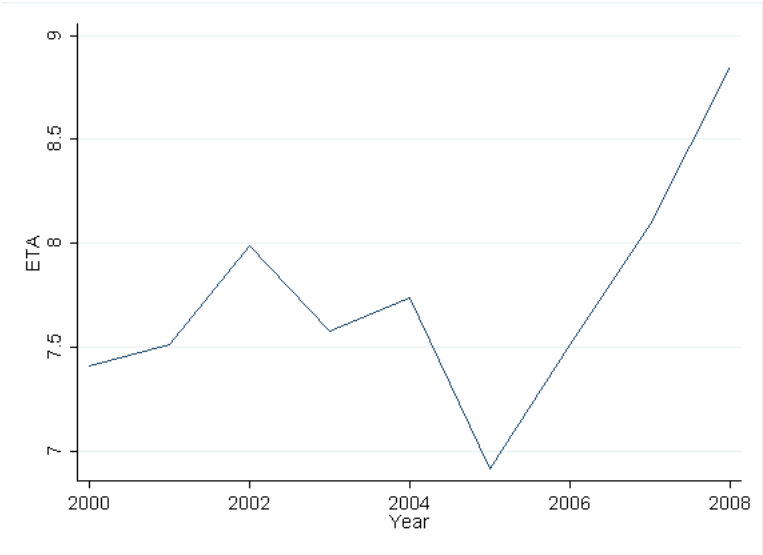
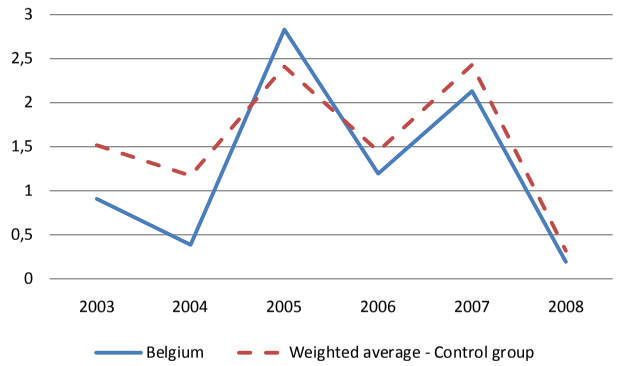
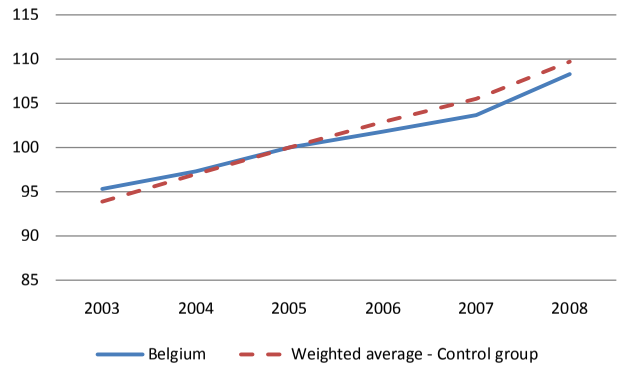


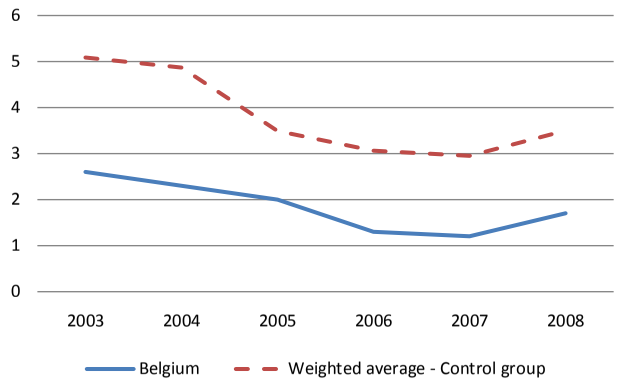
Figure 2: Macro environment



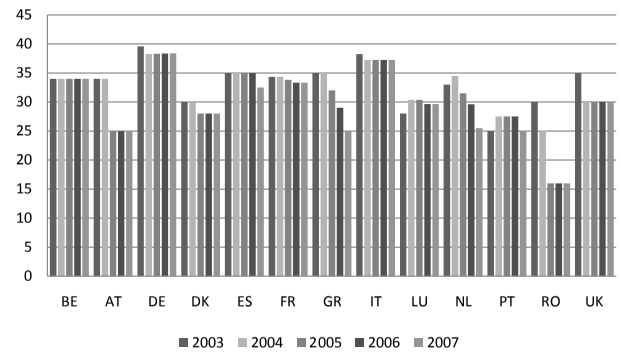
(a) GDP per capita - growth rates



(b) CPI - 2005=100



(c) Non-Performing Loans



(d) Tax rates