Taxes and bank capital structure

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Abstract

This paper shows that a reduction in tax discrimination between debt and equity funding leads to better capitalized financial institutions. In many countries, the cost of debt is tax-deductible while the remuneration for equity (dividends) is not deductible. Theoretically, this unequal treatment gives a bank - as any other firm - an incentive to take on more debt. This paper exploits exogenous variation in the tax treatment of debt and equity created by the introduction of a tax shield for equity in Belgium. This quasi-natural experiment demonstrates that a more equal treatment of debt and equity significantly increases bank capital ratios, driven by an increase in common equity. Additionally, the results illustrate that both high and low capitalized banks react to the change in tax legislation, but that the latter profit more in terms of overall risk reduction. Overall, the findings confirm that reducing the tax discrimination between debt and equity could be an innovative policy tool for bank regulators.

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1 Introduction

This paper investigates whether reducing the relative tax benefit of debt can be a valuable addition to existing bank capital regulation. The 2008-2009 financial crisis spurred both regulators and politicians around the world to rethink bank capital regulation. Ensuring that regulation contributes to proper risk-taking incentives and sufficient loss-absorbing capacity for financial institutions, however, remains a difficult task. This paper focuses on an often overlooked factor in the regulatory debate on bank capital, being tax deductibility of interest expenses on debt. Following up on the seminal work of Modigliani and Miller (1958), both Stiglitz (1973) and King (1974) theoretically showed that tax shields have an impact on corporate capital structures, and thus ultimately on financial stability. Hence, reducing the unequal tax treatment of debt and equity could be an excellent addition to current capital regulation (see, e.g., Poole (2009)). Studying the direct impact of tax shields on bank capital structure, however, is a complicated task. Corporate tax shields tend to be rather constant over time and changes to tax rates are more often than not part of a broader fiscal reform package, which makes it difficult to tease out the direct impact of tax shields. As a consequence, empirical evidence on the relation between tax shields and capital structure is mixed for non-financial corporates (see Graham and Leary (2011) for an excellent overview of the existing capital structure literature) and very limited for financial institutions.

To better understand the impact of tax shields on the capital structure decisions of financial institutions, I exploit an exogenous change in tax legislation in Belgium in 2006 that reduced the relative tax advantage of debt funding by creating a tax shield for equity, called the notional interest rate deduction (NID). The exogenous variation created by this change allows me to identify the direct impact of the unequal tax treatment of debt and equity on bank capital levels. As such, it allows me to investigate how changes to tax shields can contribute to better bank capital regulation.

The first contribution of this paper is the empirical confirmation that tax shields have a significant impact on bank capital structure decisions. Employing a difference-in-differences approach, I show that the equity ratios of Belgian banks increased significantly after reducing the relative tax advantage of debt, compared to a control group of European banks. 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 increases the equity ratio of the average treated bank in the baseline setup with 1.03 percentage points, which corresponds with an increase of more than 15 percent. The explanation for this finding can be found in the trade-off theory of capital structure, as creating a tax shield for equity decreases the marginal benefit of debt. This confirms that reducing the tax discrimination between debt and equity could be an interesting and innovative policy tool for bank regulators.

Second, I investigate which factors are driving this change in equity ratios. Banks can increase their equity ratios either by increasing their equity or by jointly decreasing liabilities and total assets. If the observed increase in capital buffers is driven by the surge in the (relative) benefit of equity, the change should be rather coming from an increase in equity instead of a reduction of activities. The results in this paper confirm that the impact of the change in tax treatment is driven by an increase in bank equity and not by a reduction of activities. Following the introduction of the notional interest rate deduction, Belgian banks retain a significantly larger portion of their income compared to the banks in the control group. Additionally, also the non-reserves part of equity increases for the treated banks. The finding that the increase in equity ratios is driven by an increase in the amount of equity is crucial for at least three reasons. First, a bank regulator will generally prefer an increase in equity over a reduction in assets - which could potentially harm the real economy - when requiring higher capital buffers. Indeed, a large part of the regulatory discussion on higher capital requirements exactly focuses on whether or not they could harm the real economy through for example a reduction in bank lending. The fact that the increase in equity ratios is driven by an increase in equity is thus essential if one wants to consider tax shields as a regulatory policy tool. Second, it indicates that the observed changes in equity ratios are unlikely to be driven by a reduction in loan demand due to the fact that the tax change also holds for non-financial firms. Third, this result also suggest that the increase in capital buffers is not driven by heterogeneity in the pass-through of a contemporaneous increase in ECB policy rates during the treatment period. Higher policy rates are expected to have a negative impact on loan growth, and lower loan growth could reduce overall growth in total assets, which will normally happen at a different speed in different countries (see, e.g., Van Leuvensteijn et al. (2013), Kok and Werner (2006), De Graeve et al. (2007)). The fact that I do not find a significant difference in asset or loan growth between the treated and the control banks, while I do observe higher equity growth rates, makes it highly unlikely that a heterogeneous pass-through of the contemporaneous interest rate hike is driving the results. Additional robustness tests also confirm this finding.

The third contribution of this paper lies in addressing two additional concerns a regulator might have when contemplating to use tax shields as an incentive mechanism to increase bank capital buffers. First, regulators will be concerned whether both (ex-ante) low and high capitalized banks react to the change in tax treatment. Second, one will also be interested in the impact on bank risk behavior. Higher equity ratios are beneficial for bank stability as they increase the loss-absorbing capacity of banks. Additionally, they could also impact ex-ante risk taking behavior. Theoretical work on this topic has shown that higher capital reduces asset-substitution moral hazard (Merton (1977), Furlong and Keeley (1989), Coval and Thakor (2005)) and strengthens a banks' incentive to monitor, as shareholders of better capitalized banks have more to lose from bank failure (see, e.g., Holmstrom and Tirole (1997), Mehran and Thakor (2011)). The results in this paper show that both (ex-ante) low and high capitalized banks react similar to the introduction of a tax shield for equity in terms of capital structure adjustments, but that they react differently in terms of risk taking behavior. More specifically, the findings show a significant risk reduction for ex-ante low-capitalized banks after the introduction of the NID, while there is no change in riskiness for ex-ante high capitalized banks. A potential explanation for this finding is that there are diminishing returns to the screening and monitoring of borrowers. Higher capital ratios lead to a stronger incentive for the bank to screen and monitor borrowers, but these efforts become increasingly more costly. Hence, ex-ante low capitalized banks profit more of the increase in equity ratios in terms of risk reduction. Additionally, the idea of diminishing returns to the screening and monitoring of borrowers is also in line with the assumption of a convex cost function of bank monitoring, as for example assumed by Besanko and Kanatas (1993) and Carletti (2004).

Overall, the results in this paper confirm that a reduction of tax frictions could be an important part of a regulatory incentive scheme that leads to better capitalized and more stable financial institutions. The empirical identification for this finding relies on a difference-in-differences (DiD) approach which compares the evolution of the capital buffers of Belgian banks that were subject to the change in tax legislation (treated group) with a group of banks in other European countries that did not experience such a change (control group). The key identifying assumption is that, in absence of the treatment, both groups are only randomly different ('common trend assumption'). As such, a propensity score matching procedure is used to match the treated Belgian banks with a group of similar, non-Belgian European banks. After this matching, there are no differences in pre-treatment trends of the equity ratio between both groups, which is a necessary condition for the common trend assumption to hold. Additionally, I also control for traditional time-varying determinants of bank capital structure in the DiD setup, next to the standard bank and period fixed effects. After this, the only remaining concern is that there are country-specific events happening contemporaneously with the change in tax legislation that also impact bank capital structure. Next to controlling for country-specific characteristics in the DiD setup, I perform several additional robustness checks to reduce this concern. First, I limit the control group to banks located in neighboring countries to better control for common shocks. Second, I devote special attention to the increase in the ECB monetary policy rate that happened simultaneously with the introduction of tax change. The results of these extra tests alleviate the concern that the main result is driven by contemporaneous changes in the economic environment of the Belgian banks. A similar methodology is also used when analyzing the impact of the tax treatment on the sub-components of the equity ratio and on the risk characteristics of the banks.

This paper contributes to the literature on bank capital structure by focusing on the direct impact of tax shields. While tax shields play an important role in the theoretical (Stiglitz (1973), King (1974)) and empirical (see, e.g., Titman and Wessels (1988), Fisher et al. (1989), Ang and Peterson (1986), MacKie-Mason (1990), Graham (1996) or more recently, Heider and Ljungqvist (2014) and Panier et al. (2013)) literature on firm capital structure, the impact on bank capital structure is largely unexploited. Previous work on bank capital structure primarily focuses on the bank-specific determinants of (optimal) bank capital structure (Gropp and Heider (2010), Flannery and Rangan (2008), Berger et al. (2008)) or on how banks make capital structure adjustments (De Jonghe and Öztekin (2013), Memmel and Raupach (2010), Francis and Osborne (2012)). Papers focusing on corporate tax rates and bank leverage are scarce. Ashcraft (2008) shows that there is a positive cross-sectional relation between effective state-level tax rates and bank leverage ratios in the United States. In two related IMF working papers, De Mooij and Keen (2012) and De Mooij et al. (2013) analyze the relation between corporate taxes, bank leverage and the probability of financial crisis for a worldwide panel of banks. They find that a favorable corporate tax treatment of debt is positively correlated with higher bank leverage and a higher probability of experiencing a financial crisis. Horváth (2013) uses a similar panel and confirms the positive relation between tax rates and leverage, while also adding that higher corporate tax rates lead to a reduction in risk-weighted assets. Finally, Schandlbauer (2013) documents that an increase in local U.S. state corporate tax rates leads to an increase in debt for well-capitalized banks, while low-capitalized banks alter the asset side of their balance sheet. By the best of my knowledge, this paper is the first paper that exploits exogenous variation in the tax treatment of debt and equity created by the introduction of a tax shield for equity to identify the direct impact of tax shields on bank capital structure.[1] While previous work mainly relies on (minor) changes in corporate tax rates that often go hand in hand with additional legislative changes, this paper relies on an explicit and exogenous change in tax shields. As such, the paper provides a clean estimation of the importance of tax shields for

[1]In a contemporaneous paper, Panier et al. (2013) analyzes the impact of equity tax shields on firm capital structure

financial institutions, which makes it possible to evaluate whether they should be part of the standard toolbox of bank capital regulators.

Second, this paper also contributes to the discussion on bank capital and risk taking. Existing theoretical work shows that higher bank capital could lead to lower bank risk taking because it reduces asset-substitution moral hazard (Merton (1977), Furlong and Keeley (1989), Coval and Thakor (2005)) and strengthens banks monitoring incentives (Holmstrom and Tirole (1997), Mehran and Thakor (2011)). In contrast, Koehn and Santomero (1980) and Kim and Santomero (1988) argue that higher bank capital could increase risk taking because it gives banks an incentive to shift into riskier assets. Empirical work on this topic either focuses on the impact of capital requirements on bank risk taking (Laeven and Levine (2009)), on capitalization and performance during crisis periods (Berger and Bouwman (2009), Demirgüç-Kunt et al. (2013)) or on the impact of capital support measures during crisis periods (Berger et al. (2014), Duchin and Sosyura (2014), Gropp et al. (2014), Giannetti and Simonov (2013), Black and Hazelwood (2013), Li (2013)). This paper contributes to this literature by analyzing the impact of an exogenous increase in capital ratios after a reduction in tax discrimination on bank risk behavior. Additionally, the paper also illustrates the (indirect) impact of tax shields on bank risk behavior, which is a factor that is neglected in the existing literature on bank risk taking.[2]

The remainder of the paper is structured as follows. Part 2 provides detailed information on the notional interest deduction, Part 3 describes the data used throughout the paper and part 4 describes the methodology used and the results. In part 5, I perform a battery of robustness checks to ensure that the main results are not depending on the matching procedures or potential sample selection issues, not biased by potential omitted variables and not impacted by events occurring at the same time as the actual change in tax treatment. Finally, part 6 summarizes the main conclusions.

[2]The only other paper looking at taxes and bank risk is Horváth (2013), who shows that there is a negative correlation between risk-weighted assets and corporate tax rates.

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 the cost of debt is deductible as an expenditure when calculating taxable profits, while this is not the case for dividends (Klemm (2007)). 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 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. Since 2006, Belgian firms are allowed to deduct a notional return of their book value of equity. The reason for introducing this deduction goes back to a ruling by 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 against Belgian firms. This lead to the introduction of the notional interest rate deduction, which partly replaced the tax benefit for the multinational coordination centers with an allowance on corporate equity that is applicable to all firms incorporated in Belgium. This allowance thus created a tax shield for equity for Belgian firms.

The deduction equals the calculated average 10-year Belgian 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.[3] Hence, not the actual equity cost, i.e. the return to shareholders, but an estimated equity cost is tax deductible. The new law was approved in parliament in June 2005 and 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.[4] Three other countries tried out a partial ACE system before, being Italy (1997-2003), Austria (2000-2004) and Brazil (1996 up until today).

The current evidence on the impact of the NID in Belgium is scarce and mixed for non-financial corporations and non-existing for financial institutions. Kestens et al. (2011) use a non-random sample of firms to perform a simulation study to analyze the impact of the tax change on small and medium enterprises. They 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 group of French and German firms, and finds that there is a negative impact on firm leverage. Panier et al. (2013) confirms these findings when using a broader and better defined control group while also focusing on differences within the treatment group. Van Campenhout and Van Caneghem (2013), however, show that the allowance for corporate equity did not affect the financing decisions of a group of small enterprises.

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

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

3 Data

The bank-specific balance sheet data used for the empirical analysis is retrieved from the bureau van Dijk Bankscope database. I select all EU-27 commercial, savings and cooperative banks that have data available for each year between 2003 and 2007 on all main 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, such as government support measures in 2008. For the introductory analysis in part 4.1, I also use data for this same group of banks for the period 2000-2003. This selection leaves us with a starting sample of 30 Belgian banks and 2,851 other European banks, for which I collect data between 2000 and 2007.

The main variable of interest is the equity ratio, defined as total equity over total assets. To analyze the underlying drivers of the change in equity ratios, I use the share of retained income (defined as retained income over pre-tax profits) and the total amount of equity reserves. Throughout the paper, a group of bank-specific characteristics are used as control variables: bank size (defined as the log of total assets), profitability (proxied by return on assets) bank risk (proxied by the Z-score or by the standard deviation of returns) and bank diversification (proxied by loans over total assets or by the share of non-interest income in total income).

When focusing on bank risk behavior, I construct two balance sheet risk measures and three loan portfolio risk measures. The two balance sheet measures are the standard deviation of return on assets (based on the returns between t-2 and t) and the Z-score. Each of these indicators is calculated using Bankscope data. The Z-score measures the distance to insolvency (Roy (1952)) and can be interpreted as the number of standard deviations by which returns would have to fall from the mean to wipe out all equity in the bank. A higher Z-score thus implies a more stable bank. The Z-score is calculated as the ratio of the sum of return on assets and the equity ratio over the standard deviation of the returns (over a three year window). It is frequently used as a measure of stability in the banking literature, see, e.g. Demirgüç-Kunt and Huizinga (2010), Houston et al. (2010), Laeven and Levine (2009), Beck et al. (2013). To obtain information on bank loans and bank loan portfolio risk, I make use of the Belgian corporate credit register and the Belgian Central Balance Sheet Office. For the period under analysis, the corporate credit register contains monthly data on all outstanding loans of banks active in Belgium to firms incorporated in Belgium, from the moment that the total amount borrowed by the firm is larger than 25,000 euro. For this paper, I use quarterly aggregates at the bank-firm level instead of monthly data. After linking the 30 banks to the register and removing banks that have on average less than 20 firms in their portfolio I retain 22 banks in the sample for the risk analysis. Next, I obtain balance sheet data for the firms that are borrowing from these banks from the Central Balance Sheet Office. For each firm, I calculate their leverage ratio, interest burden (financial costs over cash flow) and the Altman Z-score. I then calculate weighted versions of these variables at the bank-quarter level for all new bank loans in a quarter, with the weights being the size of the loans. These three measures are then used as proxies for the riskiness of new loans granted by the banks. The part of the risk analysis that is based on loan data is thus performed at the bank-quarter level, in contrast with the other parts of the paper, where bank-year level data is used.

The three macro-economic variables used throughout the analysis (GDP per capita growth, GDP per capital and CPI) are downloaded from the World Development Indicators database at the World Bank. All variables are winsorized at the one percent level in order to deal with outliers. Summary statistics for these variables can be found in table 3.

4 Empirical analysis

To better understand the underlying relationship between tax shields and bank capital structure, I analyze the introduction of an allowance for corporate equity in Belgium in 2006. This section first describes the methodology used throughout the empirical analysis and then presents the results. I first analyze whether Belgian capital ratios increased after the introduction of the allowance for corporate equity. Next, I focus on the matching procedure and the difference-in-differences strategy that are used to come to consistent estimates of the impact of the change in tax treatment. After having established that the notional interest rate deduction impacts bank capital structure decisions through changes in equity, I focus on the heterogeneity in the impact of the tax shield across banks and on the consequences for bank risk taking.

4.1 Methodology

4.1.1 Belgian capital ratios: evolution over time

I start the empirical analysis by investigating the evolution of the capital ratios of the Belgian banks in my sample over time. To do this, I run the following regression:

$$ETA_{i,t} = \alpha + \beta_1 * D_{2006} + \beta_2 * D_{2007} + \beta_3 * X_{i,t-1} + \delta_i + \varepsilon_{i,t} \tag{1}$$

Where $ETA_{i,t}$ is the bank capital ratio, defined as equity over total assets, D_{2006} and D_{2007} are dummies equal to one in respectively 2006 and 2007 , $X_{i,t-1}$ is a vector with additional bank capital structure determinants and δ_i is a bank fixed effect. Previous bank capital structure research (see, e.g., Gropp and Heider (2010), Berger et al. (2008), Flannery and Rangan (2006), De Jonghe and Öztekin (2013)) has shown that although bank fixed effects explain the majority of the variation in bank equity ratios, there are also time-varying bank-specific characteristics that have an impact on the equity ratio. Therefore, $X_{i,t-1}$ includes one period lagged proxies for bank size (the logarithm of total assets), bank profitability (return on assets), risk (the standard deviation of return on assets), asset composition (total loans over total assets) and income structure (non-interest income over total income) to the regression. As the allowance for corporate equity reduced the tax discrimination between debt and equity funding after 2005, I expect a significant positive coefficient for both the 2006 and 2007 dummy.

4.1.2 Difference-in-difference setup and matching

A potential problem with the analysis of the Belgian capital ratios over time is that it does not allow to control for trends that affect the equity ratio before and after the change in tax legislation. 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 equity ratios, which could lead to a biased estimate of the impact of the change in tax treatment. To overcome this problem, I apply a difference-in-differences 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 tax environment did not change. More precisely, the baseline difference-in-differences setup looks as follows:

$$ETA_{i,t} = \alpha + \beta_1 * Treated_i + \beta_2 * Post_t + \beta_3 * Treated_i * Post_t + \varepsilon_{i,t} \tag{2}$$

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 coefficient of interest is the coefficient for the interaction variable (β_3), as it shows the actual impact of the treatment. The difference-in-differences approach ensures that the estimates will not be biased by permanent differences between the treatment and the control group or by shared trends.

The key identifying assumption for obtaining reliable difference-in-differences estimates is the common trend assumption. This assumption states that, in the absence of treatment, the average outcome for the treatment and control group would have followed parallel paths over time, which is something that is hard to verify. In order to try to comply with this assumption, I use a propensity score matching procedure to construct a control group of European banks, based on their characteristics in the pre-treatment period. The reason for using this technique is twofold. First, the common trend 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. 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. Additionally, I add two macro-economic variables (GDP growth and inflation) 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.

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 equity 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 equity ratio in the pre-treatment period to make it more likely that the parallel trends assumption is fulfilled 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 two lags of the equity ratio and 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. I then use the predicted probabilities of the probit model to match each Belgian bank with its three nearest non-Belgian neighbors.[5] The matching is done with replacement, which means that each non-Belgian bank

[5] Additional robustness checks show that the results are not sensitive to changing the number of matched banks, see table 8.

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 30 treated Belgian banks and 93 control group banks.[6] 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 impact of the matching procedure is illustrated in table 1 and table 2. Table 1 shows summary statistics for the period before the the introduction of the notional interest rate deduction (2003-2005), for both the Belgian banks, the full sample of non-Belgian banks and the banks in the control group after the matching procedure. It also reports statistics on the reduction of the differences between the Belgian banks and the banks in the non-Belgian sample. The summary statistics first of all indicate that the common trend assumption is violated when using the full sample of non-Belgian banks as a benchmark group, as the growth in the equity ratios in the pre-treatment period is significantly different compared to the Belgian banks. Furthermore, banks operating in Belgium also differ in terms of a number of other characteristics. For example, Belgian banks are on average larger and have significantly lower equity ratios during the pre-treatment period. The success of the matching procedure is illustrated by two different indicators. First, the p-values in the 'control group' panel of table 1 illustrate that there are no significant differences between the majority of the variables in the treatment and the control group. Most importantly, after the matching procedure the growth of the equity ratio in the pre-treatment period does not significantly differ between the Belgian banks and the control group banks, which is a necessary condition for the common trend assumption to hold. Additionally, the p-values also indicate that the matching procedure equalized a lot of other differences between the Belgian and non-Belgian banks. Whereas bank characteristics such as market share and bank size are statistically different when comparing the Belgian banks with the full sample of EU-27 banks,

[6]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 10.

this does not hold any more when comparing the Belgian banks with the matched control group. In a similar vein, comparing the columns 'Bias full' and 'Bias matched' shows a strong decrease in the standardized percentage bias between the Belgian banks and respectively all banks in the full sample and the banks in the control group. The bias is the percentage difference of the sample means in the treated and non-treated sub-samples as a percentage of the square root of the average of the sample variances in the treated and non-treated groups (see Rosenbaum and Rubin (1985)). The column '% change in bias' shows the percentage change in this bias after matching. A positive value implies that the averages are lying closer to each other after matching. This statistic shows a large reduction in the bias - ranging between 13 and 100 percent - after the matching procedure for the majority of the variables. For the loan ratio and the CPI rate there was no such improvement after the matching. Remember, however that the banks in both the control and the treatment group are not required to be exactly similar along all dimensions. The fact that the trend in the dependent variable is made similar is by far the most important prerequisite for the difference-in-differences analysis, and this is indeed obtained through the matching procedure. Table 2 further focuses on this common trend assumption. The equity ratio is the main variable of interest, but the paper also analyzes the impact of the NID on several sub-components of the equity ratio and on bank risk characteristics. As these variables are used as dependent variable in a difference-in-differences setup, the common trend assumption should also hold for them. As such, table 2 reports the growth rates for all dependent variables during the full pre-treatment period (2003-2005) on a year-by-year basis. The table shows the average growth rate for each variable for both the treatment and the control group, the difference between both and a corresponding p-value for a t-test on the equality of the means. The summary statistics in this table indicate that the parallel trend assumption is satisfied for the vast majority of the variables of interest. The average values for the growth in the equity ratio, its two sub-components (total assets and total equity) and the growth in the two main risk indicators (Z-score and the volatility of returns) are always statistically indistinguishable when comparing the treatment and the control group, with the exception of 2004 for the Z-score. Overall, the summary statistics in table 2 confirm that the matching procedure leads to an appropriate control group for our analysis. The propensity score matching not only ensured that the common trends assumption holds for the main dependent variable, c.q. the equity ratio, but also ensured that it holds for the other dependent variables that are analyzed. On top of that, it also made the banks in the treatment and the control group more similar along other dimensions that could impact capital structure decisions, such as size and a group of bank business model characteristics.

Next, I use the matched sample to analyze the difference in equity 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-differences approach, I can also control for unobserved (non-time varying) differences between both groups and for confounding time trends. In robustness tests, I also add time-varying bank-and country-specific bank capital structure determinants to assure that my estimates of the impact of the NID are not impacted by a contemporaneous shock to these characteristics. After this, the only remaining concern is that there are country-specific events happening contemporaneously with the change in tax legislation that also impact bank capital structure. Next to controlling for country-specific characteristics in the DiD setup, I perform several additional robustness checks to reduce this concern in the robustness section.

4.2 Results

4.2.1 Evolution of the Belgian capital ratios over time - results

The regression results in the first four columns of table 4 illustrate 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. In column one and two of table 4 I regress the equity ratio of the 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 likely 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. Both regressions also include bank fixed effects, as do all other regressions in this table.

The results in the first column of table 4 indicate that the equity ratio for the Belgian banks gradually increased in 2006 and 2007, leading to an equity ratio that was 0.25 percentage points higher in 2006 and 0.45 percentage points higher in 2007 compared to the average equity ratio between 2003 and 2005.

In the second column, I add a group of bank-specific capital structure determinants to the regression. Adding these variables strongly increases the coefficients on the 2006 and 2007 dummies and leads to a significant impact for 2007: the coefficients respectively rise from 0.25 and 0.45 to 0.42 and 0.81, 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 is around 1.5 billion euros, while the median size for the 2006-2007 period equals 2.05 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 close to the ones reported in column 2. In the third column, the dependent variable is the natural logarithm of the equity ratio. The results show that the increase in 2006 and 2007 corresponds with a higher equity ratio of around 8.6 percent in 2006 and 18.2 percent in 2007, which is economically large. [7]

In the fourth column of table 4, I expand the sample by also including the observations between 2000 and 2002 as a further robustness check. The results indicate that the 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 change in tax legislation 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 setup for the fifth column of table 4 is similar to the one used in column three, but the sample now contains all non-Belgian, EU-27 banks. The results show that the equity ratios for the average European bank outside of Belgium remained relatively stable, with growth rates of 2.56 percent in 2006 and growth rates of around zero in 2007. This indicates that the growth rates of 8.1 and 18.1 percent in Belgium during these two years were indeed rather exceptional.

The last column of table 4 illustrates the evolution of the effective tax rate for the Belgian banks in the sample, calculated as taxes paid over pre-tax profits. 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. Indeed, the

[7] 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 dummy variables is derived by Kennedy (1981):

$$\hat{p} = 100 * (exp[\hat{c} - 0.5 * \hat{V}(\hat{c})] - 1)$$

where $\hat{p}$ is the percentage change in the dependent variable given a change in the dummy variable from zero to one, $\hat{c}$ is the coefficient estimate for the dummy variable and $\hat{V}(\hat{c})$ is the estimated variance for this coefficient. For example, the coefficient of 0.170 for the 2007 dummy in column three of table 4 corresponds with an increase of $100*(exp[0.171-0.5*0.0823^2]-1) = 18.2$ percent. This transformation is used throughout the paper when discussing the results for log-linear regressions.

average tax rate was 5.8 and 8.6 percentage points lower in the two years after the introduction of the tax shield for equity. Overall, the evolution of the equity ratios for Belgian banks presented in this table are a first indication that there was an increase in the equity ratio for Belgian banks following the introduction of the allowance for corporate equity. The more stable evolution of the equity ratio in other EU-27 countries and the decrease in effective tax rates for Belgian banks indicates that this was potentially driven by the introduction of the tax shield for equity.

4.2.2 The equity tax shield and bank capital structure: Difference-in-differences results

Table 5 shows the results for the difference-in-differences analysis which compares the evolution of the equity ratios of the Belgian banks with those of a control group of European banks. All standard errors are clustered at the bank level, unless explicitly mentioned otherwise. The first column of table 5 reports the baseline result in a setup without bank fixed effects. 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 captures the actual impact of the introduction of the tax shield for equity. The significant and positive coefficient of 1.03 indicates that the average equity ratio for Belgian banks increased significantly compared to what one would expect without the change in tax treatment. Figure 1 gives a graphical illustration of this finding. While the equity ratio of the banks in the control group further follows the pre-2005 trend, the equity ratio of the Belgian banks experiences a positive shock after the introduction of the equity tax shield. In the second column of table 5, I incorporate a bank fixed effect, which makes the treated dummy redundant, as it does not vary within the same bank. In the third column, the dependent variable is replaced by the natural logarithm of the equity ratio. The result in this column shows that the impact is also economically large, as the increase in the equity ratio of 1.03 percentage points corresponds with an increase of 15.1 percent for the average bank in our sample.

The difference-in-differences approach allows to control for unobserved differences between the banks in the treatment and the control group that do not vary over time and to control for similar trends in both groups. The matching exercise allows to construct a balanced control group with similar bank-specific characteristics as the banks in the treatment group. Next, I make sure that potential shocks in one of the time-varying determinants of bank capital structure are not driving the results in the fourth column of table 5. Therefore, I add a group of bank- and country-specific control variables to the difference-in-differences setup. I add proxies for bank profitability (return on assets), bank size (log of total assets), risk (standard deviation of return), income and asset structure (non-interest income ratio and loans over total assets ratio) and market power (market share in terms of total assets). Additionally, in order to control for contemporaneous shocks to the economic environment of the banks, I also add macro-economic control variables to the setup (GDP growth, GDP per capita and the CPI rate). The positive and significant coefficient on the interaction term of 1.14 indicates that the main result also holds when further controlling for observable changes over time of capital structure determinants. It also confirms that the propensity score matching procedure created a reliable control group, as the coefficient and standard deviation are similar to the ones in the baseline setup without control variables.

For the regression in column five of table 5, the data is first collapsed 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, clustering the error terms at the bank or country level took care of potential correlations in the error term. The setup in column five allows to control for similar problems through averaging, which should also lead to correct standard errors (see Bertrand et al. (2004)). Using this approach, the impact of the change in tax treatment remains positive and highly significant, with a point estimate of 0.93.

Finally, the last column of table 5 illustrates the impact of the allowance for corporate equity on the effective tax rate. If the change in equity ratios is driven by a change in the tax environment due to the introduction of the notional interest rate deduction, the effective tax ratio should decrease for the Belgian banks in the post-treatment period. The results corroborate this hypothesis as they show that the effective tax rate for Belgian banks is almost 8 percentage points lower after the introduction of the NID than expected. This strengthens the argument that the increase in equity ratios during the 2006-2007 period is effectively driven by tax concerns.

Overall, the results in table 5 show that 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 with around 15 percent for the Belgian banks in our sample, compared to what we would expect without the introduction of the NID. This finding indicates that - as for non-financial firms (see Panier et al. (2013)) - tax shields matter for the capital structure of financial institutions. As such, reducing the relative tax advantage of debt financing can be used to induce banks to build up their capital buffers.

Next, I investigate which factors are driving this change in equity ratios. Banks can increase their equity ratios either by increasing their equity or by jointly decreasing liabilities and total assets. If the observed increase in capital buffers is driven by the increase of the (relative) tax benefit of equity, the change should be rather coming from an increase in equity instead of from a reduction of activities. Additionally, if the observed increase in capital buffers is driven by a reduction in lending, this could be potentially harmful for the real economy. This would make the notional interest rate deduction less appealing as a capital regulation tool. Table 6 sheds more light on this issue. The first column indicates that the equity ratio for the Belgian banks is 15.1 percent higher than expected after the introduction of the notional interest rate deduction. Column 2 shows that this increase is mainly driven by a rise in equity. Equity levels for the Belgian banks are on average 13.6 percent higher (with a t-statistic of 1.63) during the post-treatment period compared to what one would expect based on the evolution of the equity levels in the control group. Additionally, column 3 and 4 of table 6 confirm that the increase in the equity ratios of the Belgian banks is not driven by a shrinking or slower growing balance sheet. There is no significant difference in the evolution of total assets or loans between the Belgian banks and the control group. The result in column 5 to 7 indicate how the higher amount of total equity is reached. The easiest way to increase equity levels is retaining a larger share of profits in the bank instead of distributing it to shareholders. Indeed, column 5 shows that the NID leads to a significant rise in the share of retained income (defined as retained income over total pre-tax profits) for the Belgian banks with about 20.7 percent. The NID gives banks an incentive to retain a higher share of their earnings. Column 7, however, illustrates that this rise did not lead to a significantly different evolution in total retained reserves for the Belgian banks, although the coefficient is positive. The main explanation for this is that profits rose faster for the control group banks, such that the higher retention rate for Belgian banks did not lead to a higher increase in retained earnings. Column 6 indicates that the non-retained earnings component of total equity also did increase for the Belgian banks, although the effect is again insignificant. Overall, the results in this table indicate that the increase in equity ratios after the introduction of the NID is driven by an increase in total equity. Furthermore, while the NID also gave Belgian banks an incentive to retain a higher share of their earnings, the main driver for the difference in equity ratio growth rates between the Belgian banks and the control group might as well be an increase in the non-retained earnings related component of total equity.[8] The data set at hand, however, makes it difficult to precisely estimate where the increase in equity is coming from, as the sub-components are not always available and as the actual split up is not always clear.

4.2.3 NID, heterogeneity in treatment and the evolution of bank risk taking

This part analyzes two additional concerns a regulator could have when contemplating to use tax shields as an incentive mechanism to increase bank capital buffers. First, regulators will be interested whether different types of banks react similar to the reduction in tax discrimination. For example, if only high capitalized banks react to the policy change, then the reduction in tax discrimination would be less appealing compared

[8]This component includes actual shareholder capital, minority interests and other reserves. The data set at hand, however, does not allow me to make a further split up.

to a situations where it also impacts banks that (ex-ante) have a low capital buffer. Second, one will also be interested in the impact on bank risk behavior. 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. Additionally, this could also impact ex-ante risk taking behavior. Theoretical work on this topic has shown that higher capital reduces asset-substitution moral hazard (Merton (1977), Furlong and Keeley (1989), Coval and Thakor (2005)) and strengthens a banks' incentive to monitor, as shareholders of better capitalized banks have more to lose from bank failure (see, e.g., Holmstrom and Tirole (1997), Mehran and Thakor (2011)). In order to shed more light on these issues, the first four columns of table 7 show the impact of the allowance for corporate equity on the equity ratio, the Z-score and the standard deviation of the return on assets, conditional on a banks' pre-treatment equity ratio. The Z-score is a frequently used bank stability measure which is calculated as the ratio of the sum of the equity ratio and return on assets over the standard deviation of the returns.[9] A higher Z-score thus implies a more stable bank.

The first column of table 7 retakes the baseline result, indicating that the equity ratio is around 15.1 percent higher (compared to the control group) for the average Belgian bank after the reduction in tax discrimination. The second column shows the underlying heterogeneity in this result. More specifically, the regression in the second column includes interaction terms between the treated and post dummy and the pre-treatment (2005) equity ratio. This ratio is normalized to have zero mean and unit variance, such that the treated x post dummy shows the impact for the average bank, while the coefficient on the interaction term with the equity ratio indicates the impact of a standard deviation change in the (ex-ante) equity ratio. The results in the second column of table 7 indicate that the impact of the policy change on the capital buffer is not significantly different for banks that are a standard deviation away from the average equity ratio compared to the average bank. Put differently, both high and low capitalized banks react similar to

[9] The standard deviation of the returns is calculated over a three year window, including year t-2, t-1 and t.

the NID in terms of equity ratio growth. Column 3 of table 7 illustrates the impact of the policy change on overall bank stability, proxied by the logarithm of the Z-score. The significant and positive coefficient for the treated x post interaction indicates that there is a significant increase in Z-score for the average Belgian bank. However, the negative coefficient for the interaction term with the standardized equity ratio implies that low capitalized banks experience a more positive shock in the Z-score and thus in their overall stability. A similar result is found in column four, where the dependent variables is the (3 year) standard deviation of returns. The results in column 4, for example, imply that there is a decrease in the volatility of returns for the average bank of around 10.6 percent, while there is a 24 percent reduction in volatility for banks that are a standard deviation below the average equity ratio. As the equity ratio variable is normalized, the coefficient for the treated x post interaction shows the impact for the average bank (-0.103). The coefficient of 0.11 for the interaction term with the standardized 2005 equity ratio implies that the impact for a bank that is one standard deviation below the average equity ratio is equal to -0.10 minus 0.11 = -0.21, which is significantly different from zero (t-stat =2.45, not reported), and corresponds with a 24 percent reduction.[10] In contrast, the impact for a bank that is one standard deviation above the average equity ratio in 2005 is -0.013, which corresponds with a 1.7 percentage reduction, but which is not statistically different from zero (t-stat=0.174, not reported).

The advantage of using widely used risk measures as the Z-score and the volatility of returns is that they can be easily calculated for a large group of banks. A potential disadvantage may be that they are rather crude proxies of bank risk. Therefore, while the first part of table 7 focuses on the evolution of these risk indicators for Belgian banks relative to the evolution in the control group, the second part contains information on the

[10]as explained above, coefficients for dummy variable need to be transformed if we want to interpret in terms of the percentage impact on a dependent variable. The appropriate transformation is given by Kennedy (1981):

$$\hat{p} = 100 * (exp[\hat{c} - 0.5 * \hat{V}(\hat{c})] - 1)$$

where $\hat{p}$ is the percentage change in the dependent variable given a change in the dummy variable from zero to one, $\hat{c}$ is the coefficient estimate for the dummy variable and $\hat{V}(\hat{c})$ is the estimated variance for this coefficient.

evolution over time of the riskiness of the loan portfolios of the Belgian banks. As I only have credit data available for Belgian banks, a difference-in-differences setup is not possible. The advantage, however, is that this credit data allows me to construct more detailed (credit) risk measures, which is an interesting addition to the risk analysis in the first part of table 7. To obtain information on bank loan portfolio risk, I make use of the Belgian corporate credit register. For the period under analysis, this register contains monthly data on all outstanding loans of banks active in Belgium to firms incorporated in Belgium, from the moment that the total amount borrowed by the firm is larger than 25,000 euro. After linking the 30 banks to the register and removing banks that have on average less than 20 firms in their portfolio I retain 22 banks in the sample. Next, I obtain balance sheet and income statement data for the firms that are borrowing from these banks from the Central Balance Sheet Office. For each firm, I calculate their leverage ratio, interest burden (financial costs over cash flow) and the Altman Z-score. I then calculate weighted versions of these variables at the bank-quarter level for all new bank loans in a quarter, with the weights being the size of the loans. The idea is that the risk characteristics of firms that enter the loan portfolio of a bank contain valuable information on the risk taking decisions of that bank. The coefficients for the post dummies in column 5 to 7 of table 7 show the change in riskiness after the introduction of the NID for the average bank in the sample, while the coefficient on the interaction term of the post dummy with the standardized 2005 equity ratio shows the impact of a standard deviation change in the (pre-NID) equity ratio. The results confirm the findings from the cross-country analysis. Banks with ex-ante lower equity ratios exhibit a significant decrease in risk-taking. More specifically, the weighted leverage ratio and the interest burden of new loans entering the loan portfolio of low capitalized banks are significantly lower than the ones for the average bank. Similarly, the weighted Altman Z score of their new loans is higher, which indicates that they are lending to firms with lower default probabilities.

Overall, the results in table 7 indicate that there was a decrease in riskiness for the low and medium capitalized Belgian banks after the introduction of the NID, while this was not the case for higher capitalized banks. An explanation for this finding is that there are diminishing returns to the screening and monitoring of borrowers. Higher capital ratios lead to a stronger incentive for the bank to screen and monitor borrowers, but these efforts become increasingly more costly. Put differently, a bank with ex-ante low screening and monitoring incentives can gain a lot in terms of (credit) risk reduction, whereas the expected gain for a bank that already heavily invests in monitoring and screening is significantly lower. This finding is in line with the assumption of a convex cost function of bank monitoring (see, e.g. Besanko and Kanatas (1993)),Carletti (2004)), illustrating that it is increasingly difficult for a bank to find out more and more about a firm.

4.3 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 or by events taking place at the same time as the actual change in tax treatment. I make use of different matching setups, I make sure that the results are not driven by sample selection or outlier issues and I also perform placebo studies which indicate that the results do not hold when using a false treatment date. All these additional tests lend further support to the viability of the initial empirical setup and the correctness of the main results.

Matching and sample selection- Robustness

Table 8 contains a first batch of robustness tests. For each robustness test, the results for both the fixed effect setup with the logarithm of the equity ratio as dependent variable (similar to column three in table 5) and for the setup using pre- and post-treatment averages are reported (similar to column five in table 5).

In the first four columns of table 8, I change the number of matched banks. In the baseline setup, I match each Belgian bank with 3 other EU-27 banks. Column one to column four of table 8 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 only 1 match for each bank (column one and two) or 5 matches for each bank (column 3 and 4) again leads to a positive impact of the tax treatment, ranging between 11.4 and 16.3 percent .

For the regressions in column five and six of table 8, 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), non-interest income share, collateral (fixed assets over total assets) and a loan ratio (total loans over total assets). The regression results show that expanding the group of matching variables has no significant impact on the initial result: the impact of the tax treatment now lies around 12.5 percent and remains significant. In columns seven and eight I restrict the number of countries from which the control group banks are selected to the three largest neighbors of Belgium (Germany, France and the Netherlands) in order to control better for common macro-shocks in the treatment and the control group. Again, this change does not qualitatively alter the main result, as I now find an increase in equity ratios that is about 14.1 percent higher for the Belgian banks.

In the next two columns of table 8, I redo the difference-in-differences analysis while falsely assuming that the NID came into effect in 2000 instead of in 2006.[11] As the change in tax discrimination did not take place in this year, the estimated treatment effect should not be significantly different from zero. If not, then the difference-in-differences 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. I rerun the matching analysis based on the observations the year before the false treatment date, which is similar to the procedure used in the initial analysis. I again require that all banks in the sample have data available for 3 years before the treatment and 2 years after, similar to the baseline setup. The results in columns nine and ten of table 8 indicate that there is no significant impact of the false

[11]in an unreported specification, I do a similar analysis but with 2003 as the false treatment date. The results are again insignificant.

treatment on the equity ratio, which lends further support to the viability of the difference-in-differences setup. Additionally, this placebo study is a very interesting test as the evolution of the ECB policy rate in 2000 was very similar to the one 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. 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 et al. (2013) , Kok and Werner (2006), De Graeve et al. (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 equity 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. Additionally, the fact that there is no significant difference between the treatment and the control group in terms of loan growth after the introduction of the NID (see table 6, column 4) further corroborates this finding. Finally, the regressions in the last two columns of table 8 are similar to the baseline regressions, but include a larger sample of banks. For the baseline analysis in this paper, I require that the banks have 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 (with a minimum of one year for the post period), which increases the number of available Belgian banks from 30 to 44. The results show that the positive impact of the notional interest rate deduction also hold in this broader sample.

Expectations and outliers - Robustness

As a final set of robustness checks, this part ensures that the main results are not driven by M&A's in

Belgium during the treatment period, potential changes during the last year before the treatment or by a group of outlier bank in either the treatment or the control group.

In the first four columns of table 9, I study the impact of potential outliers on the main result. In the first column of table 9, I exclude bank-year observations for Belgian banks that were involved in takeovers during the treatment period, which could cause shocks to the equity ratio that have no relation with the NID and thus could bias the results. In practice, this means that I exclude 4 bank-year observations from the treatment period. In the second column, I remove the 10 percent of Belgian banks that had the largest growth in equity ratios after the introduction of the NID compared to their growth rate before the introduction. In this way, I make sure that my results are not driven by only three or four Belgian banks with the biggest shock in equity ratios. The sample specification for the regression in column three is similar to the one in column two, but I now also remove the 10 percent of control group banks that had the lowest growth rate in equity ratios after the introduction of the NID. In the fourth column, I combine the two restrictions from column two and three. The results in these four columns indicate that the main findings are not driven by these mergers or by the banks with extreme growth rates in equity ratios. I still find a significant positive impact of the NID on equity ratio growth ranging between 10.7 and 14.6 percent, compared to an impact of 15.2 percent in the main analysis. Finally, in the last column of table 9 I remove the observations for 2005, as they could already be impacted by the announcement of the tax change taking place from 2006 onwards. The result remains very close to the baseline result, with a significant point estimate of the impact of the NID of 15.3 percent.

5 Conclusion

As previous financial crisis periods, the '08-'09 crisis triggered an extensive and worldwide debate on bank capital regulation. This paper focuses on an often overlooked factor in this regulatory discussion on bank capital, being tax deductibility of interest expenses on debt. In many countries, the cost of debt is tax-deductible while the remuneration for equity (dividends) is not deductible. Theoretically, reducing this unequal tax treatment should reduce bank leverage, which could help in creating a more stable banking system.

This paper documents the impact of tax shields on bank capital structure by taking advantage of exogenous variation in the tax treatment of debt and equity created by the introduction of a tax shield for equity in Belgium. The results in this paper first of all indicate that reducing the relative tax advantage of debt has a substantial positive impact on bank equity ratios. Using a difference-in-differences approach, I show that the equity ratios of Belgian banks increased significantly after the introduction of a tax shield for equity, compared to a control group of European banks. More specifically, the equity ratio of the average Belgian bank in the baseline setup increases with around 15 percent. Next, I show that the impact of the change in tax treatment is driven by an increase in bank equity and not by a reduction of activities. The finding that the increase in equity ratios is driven by an increase in the amount of equity is important for at least three reasons. First, it confirms the potential usefulness of tax shields as a capital regulation tool. If the change in equity ratio after the reduction in tax discrimination would have been driven by a reduction in bank activities, it would be far less interesting as a policy tool, given the potential negative side effects for the real economy. Second, it suggests that the observed changes in equity ratios are unlikely to be driven by a reduction in loan demand due to the fact that the tax change also holds for non-financial firms. Third, these findings also suggest that the increase in capital buffers is not driven by heterogeneity in the pass-through of a contemporaneous increase in ECB policy rates during the treatment period.

Finally, I also analyze the heterogeneity across ex-ante low and high capitalized banks and the consequences for bank risk taking. Higher equity ratios are beneficial for bank stability as they increase the loss-absorbing capacity of banks. Additionally, they could also impact ex-ante risk taking behavior. 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. The results in this paper indicate that there was a decrease in riskiness for the (ex-ante) low capitalized Belgian banks after the introduction of the NID, while this was not the case for (ex-ante) high capitalized banks. An explanation for this finding is that there are diminishing returns to the screening and monitoring of borrowers. Higher capital ratios lead to a stronger incentive for the bank to screen and monitor borrowers, but these efforts become increasingly more costly. Hence, the increase in screening and monitoring will be proportionally larger for the low capitalized banks, which is an interesting feature from a policy point of view.

Overall, the results in this paper suggest that a reduction of tax frictions could be an important part of a regulatory incentive scheme that leads to better capitalized financial institutions. Furthermore, the findings also indicate that this increase in capital levels reduces bank risk taking incentives for ex-ante low capitalized banks. Hence, the reduction of tax frictions not only increases capital buffers for all banks, it also decreases risk taking behavior for exactly those banks that regulators would want to target.

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Table 1: Propensity score matching - diagnostics

This table reports summary statistics and matching diagnostics for the pre-treatment period (2003-2005) for the 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 third 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 equal to the average value for the Belgian banks. The columns 'Bias full' and 'Bias matched' show the standardized percentage bias between the Belgian banks and respectively all banks in the full sample and the banks in the control group. The bias is the % difference of the sample means in the treated and non-treated sub-samples as a percentage of the square root of the average of the sample variances in the treated and non-treated groups (see Rosenbaum and Rubin (1985)). The column % change in bias shows the percentage change in this bias after matching. A positive value implies that the averages are lying closer to each other after matching.

	Belgian banks			Non-Belgian banks										
	Treatment group			Full sample					Control group					
	N	Mean	St. dev.	N	Mean	St. dev.	P-value	Bias full	N	Mean	St. dev.	P-value	Bias matched	% Change in bias
Equity ratio - growth	90	-1.26	20.25	8553	3.71	63.61	0.03	0.105	270	-2.4	17.51	0.65	0.058	44.8%
Equity ratio	90	7.01	5.7	8553	9.33	8.78	0	0.313	270	8.04	4.37	0.12	0.203	35.3%
ln(Total assets)	90	8.18	2.03	8553	6.86	1.75	0	0.697	270	8.7	2.05	0.14	0.255	63.4%
Return on assets	90	0.54	0.78	8553	0.62	0.98	0.32	0.090	270	0.62	0.98	0.41	0.090	0.0%
Market share	90	0.03	0.09	8553	0.01	0.04	0.01	0.287	270	0.03	0.08	0.79	0.000	100.0%
Loan ratio	90	0.37	0.21	8553	0.57	0.2	0	0.975	270	0.63	0.21	0	1.238	-26.9%
Non-interst income share	90	0.34	0.26	8553	0.31	0.17	0.27	0.137	270	0.35	0.16	0.63	0.046	66.1%
sd(Return on assets)	90	0.42	0.55	8540	0.24	0.39	0	0.378	259	0.27	0.44	0.03	0.301	20.2%
ln(Z-score)	90	3.5	1.49	8176	4.35	1.18	0	0.632	259	4.04	1.12	0.08	0.410	35.2%
GDP per capita - growth	3	1.44	1.23	78	3.43	2.93	0.09	0.886	36	1.66	2.04	0.68	0.131	85.3%
ln(GDP per capita)	3	10.07	0.02	78	9.4	0.86	0	1.101	36	9.61	0.68	0.01	0.956	13.2%
CPI rate	3	2.29	0.58	78	3.07	2.35	0.12	0.456	36	3.13	2.54	0.31	0.456	-0.1%

Table 2: Common trend assumption - Matched sample

This table illustrates the trends in the dependent variables during the pre-treatment period for the matched sample. The table reports the mean growth rates for the treatment and the control group, the difference between both and the p-value for a t-test that tests whether the means in both groups are equal. The table consists of three panels, reporting the growth rates for each year of the pre-treatment period.

		'05 growth rates		
	Mean-control	Mean-treated	diff	P-value
Equity ratio growth	0.48	1.52	-1.03	0.83
ln(Total equity) growth	0.00	0.00	0.00	0.86
ln(Total assets) growth	0.00	0.00	0.00	0.66
ln(sd(Return on assets)) growth	-0.03	-0.07	0.04	0.77
ln(Z-score) growth	0.02	0.16	-0.18	0.13
ln(Loans) growth	0.00	0.01	-0.02	0.31
ln(Retained income) growth	-11.17	-83.23	72.05	0.39
ln(Equity reserves) growth	0.30	-0.63	0.92	0.13
ln(Equity without reserves) growth	0.15	0.91	-0.76	0.40
		'04 growth rates		
	Mean-control	Mean-treated	diff	P-value
Equity ratio growth	-5.35	-3.67	-1.68	0.71
ln(Total equity) growth	0.02	0.03	-0.01	0.22
ln(Total assets) growth	0.03	0.03	0.00	0.63
ln(sd(Return on assets)) growth	-0.02	-0.13	0.11	0.50
ln(Z-score) growth	-0.05	0.09	-0.14	0.05
ln(Loans) growth	0.03	0.06	-0.03	0.16
ln(Retained income) growth	63.82	-0.61	64.43	0.03
ln(Equity reserves) growth	-1.51	-0.10	-1.41	0.23
ln(Equity without reserves) growth	-0.01	-0.07	0.05	0.32
		'03 growth rates		
	Mean-control	Mean-treated	diff	P-value
Equity ratio growth	-2.21	-1.62	-0.59	0.85
ln(Total equity) growth	0.05	0.04	0.00	0.68
ln(Total assets) growth	0.05	0.04	0.00	0.86
ln(sd(Return on assets)) growth	0.09	0.62	-0.53	0.24
ln(Z- score) growth	0.03	0.07	-0.04	0.53
ln(Loans) growth	0.05	0.04	0.01	0.76
ln(Retained income) growth	-1.72	-0.60	-1.12	0.27
ln(Equity reserves) growth	0.14	-0.03	0.16	0.53
ln(Equity without reserves) growth	0.02	-0.05	0.07	0.13

Table 3: Summary statistics after matching - '03-'07

This table shows the summary statistics for the full sample period (2003-2007) for the main variables after the matching procedure. The sample consist of a treatment group of 31 Belgian banks and a control group of 93 other European banks.

Variable	**Mean**	**Std. Dev.**	**p10**	**p90**	**N**
Equity ratio	7.62	4.41	4.17	15.9	600
Effective tax rate	25.59	19.55	0	61.5	600
ln(Total assets)	8.70	2.12	4.80	9.32	600
Return on assets	0.70	0.85	0.08	1.38	600
Loan Ratio	0.51	0.24	0.26	0.79	600
NII Share	0.35	0.19	0.15	0.53	600
sd(Return on assets)	0.31	0.44	0.01	0.62	581
ln(Z-score)	3.85	1.17	2.77	5.96	580
ln(Equity)	6.01	1.95	2.56	6.52	600
ln(Loans)	7.94	2.41	4.02	8.70	600
GDP per capita - growth	2.11	1.91	0.13	4.26	65
ln(GDP per capita)	9.67	0.64	9.20	10.19	65
CPI	2.97	2.06	1.39	4.2	65

Table 4: Evolution of Belgian equity ratios

This table documents the change in equity ratios after the introduction of the allowance for corporate equity. The dependent variable in the first five regressions is (the natural logarithm of) the equity ratio (total equity over total assets), in the last column the dependent variable is the effective tax rate. The first four columns only include observations for Belgium. 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 and the third column, I add a group of bank capital structure determinants to the regression. In the fourth column I expand the sample period by starting in 2000. The fifth column shows the result for all non-Belgian, EU-27 banks. In the last column I look at the impact on the effective tax rate, defined as taxes paid over pre-tax profits. All regression include bank fixed effects, standard errors are clustered at the bank level. For the regression where 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 (1981):$\hat{p} = 100 * (exp[\hat{c} - 0.5 * \hat{V}(\hat{c})] - 1)$ where $\hat{p}$ is the percentage change in the dependent variable given a change in the dummy variable from zero to one, $\hat{c}$ is the coefficient estimate for the dummy variable and $\hat{V}(\hat{c})$ is the estimated variance for this coefficient. It is this transformed variable (which only slightly deviates from the estimated coefficient for our estimation) that is always discussed in the text.

	(1) ETA	(2) ETA	(3) ln(ETA)	(4) ETA	(5) ln(ETA)	(6) Effective tax rate
Dummy 2006	0.254	0.423	0.0852	0.622**	0.0285***	-5.777
	(0.301)	(0.384)	(0.0643)	(0.302)	(0.00459)	(3.520)
Dummy 2007	0.456	0.818*	0.171**	1.188**	-0.000712	-8.692**
	(0.301)	(0.491)	(0.0823)	(0.495)	(0.00955)	(3.777)
ln(Total assets)		-0.907**	-0.188***	-1.489***	-0.154***	
		(0.441)	(0.0643)	(0.429)	(0.0278)	
Return on assets		0.0405	-0.0252	0.540**	0.0147**	
		(0.311)	(0.0519)	(0.261)	(0.00725)	
sd(Return on assets)		0.132	0.0228	-0.302	0.0396***	
		(0.374)	(0.0625)	(0.460)	(0.0149)	
Non-interest income share		1.996	0.741	-1.207	0.0803	
		(3.026)	(0.579)	(2.654)	(0.0494)	
Loan ratio		-0.697	0.0314	-1.175	-0.118	
		(3.531)	(0.542)	(2.820)	(0.0800)	
GDP per capita - growth		0.0394	0.0136	-0.116	0.0266***	
		(0.126)	(0.0260)	(0.0947)	(0.00281)	
Constant	7.007***	13.84***	2.990***	19.86***	3.062***	20.51***
	(0.151)	(2.983)	(0.444)	(3.529)	(0.200)	(1.327)
Observations	150	147	147	227	14,949	150
Adjusted R-squared	0.935	0.940	0.851	0.934	0.927	0.407
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Clusterlevel	Bank	Bank	Bank		Bank	
Sample	BE ’03-’07	BE ’03-’07	BE ’03-’07	BE ’00-’07	other EU-27 ’03-’07	BE ’03-’07

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Difference-in-difference regressions

This table analyzes the impact of the change in tax regulation in a difference-in-differences setup. The sample period is 2003-2007. The first column shows the regression of 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, 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 instead of the equity ratio itself. In column four, a group of bank- and country-specific control variables is added to the regression. The bank-specific control variables included are total assets, return on assets, loans over total assets non-interest income share and the standard deviation of the return on assets. The country-specific control variables are GDP growth, GDP per capita and the CPI rate. In the fifth column, I 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. For the regression where 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 (1981):$\hat{p} = 100 * (exp[\hat{c} - 0.5 * \hat{V}(\hat{c})] - 1)$ where $\hat{p}$ is the percentage change in the dependent variable given a change in the dummy variable from zero to one, $\hat{c}$ is the coefficient estimate for the dummy variable and $\hat{V}(\hat{c})$ is the estimated variance for this coefficient. It is this transformed variable (which only slightly deviates from the estimated coefficient for our estimation) that is always discussed in the text.

	(1) ETA	(2) ETA	(3) ln(ETA)	(4) ETA	(5) Average ETA	(6) Effective tax rate
Post	-0.672**	-0.672*	-0.0637**	0.700**	-0.417*	0.727
	(0.305)	(0.341)	(0.0283)	(0.268)	(0.237)	(1.746)
Treated x Post	1.027**	1.027**	0.144**	1.147**	0.927**	-7.962**
	(0.443)	(0.495)	(0.0664)	(0.439)	(0.384)	(3.702)
Constant	8.039***	7.781***	1.912***	335.5***	7.551***	26.10***
	(0.435)	(0.108)	(0.0104)	(122.8)	(0.137)	(0.617)
Observations	600	600	600	556	240	600
Adjusted R-squared	0.003	0.805	0.841	0.921	0.864	0.527
Bank FE	No	Yes	Yes	Yes	Yes	Yes
Clusterlevel	Bank	Bank	Bank	Bank	Bank	Bank
Control variables				Yes		

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

Table 6: Equity ratio - sub-components

This table analyzes the underlying drivers of the equity ratio after the introduction of the notional interest rate deduction. The first column retakes the baseline result from table 5. Columns 2, 5, 6 and 7 analyze the impact on equity and 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.

	(1) ln(ETA)	(2) ln(Equity)	(3) ln(Total assets)	(4) ln(Loans)	(5) ln(Retained Earnings)	(6) ln(Other equity)	(7) ln(Equity reserves)
Post	-0.0637**	0.289***	0.348***	0.337***	-0.181***	-0.0611	0.964***
	(0.0283)	(0.0234)	(0.0384)	(0.0707)	(0.0625)	(0.103)	(0.134)
Treated x Post	0.144**	0.131	-0.00418	0.149	0.194*	0.154	0.120
	(0.0664)	(0.0805)	(0.0791)	(0.103)	(0.102)	(0.215)	(0.354)
Constant	1.912***	5.885***	8.570***	7.793***	0.613***	5.500***	4.186***
	(0.0104)	(0.0104)	(0.0129)	(0.0225)	(0.0213)	(0.0324)	(0.0488)
Observations	600	600	600	600	521	399	399
R-squared	0.873	0.992	0.990	0.973	0.243	0.943	0.861
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusterlevel	Bank	Bank	Bank	Bank		Bank	Bank

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

Table 7: Heterogeneity in the treatment effect and bank risk behavior

This table illustrates the difference in impact of the allowance for corporate equity between banks conditional on their pre-treatment equity ratio. The first four columns of the table show the impact of the allowance for corporate equity on the equity ratio (ETA), the Z-score and the standard deviation of the return on assets and by applying a difference-in-differences setup similar to table 5. From column 2 onwards, the regressions make a distinction between the impact on (ex-ante) high and low capitalized banks by interacting the treated x post dummy with a pre-treatment equity ratio. The pre-treatment equity ratio is standardized such that the coefficient shows the impact of a standard deviation change. 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. The last three columns show the evolution of three loan-portfolio risk measures for the Belgian banks, based on characteristics of firms entering the loan portfolio of a bank (on a quarterly basis). The three risk measures are a weighted leverage ratio, a weighted Altman Z-score and a weighted debt burden variable (defined as a firms' interest financial costs over cash flows). Weights are based on loan size. All regressions include bank fixed effects, standard errors are clustered at the bank level.

	Bank characteristics				Loan portfolio characteristics		
	ln(ETA)	ln(ETA)	ln(Z-score)	ln(sd(Return on assets))	ln(leverage)	ln(Altman Z)	ln(interest burden)
Treated x Post	0.144**	0.144**	0.597**	-0.103*			
	(0.066)	(0.065)	(0.280)	(0.059)			
Treated x Post x ETA '05		0.002	-0.424**	0.116**			
		(0.060)	(0.210)	(0.057)			
Post x ETA '05		-0.061	-0.040	-0.002	0.049***	-0.056***	0.029**
		(0.039)	(0.114)	(0.024)	(0.014)	(0.020)	(0.013)
Post	-0.064**	-0.064**	-0.245**	0.017	-0.029	-0.006	-0.034
	(0.028)	(0.027)	(0.108)	(0.022)	(0.025)	(0.051)	(0.026)
Constant	1.821***	1.821***	3.843***	0.213***	0.467***	0.632***	0.256***
	(0.010)	(0.010)	(0.045)	(0.009)	(0.010)	(0.021)	(0.011)
Observations	620	620	596	597	375	350	375
Adjusted R-squared	0.873	0.873	0.484	0.531	0.160	0.173	0.250
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusterlevel	Bank	Bank	Bank	Bank	Bank	Bank	Bank

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

Table 8: Robustness - Matching, placebo tests and sample selection

This table includes 5 robustness checks for the difference-in-difference results. For each robustness check, the table reports the results for a setup similar to column three of table 5 and column 5 of table 5.The former includes bank-year observation for the 2003-2007 period, has the natural logarithm of the equity ratio as dependent variable and is estimated using bank fixed effects, while the latter compares 2004-2005 average equity ratios with 2006-2007 averages. For the first robustness check (column 1 to 4) I match each bank in the treatment group with either 1 or 5 non-treated banks instead of 3. For the second robustness check (column 5 and 6) I use a broader set of matching variables. In column 7 and 8, I restrict the countries from which the control group banks are selected to the three biggest neighbors of Belgium, being France, Germany and the Netherlands. In column 9 and 10, I perform a placebo study where I assume that the treatment took place in 2000 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 Belgian banks instead of 31.

	1 match		5 matches		Match variables		Neighbor countries		00 Placebo		Unrestricted sample	
	ln(ETA)	Av. ETA	ln(ETA)	Av. ETA	ln(ETA)	Av. ETA	ln(ETA)	Av. ETA	ln(ETA)	Av. ETA	ln(ETA)	Av. ETA
Post	-0.0763	-0.643	-0.0328	-0.226	-0.0423*	-0.277**	-0.0555	-0.437	0.0424*	0.798**	-0.0702**	-1.059***
	(0.0577)	(0.508)	(0.0225)	(0.202)	(0.0245)	(0.136)	(0.0406)	(0.269)	(0.0228)	(0.370)	(0.0307)	(0.315)
Treated x Post	0.155*	1.153*	0.111*	0.736**	0.121*	0.788**	0.134*	0.947**	-0.00192	-0.316	0.152***	1.612***
	(0.0826)	(0.592)	(0.0629)	(0.363)	(0.0637)	(0.331)	(0.0714)	(0.405)	(0.0434)	(0.443)	(0.0534)	(0.442)
Constant	1.756***	6.614***	1.791***	6.712***	1.746***	6.576***	1.877***	7.672***	1.763***	6.862***	2.145***	11.47***
	(0.0165)	(0.209)	(0.00846)	(0.124)	(0.00942)	(0.0897)	(0.0135)	(0.153)	(0.00389)	(0.199)	(0.00994)	(0.169)
Observations	300	120	900	360	600	240	600	240	485	194	865	337
Adjusted R-squared	0.827	0.798	0.832	0.780	0.887	0.928	0.816	0.865	0.893	0.884	0.902	0.967
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusterlevel	Bank		Bank		Bank		Bank		Bank		Bank	

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

Table 9: Robustness - Sample period and outliers

This table includes additional robustness checks for the difference-in-difference results. In the first column, observations from Belgian banks involved in mergers after the introduction of the NID are removed from the sample. In the second column I remove the Belgian bank above the 90th percentile in terms of the difference between equity ratio growth after and before the introduction of the NID.The third column excludes the control group banks below the 10th percentile in term of the difference in equity ratio growth before and after the introduction of the NID. The fourth column combines the restriction of column two and three. The last column removes the year 2005 from the analysis. All regressions include bank fixed effects. Standard errors are clustered at the bank level.

	(1) ln(ETA)	(2) ln(ETA)	(3) ln(ETA)	(4) ln(ETA)	(5) ln(ETA)
Post	-0.0637**	-0.0637**	-0.0589*	-0.0589*	-0.0802**
	(0.0284)	(0.0283)	(0.0311)	(0.0311)	(0.0351)
Treated x Post	0.103*	0.117*	0.139**	0.113	0.146*
	(0.0534)	(0.0697)	(0.0677)	(0.0709)	(0.0800)
Constant	1.917***	1.930***	1.911***	1.930***	1.928***
	(0.00956)	(0.0105)	(0.0112)	(0.0113)	(0.0159)
Observations	596	585	555	540	480
Adjusted R-squared	0.856	0.853	0.845	0.858	0.815
Bank FE	Yes	Yes	Yes	Yes	Yes
Clusterlevel	Bank	Bank	Bank	Bank	Bank

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

Table 10: Country list

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

Country	Nr. Banks	Equity ratio	Effective tax rate
AUSTRIA	1	4.87	23.19
BELGIUM	30	6.75	17.94
FRANCE	7	4.36	30.12
GERMANY	6	5.03	36.16
GREECE	2	6.21	18.20
ITALY	40	7.60	38.32
NETHERLANDS	1	2.79	22.63
PORTUGAL	8	5.06	11.59
ROMANIA	6	17.58	10.64
SPAIN	12	6.06	27.75
UNITED KINGDOM	7	4.04	26.87

Table 11: Variable definitions

This table includes the definitions of the variables used throughout the paper. The first column shows the name of the variable as used throughout the paper, the second column shows the corresponding definition and the third column gives the source for the raw data used to construct the variable.

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
Total assets	total assets (in 2007 USD millions)	Bankscope
Loans	total loans (in 2007 USD millions)	Bankscope
Return on assets	profits over total assets	Bankscope
sd(ROA)	standard deviation of the return on assets over the past three years	Bankscope
Z-score	ratio of equity plus return on assets over sd(ROA)	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
Equity	Total equity	Bankscope
Retained income share	retained income over post-tax profit	Bankscope
Equity reserves	retained earnings plus other equity reserves	Bankscope
Leverage	Average leverage (debt/total assets) of firms in a banks' loan portfolio	Belgian balance sheet central
Altman Z	Average Altman Z of firms in a banks' loan portfolio	Belgian balance sheet central
Interest burden	Average interest burden (interest paid over cash flows) of firms in a banks' loan portfolio	Belgian balance sheet central
	Country-specific variables	
GDP per capita growth	Growth in GDP per capita	World Development Indicators
CPI	Growth in the consumer price index	World Development Indicators
GDP per capita	GDP per capita	World Development Indicators
Corporate tax rate	Corporate tax rate	KPMG - Corporate and Indirect tax survey

Figure 1: Evolution of the equity ratio for the Belgian banks and the control group of banks