Does the Cost of Equity Affect Bank Lending?

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Abstract

How is the supply of credit by banks affected by their cost of equity? To unequivocally answer this question we identify the impact on the local supply of bank credit of tax reforms that affected the cost of equity abroad. In 2000 and 2006 Italy and Belgium, respectively, introduced an allowance for corporate equity so that firms as well as banks could deduct a notional interest on their equity from their taxable income. We employ loan level data from the German credit register to study the differential impact on lending in Germany by banks that were 'treated' by these tax reforms versus a control group of banks that were not. We find that the decrease in the cost of equity leads banks to raise their equity ratio, and to concurrently expand their balance sheet by increasing the amount of credit supplied. Conversely, the reversal of these reforms leads to a decrease in lending. The magnitude of the expansions and contractions suggests that the increase in lending cannot be solely driven by a pure income effect.

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1 Introduction

The financial crisis of 2007-2008 demonstrated that highly levered banks can generate large negative externalities for the rest of the economy when they become distressed. As a consequence, a vigorous debate has ensued to what extent capital requirements imposed on banks should be increased (Admati et al., 2013; Hanson et al., 2011). If equity is expensive, however, increasing capital requirements could lead banks to contract lending, which in turn may negatively affect the real economy. Aiyar et al. (2014), Fraisse et al. (2015) and Jiménez et al. (2016), for example, empirically show that increasing the level of capital requirements had such a contractionary impact on bank lending in various settings. But to reduce bank leverage there exists an alternative to increasing capital requirements, i.e., decreasing the cost of equity. Such a decrease should on the margin increase the relative benefit of issuing equity thereby reducing bank leverage. Schepens (2016) for example shows that the introduction of a tax reform that reduces the cost of equity in Belgium in 2006 leads to better capitalized financial institutions there. Does a decrease in cost of equity also affect bank lending? And if so, to what extent?

To address this question, we study the introduction of a so-called Allowance for Corporate Equity (ACE) which took place in Italy and Belgium in 2002 and 2006, respectively. Corporate income tax systems generally allow for the deductibility of interest payments on debt, while the return on equity is not considered as a deductible cost. This asymmetry favors debt over equity as a means of funding investments, which may lead to excessive leverage. The objective of the ACE is to establish a symmetric tax treatment between debt and equity at the firm level. More precisely, the ACE allows firms (and also banks) to deduct a notional

interest on the book value of part or the totality of their equity from their taxable income. Although ACE will have a direct cost in terms of foregone tax revenues for the government, it may also yield tangible benefits through: (1) the debt-equity substitution and the consequent lower deduction of interest costs on debt; (2) the enhancement of financial stability because of the lower leveraging of financial institutions in particular; and (3) an expansion in bank lending. Estimating the effect of the ACE on bank lending is therefore key to consider the possible impact of this type of reform.

How can a decrease in the cost of equity through an ACE impact bank lending? Three different mechanisms are potentially at play. First, the tax deduction of the notional interest on equity generates an additional income that banks can directly lend to firms, this is what we refer to as the 'income effect'. Second, subsidizing equity should result in a lower total cost of capital, therefore leading to a decrease in the cost of funds for banks, and hence of lending rates. Lending may then increase if more projects become profitable. This is the 'cost of funds' effect. Finally, decreasing the relative tax advantage of debt may induce banks to hold more equity, thereby relaxing the regulatory constraints on equity ratios and allowing them to lend more, the 'capital structure effect'. Whereas the income effect should be rather small, the magnitude of the cost of funds or capital structure effects could be large. In the end whether a reduction in the fiscal cost of equity expands lending, and if yes, what mechanism is at play, is the empirical question we aim to answer.

We therefore study the impact on local bank lending of ACE reforms that occurred abroad but that 'treated' only a subset of local credit-granting banks in Germany. The first ACE reform we investigate is the one implemented for banks in Italy in 2000. With this reform, a notional interest for *post-reform equity* stocks is applied and taxed at a reduced rate of 19%, instead of 37% for profits. This

reform was progressively phased out starting from 2002. The second ACE reform is the one that was passed in 2006 in Belgium. This reform allows all corporations, including financial institutions, to deduct a notional charge on the book value of their entire equity from their taxable income. We estimate whether these ACE reforms, which decrease the fiscal cost of equity of 'treated' banks, lead to an increase in their supply of credit in Germany compared to that of 'control' banks. By using loan level data we can further comprehensively account for concurrent changes in the demand for bank credit by German firms.

We focus on credit granted in Germany to uniquely identify how the reforms did impact bank lending. We surmise that credit demand in Germany did not cause or influence any of the reforms we investigate. We access the German credit register which includes *all* bank-firm exposures that initially surpassed 1.5 million euros. We study the entire 1994-2013 period and for identification purposes restrict the sample to firms that borrowed at least once during this sample period from banks headquartered in two different countries, including Germany (given this and other imposed identifying restrictions and the resultant focus on firms in Germany with multiple banks of different nationalities, the aforementioned exposure hurdle is likely not binding). We also study interbank lending by banks to other banks. Our final sample involves 6 Italian banks, 4 Belgian banks and 3,525 German banks.

We follow a difference-in-differences approach, whereby we compare before and after each reform, the lending that takes place to the same firm by treated banks versus control banks. We analyze both the changes in committed credit volume (i.e., the intensive margin) and the likelihood that a new loan is granted (i.e., the extensive margin). Across specifications, and in addition to comprehensive sets of fixed effects, we also control for various bank and bank-firm relationship characteristics.

Our estimations are lined up as follows. First, we show that banks increase equity ratios within two years after the introduction of the ACE, both in Italy and in Belgium, and, most importantly, that the effect is reversed when the reforms are ended. We obtain this result using a subsample of matched banks based on pre-reform observable characteristics (Heckman, Ichimura and Todd, 1997). This result is in line with the finding of Schepens (2016) on the introduction of the ACE in Belgium.

Second, we find that treated banks expand lending abroad when the cost of equity decreases, and that the effect is reversed when the relative cost of equity increases. The magnitude of the effect is large, suggesting that the effect is not only driven by a pure income effect, but also by the fact that equity is a binding constraint in lending. More precisely, Italian and Belgian banks increased lending to German firms on the intensive margin by more than 40% relative to other banks. On the extensive margin, the probability of granting a new loan is less significant, but up to 5% for Belgian banks after the introduction of the ACE in Belgium. The effect on the riskiness of the loan portfolio still has to be investigated.

As a robustness check, we provide additional uniquely clean evidence that higher capital requirements have a negative effect on lending. Jiménez et al. (2016) show that the introduction and later modification of dynamic provisioning in Spain affected bank lending there. We extend their work by studying the impact on lending by Spanish banks in Germany. We find that after the introduction of dynamic provisioning in 2000 Spanish banks cut committed credit by more than the other (i.e., German or other foreign) banks that were concurrently lending to the same firms in Germany. These findings also hold on the extensive margin of credit granting. Similarly we find that the modification in 2005 (which implied an overall loosening of the dynamic provisioning requirements) is followed by an increase in the amount of credit granted by Spanish banks relative to the amounts granted

by their German or foreign counterparts to the same firms in Germany. The magnitude of the estimated impact is higher than to those reported in Jiménez et al. (2016). This validates our chosen identification strategy and resultant estimates. But it also provides new evidence (in line with their findings) in a setup that is totally free of any lingering concerns about the endogeneity of changes in banking regulation.

This paper contributes to the literature that seeks to identify the impact of bank capital regulation on bank lending. Whereas the existing literature has focused on the impact of an increase in capital requirements (Aiyar et al., 2014; Fraisse et al., 2015; Jiménez et al., 2016), we investigate the effect of a decrease in the cost of equity. We find strong effects. We therefore contribute to the debate on optimal capital regulation, by providing the first evidence that a lower cost of equity can increase both bank equity ratios and bank lending.

By looking at the impact of changes in regulation abroad, we better control for the inevitable endogeneity in regulation. We also find that the effects of changes in capital regulation abroad are amplified. In this way, our paper also adds to the literature on cross-border banking. Ongena et al. (2013) show that tighter bank regulation is associated with lower lending standards abroad. Aiyar et al. (2014) analyse the impact of changes in UK regulation on lending of UK banks to foreign country and find that a 100 basis point increase in the requirement is associated with a reduction in the growth rate of cross-border credit of 5.5 percentage points. We substantially extend their analysis by looking at multiple shocks in capital regulation and by controlling better for credit demand with firm fixed effects.

Finally, our study complements the literature on the impact of taxes on bank decisions. Schepens (2016), Keen and de Mooij (2012), Gu et al. (2015) study the effect of tax reforms on bank capital structure. Schepens (2016) in particular investigates the effect of the introduction of the ACE on the capital structure of

Belgian banks. As far as we know, this paper is the first in the literature that look at the effect of taxes on bank lending when controlling for demand.

The remainder of our paper proceeds as follows. Section 2 describes the ACE reforms we exploit, Section 3 describes our data. We present our results in Section 4. Section 5 concludes.

2 ACE Tax Reforms

This section describes the ACE tax reforms we investigate.

2.1 The ACE in Italy: 2000 - 2002

Starting in 1997 a reduced corporate income tax rate of 19% was applied to firms in Italy which replaced the 37% as a notional interest for *post-reform* equity stocks of firms. The notional rate started off at 7% and was applied to the book value of new equity, taking the year 1996 as a reference. The reform was extended to banks in 2000, and, in 2000 and 2001, the book value was raised to 120% and 140% of the new equity stock, respectively, in order to converge more quickly to a system where the entire capital stock was considered.

After the 2001 elections the ACE is progressively phased out. In 2002, the book value is cut again to 100%, only equity increases until June 2001 are taken into account, the notional interest rate was decreased down to 3.5%, and the corporate tax rate was decreased from 37 to 33%.

2.2 The ACE in Belgium: 2006

The introduction of an ACE tax reform in Belgium in 2006 allowed all corporations, including financial institutions, to deduct from their taxable income notional interests on equity. These interests amount to the product of the book value of equity times a benchmark rate, which is set at the average rate on 10-year bonds.

The reform is voted two years after the European Commission put an end to a unique Belgian fiscal advantage for subsidiaries of non-Belgian multinationals. These subsidiaries were specialized in financial, accounting and administrative services, and were called 'coordination centers'. They benefited from a fixed tax rate, ranging from 4 to 10%, that was based on expenses less financial and salary costs, rather than on profits. The objective of the fiscal advantage was to attract profitable service centers with minor cost structures. Belgium indeed became a popular destination for a significant number of these coordination centers.

The fear of losing profit centers to other countries created political pressure for a tax reform. The resultant ACE tax reform is approved in parliament in June 2005 and implemented in July 2006. The introduction of the ACE coincides with the elimination of a 0.5% tax on new equity issuance, but this concurrent elimination has only a minor economic importance compared to the recurrent tax benefits from the ACE.

Initially, the notional rate is set to equal the average of the 10-year bonds the year preceding the fiscal year, with a maximum capped at 6.5%, and with the restriction that the rate could not change by more than one percentage point per year.

3 Data

3.1 Bank-Loan Level Data

Our principal data source is the German Credit Register compiled by the Deutsche Bundesbank.

The Bundesbank collects quarterly information on all outstanding loans that when granted exceeded 1.5 million euros. Important for our purposes, and in contrast to a number of other credit registers, this data is requested from both German and foreign banks. Essential for our estimations is also that the Register includes information on both the lenders' and the borrowers' identities and on the amount of credit that is outstanding at all times. Unfortunately the Register contains no immediate information on the interest rate paid or on the maturity of the outstanding loans.

The data set we extract contains at a quarterly frequency all credit exposures of banks to firms that borrow from banks headquartered in *at least two different countries* during the sample period, which spans 20 years from 1994 to 2013. In total there are 573,638 such bank-firm-quarter observations.

Accessing the Register we construct a balanced quarterly panel of bank-firm pairs. We include all bank-firm pairs that appear at least once during the sample period **starting in 1994**. For each bank-firm pair, we then back-fill all quarters for which the pair is not in the Register with a zero exposure. Hence, if bank b lends to firm f and is repaid within a year, the bf pair will be in our data every quarter during the entire sample period, even though the bank-firm exposure will be equal to zero most of the time.

One concern we have is that by construction our findings could be biased upward. Indeed, 1) exposures that start below 1.5 million are not reported, while 2)

exposures that start above 1.5 million are always indicated, even if they eventually drop below 1.5 million (through repayment). Hence, when building our balanced sample, we in effect set loan amounts that are below 1.5 million equal to zero at the beginning of a bank-firm relationship and thereby overestimate the increase in this bank-firm exposure when it then jumps above the 1.5 million hurdle. However, our focus on firms that borrow from foreign banks should mitigate this concern, because these firms are often larger and more likely to borrow in large volumes. In addition, in our main model we restrict the sample even further, keeping only firms that borrow concurrently from multiple banks (and again especially large firms do so). Finally, we also perform an analysis that focuses exclusively on the intensive margin, i.e., when the loan amount starts above 1.5 million (this analysis confirms the robustness of our results).

We also merge our loan level data with bank level data from the Bundesbank for German banks and from Bankscope for foreign banks.

3.2 Preliminary Statistics

Table 1 lists the shocks we study and the number of lending banks and borrowing firms and banks in Germany that are in each case affected. We focus on the impact of the ACE introduction and phasing-out in Italy and of the ACE introduction in Belgium on the the lending by Italian and Belgian banks, respectively. We have two times 6 Italian banks and 4 Belgian banks in our sample that lend to 639, 599, and 1,337 firms, respectively. To validate the three direct shocks to the cost of equity, we also check the effect of the introduction and modification of Dynamic Provisioning on the lending of Spanish banks. We have 3 and 2 Spanish banks in our sample that lend to 205 and 335 firms, respectively.

INSERT TABLE 1

Table 2 shows descriptive statistics on loan volumes, firms borrowing from foreign banks and German banks versus those borrowing from treated banks. This table focuses on firm-bank relationships. We find that treated banks are larger and more capitalized than the average German bank in our sample, whereas the doubtful ratio is similar in the two groups of banks. We control for these differences in the empirical analysis. The median number of banks the firms borrow from is 3.

INSERT TABLE 2

3.3 Bank Characteristics

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Bank level data is from the bureau van Dijk Bankscope database. We select all EU-27 commercial, savings and cooperative banks. For each shock we keep all European banks that have data available during the 5 year period around the shock. We convert data into constant dollars, and we drop banks with a jump/decrease of more than 150%/-50% in the total value of their assets to avoid bias due to mergers and acquisitions or bank failures.

The main variable of interest is the equity ratio, defined as total equity over total assets.

4 Identification Strategy

4.1 Lending

Our identification strategy consists of four steps. First, we look at the effects of each event on all bank-firm exposures. We then try to identify which part of the effect is driven by changes on the intensive margin of lending by focusing *only* on firms that were already borrowing from the treated banks *before the event*. Third, we investigate the effect of each event on the extensive margin by studying new lending. Finally, we look at the effect on aggregate credit at the firm level.

4.1.1 Overall Effect

For each event, we collapse our panel into two sub-periods: before (1 year) and after the event (2 years). For each bank-firm pair, we take the average exposure in each sub-period (as in Bertrand et al. (2004)). The benchmark model including all firm-bank data is the following:

$$\Delta logL_{b,f} = \alpha Treated_{b,f} + \beta X_f + \gamma Y_b + \lambda R_{b,f} + \epsilon_{b,f} \tag{1}$$

where $\Delta logL_{b,f}$ is the change in the logarithm of lending exposure of bank b to firm f between the pre- and the post-shock period, $Treated_{b,f}$ is a dummy indicating if the bank has been treated by a specific change in capital regulation, X_f is a vector of firm specific controls to capture changes in lending policies that are related to firm characteristics rather than regulation (size, profitability etc.) or firm fixed effects depending on the specification, Y_b is a vector of bank controls and $R_{b,f}$ a vector of bank-firm relationship characteristics. Error terms are clustered at the bank and firm levels.

Bank controls include the logarithm of total assets, the equity ratio, and the return on assets (ROA) at date $t-1$, and bank type and listed fixed effects. Banks are divided into the following categories: Large Commercial Banks, Regional Commercial Banks, Landesbanks, Savings Banks, Central Cooperative Banks, Cooperative Banks, Mortgage Banks ("Realkreditinstitute") and Financial Services Providers. We divide the vector of bank controls into two separated vectors for German versus non German banks, because controls for German banks from the Bundesbank are at a more disaggregated level (subsidiary) than controls for foreign banks (main bank level).

Bank-firm relationship characteristics include the length of the relationship and the size of this relationship. The length of the relationship is the number of quarters the exposure of bank b to firm f has been strictly positive from 1994 onwards (i.e., the beginning of our sample) to date $t-1$. The size of the bank-firm relationship is the total amount that has been lent by bank b to firm f from 1994 to date $t-1$. Both variables are in logarithm.

Firm controls include the number of banks the firm is borrowing from (in log), the total amount of debt of the firm on date $t-1$ (in log), and a indicator variable for firms belonging to the financial sector.

In order to comprehensively account for the firm demand for credit, we saturate various specifications with firm fixed effects. We therefore restrict our sample to multi-bank firms, i.e., firms borrowing from *at least two different banks* in the period **before the shock**. This identification relies on the estimation of the evolution of lending to firm f by bank b that is treated by the regulation shock compared to lending to the same firm f by bank b' that is not exposed to the shock. This approach allows us to control for changes in credit that are driven by changes in firm-specific demand.

4.1.2 Effect on Intensive Margin

In a second step, we restrict ourselves to firms that borrow at least from one bank **exposed to the shock** in the pre-period, and, for these firms, we keep only all bank-firm exposures that are **strictly larger than zero** in the pre-period. We then estimate the same regressions first without and with firm fixed effects:

$$\Delta logL_{b,f} = \alpha Treated_{b,f} + X_f + \gamma Y_b + \lambda R_{b,f} + \epsilon_{b,f} \tag{2}$$

where X_f are firm fixed effects. Controls are the same as in the previous regressions. Error terms are again clustered at the bank and firm level.

With this specification, we estimate how a bank that is treated by a shock in regulation changes its lending to its current borrowers compared to the other competing banks that are also lending to the same borrowers, but that are not treated by the same shock.

4.1.3 Effect on Extensive Margin

In the third model, the dependent variable is a dummy variable that is equal to one if a new loan is granted to a firm with currently zero exposure to the credit granting bank and is equal to zero otherwise. The objective is to estimate the effect of each shock on new lending by treated banks (extensive margin). We run the following Logit model:

$$NewLoan_{b,f} = \alpha Treated_{b,f} + \beta X_f + \gamma Y_b + \lambda R_{b,f} + \epsilon_{b,f} \tag{3}$$

where X_f is a vector of firm controls. Controls are the same as in previous regressions. Error terms are clustered at the bank level.

We complement our analysis on extensive margins by regressing the log of the

total number and volumes of new loans at the bank level in the post period on a dummy equal to 1 if the bank is a treated bank.

4.1.4 Aggregate Lending Exposure at the Firm Level

We finally aggregate loan exposure at the firm level and investigate the change in the log of total lending by all engaged banks at the firm level.

We estimate two models. In the first model, we restrict ourselves to firms that borrow at least from one bank in the pre-period, i.e. to firms with a *strictly positive loan exposure in the pre-period*. Our variable of interest $TreatedExante$ indicates, among these firms, those that are borrowing from a treated bank.[1]. We then estimate the following model:

$$\Delta logL_f = \alpha TreatedExante_f + X_f + \epsilon_f \tag{4}$$

where X_f are firm characteristics. Error terms are again clustered at the firm level.

In the second model, we restrict ourselves to firms that borrow at least from one bank in the post-period, i.e. to firms with a *strictly positive loan exposure in the post-period*. Our variable of interest, $ShareTreated$, indicates, among these firms, the share of their loans exposed to a treated bank.[2]. We then estimate the following model:

$$\Delta logL_f = \alpha ShareTreated_f + X_f + \epsilon_f \tag{5}$$

With these two specifications, we estimate how the aggregate lending exposure

[1]We restrict ourselves to this sample because, by definition, the dummy variable $TreatedExante$ is equal to 1 only for firms with strictly positive exposure

[2]We restrict ourselves to this sample because, by definition, the dummy variable $ShareTreated$ is strictly positive only for firms with strictly positive exposure

at the firm level varies when the firm is borrowing ex-ante to treated banks, and, ex-post, whether the aggregate lending exposure increases with the share of loans from treated banks.

4.2 Estimating Effects on Bank Characteristics

We address potential endogeneity concerns due to self-selection of the treated group by using a propensity score matching on bank financials and macroeconomic variable to constitute the control group. The propensity score is calculated on basis of the following variables: total assets, impaired loans over assets, level of equity ratio, yearly change in equity ratio, yearly change in total assets, as well as macroeconomic variables which are the GDP growth and the consumer price index. We take the closest three non-treated financial institutions for each treated financial institution, with possible replacement to maximize comparability.

5 Results: ACE Reforms and Bank Lending

Figure 1 shows the evolution of German firms' percentage exposures to Italian banks in the years around the introduction of the ACE in Italy in 2000. The introduction of the ACE seems to be indeed followed by an increase in lending by Italian banks. The graph plots the share of loans in volumes granted by Italian banks to German firms from our sample every quarter from 1998 to 2001. The red line corresponds to the introduction of the ACE in Italy.

INSERT FIGURE 1

Table 3 shows the changes in bank lending by Italian banks relatively to lending by control banks. We find that loan exposure by Italian banks decreases substan-

tially after the introduction of the ACE. If we look at the intensive margin for example lending to relationship firms more than doubles. When we turn to the extensive margin, however, Italian banks are not more likely to grant a new loan to German firms after the introduction of the ACE in Italy. But we find a strong effect on the aggregate borrowing of firms that are initially borrowing from an Italian banks.

INSERT TABLE 3

Conversely, the phasing out of the ACE reform in Italy has a strong negative effect on the lending of Italian banks to German firms, with both an effect on extensive and intensive margins.

INSERT FIGURE 2

INSERT TABLE 4

Finally, the introduction of the ACE in Belgium has also a large effect on lending by Belgian banks to German firms.

INSERT FIGURE 3

INSERT TABLE 5

6 What Mechanism is at Play?

In this section we try to disentangle which mechanism exactly is at play. We look first at the effect of an ACE on bank equity ratios.

6.1 ACE and Bank Capital Structure

Tables 6 and 8 investigate the impact of the introduction of an ACE reform on the equity ratio of banks located respectively in Italy and in Belgium. Column (1), (3) and (4) show the regression of the logarithm of respectively the equity ratio, total equity and total assets, on a dummy variable *Post* that equals one in the post period, and an interaction term *Post* $\times$ *Treated* where *Treated* indicates whether the bank is an Italian (respectively Belgian) bank to captures the impact of the tax reform. Column (2) compares the difference in the average equity ratio over the *Pre* period with the average ratio over the *Post* period between the treatment and the control group. The control group is obtained through a matching procedure described in Section 3. Models are estimated using OLS with bank fixed effects, and standard errors are clustered at the bank level and reported in brackets

The coefficient of the interaction in Table 8 shows that Belgian banks increase their equity ratio after the introduction of the ACE, by more than 15 percent on average, which corresponds to 1 percentage point higher equity ratio and is similar to the estimates in Schepens (2016). These are economically very relevant changes in the equity ratio that may lead to large swings in lending volumes. For example a bank with 5 euros in equity, 95 euros in deposits and 100 euros in loans, but no access to new equity, would have to reduce its lending to 83 euros (i.e., by 17 percent) in case its equity ratio would have to be raised by 1 percentage point from 5 to 6 percent.

INSERT TABLE 6

INSERT TABLE 8

Table 7 shows that when the reform ends, there is a negative effect on bank equity ratios.

7 Robustness

7.1 Robustness Checks

We run the following additional robustness checks for each of the shock we investigate, and do not find significant variations in our results (see the online appendix):

- We winsorize bank-firm exposure (2%)
- We exclude financial firms from our sample
- We exclude banks that enter or exit the sample during our period of interest

7.2 External Validity: Estimating the Effect of Dynamic Loan Provisioning in Spain

In order to confirm that changes in bank capital regulation affects bank lending abroad and also to extend the results in this literature, we estimate the effect of dynamic provisioning in Spain on lending by Spanish banks over our period of interest.

Dynamic provisioning was introduced in Spain in 2000.[3] Dynamic provisions are a special kind of loan provisions determined by a simple and transparent formula that includes two components: A specific component and a countercyclical component. The specific component is defined according to the share of non-performing loans at the bank level. The countercyclical component is based on the comparison of the average specific provisions along the last lending cycle for the whole banking sector (based on the amount of non performing loans at each

[3]The new law was introduced in 2000:M7 and enforced at the end of 2000:M9

point in time) and the current specific provision for each individual bank.[4] In addition to the formula parameters, they are floor and ceiling values Jiménez et al. (2016).

When dynamic provisioning was introduced in the third quarter of 2000, Spain had very low levels of provisioning compared to the rest of the OECD countries. The mean of the ratio of banks' Dynamic Provision over total assets is 0.26% (Jiménez et al. (2016)). Importantly, banks that introduced dynamic provisioning did not decrease Tear 1 capital ratio. This could be considered therefore as an average increase of 0.26 points in equity ratio. Jiménez et al. (2016) find that this average increase in provisions leads to a 10% decrease in lending.

Table 9 shows the changes in bank lending by Spanish banks relatively to lending by non treated banks. We find that loan exposure by Spanish banks decreases substantially after the introduction of dynamic provisioning. If we look at intensive margins for example (columns (4) to (6)) lending to relationship firms decreases by around 75%. When we turn to extensive margins, Spanish banks are also less likely to grant a new loan to German firms after the introduction of dynamic provisioning in Spain. If we compare with the results obtained by Jiménez et al. (2016), Spanish banks seem to have transmitted the shock much more strongly abroad than in their home country, despite the fact that their lending in Germany was not subject to the same new provisioning requirements. Yet our findings are consistent with recent empirical work by for example De Haas and Van Horen (2012) who show that banks may cut back dramatically on foreign lending when being hit at home. Also our findings indicate that lending abroad is not an immediate substitute for lending at home.

[4]This is what makes this element countercyclical: In good times, the number of non performing loans is low, specific provisions are low, and so the difference with the previous cycle is high. The dynamic provision fund is being built up. In bad times the opposite occurs: Specific provisions surge, as a result of the increase in non performing loans, and the countercyclical components becomes negative.

INSERT TABLE 9

In the beginning of 2005, the parameters of the dynamic provisioning formula were modified. The dynamic provisioning parameters were increased, but at the same time the ceiling of the dynamic provision funds was lowered. As many banks were close to the ceiling, the modification implied a net loosening in provisioning requirements for most banks.

Table 10 shows the estimated coefficients for the treated banks. Now the estimated coefficients are positive, also very large, between +120% and +300%. These findings again correspond well to those in Jiménez et al. (2016) who document the response of Spanish banks in their domestic lending. Again our results imply that lending in Spain and Germany are not substitutable for Spanish banks but that the loosening of capital requirements in Spain simply frees up funds to lend in Germany. However, these results should be interpreted carefully as we have only two banks that are treated for this shock.

INSERT TABLE 10

8 Conclusion

We study the impact of shocks to the cost of bank equity that occurred abroad but that treated only a subset of local credit-granting banks in Germany. Using a differences-in-differences approach we compare the lending that takes place to the same firm by treated banks versus untreated banks before and after each shock. The introduction of an ACE, which decreases the cost of bank equity, leads to a large expansion in bank lending. The magnitude of the effect is large, which suggests that bank lending are very sensitive to the cost of equity. The reform

has also an effect on bank capital structure, which suggest that equity ratio are a binding constraint in bank lending.

Our paper contributes to the debate on bank capital regulation by investigating the effects of an ACE. The question is whether the positive effect on lending may compensate for the fiscal cost of this reform.

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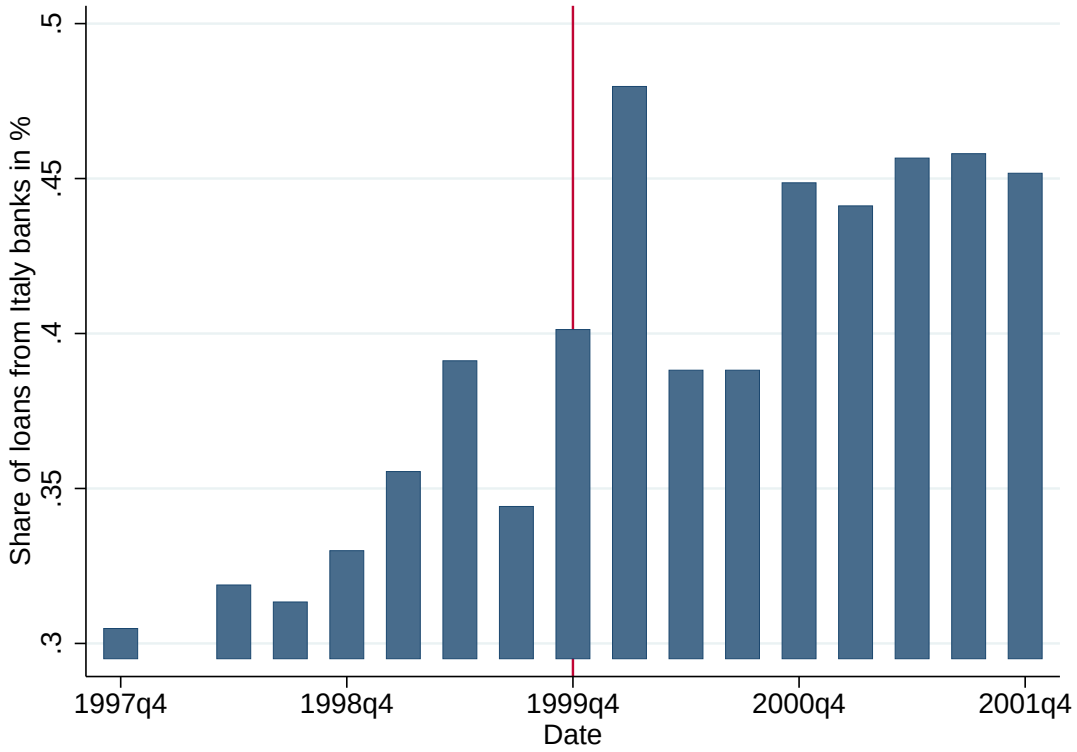
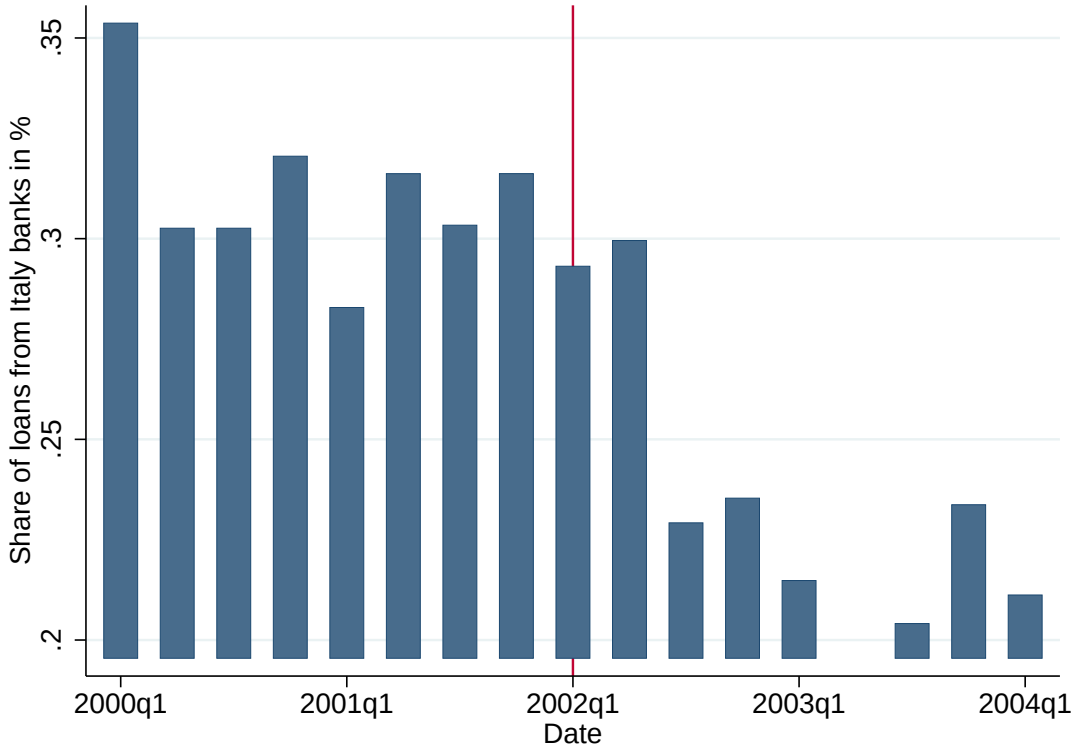
A Figures

Figure 1. Evolution of German Firm Exposure to Italian Banks around the Introduction of the ACE for banks in Italy in 2000



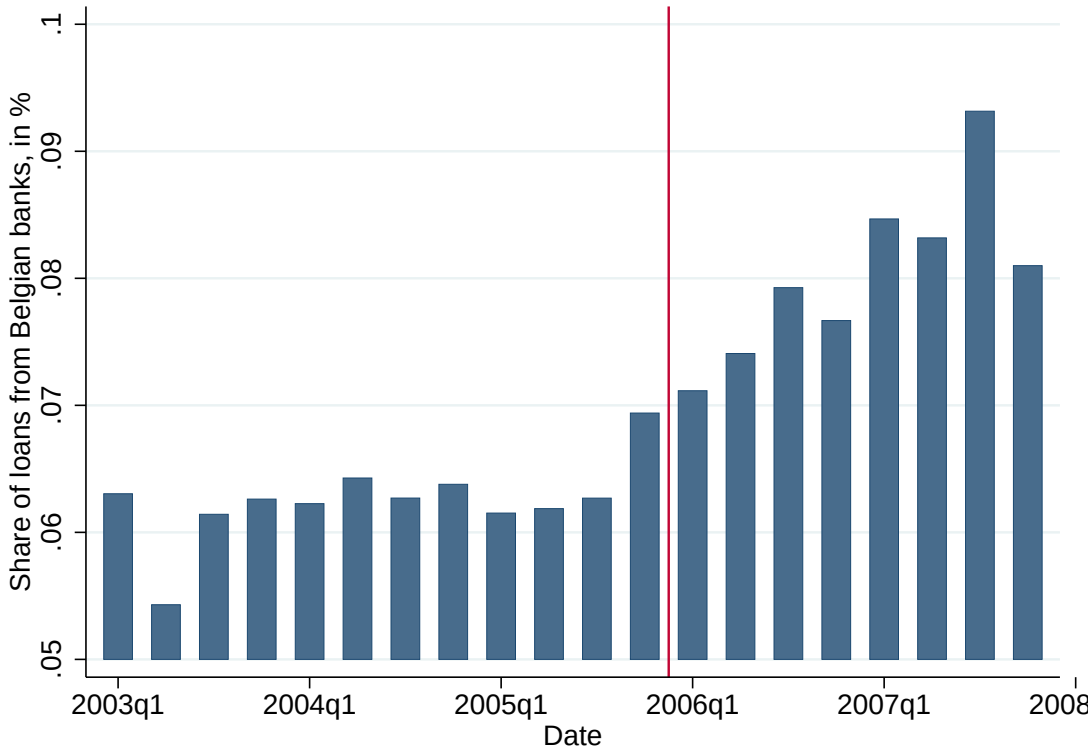
This figure shows the evolution of the relative exposure of German firms to Italian banks over the 1998-2001 period. The red vertical line corresponds to the introduction of the ACE for banks in Italy in 2000. The relative exposure is computed as the ratio of loans from Italian banks to loans from other banks (in volumes).

Figure 2. Evolution of German Firm Exposure to Italian Banks around the Phasing out of the ACE in Italy (2002)



This figure shows the evolution of the relative exposure of German firms to Italian banks over the 2000-2004 period. The red vertical line corresponds to the beginning of the phasing out of the ACE in Italy starting from 2002. The relative exposure is computed as the ratio of loans from Italian banks to loans from other banks (in volumes).

Figure 3. Evolution of German Firm Exposure to Belgian Banks around the introduction of the ACE if Belgium in 2006



This figure shows the evolution of the relative exposure of German firms to Belgian banks over the 2003-2007 period. The red vertical line corresponds to the introduction of the notional interest deduction in Belgium in 2006. The relative exposure is computed as the ratio of loans from Belgian banks to loans from other banks (in volumes).

B Tables

Table 1. Description of the Shocks

Date	Shock	Country	# Treated Banks	# Firms Borrowing from Treated Banks
Allowance for Corporate Equity Reforms				
2000q1	Introduction for Banks	Italy	6	639
2002q1	Phasing out	Italy	6	599
2006q1	Introduction	Belgium	4	1,337
Robustness Shocks				
2000q3	Creation of Dynamic Provisioning	Spain	3	205
2005q1	Loosening of Dynamic Provisioning	Spain	2	335

This table reports for each ACE reforms and other shocks we exploit the date, the number of banks from our sample that are treated and the number of firms borrowing from these treated banks.

Table 2. Summary Statistics

	Mean	St. Deviation	Minimum	Median	Maximum
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Credit Exposure (in million euros)					
All	18.7	298	0.003	2.95	95,000
From German Banks	19.7	314	0.004	3.004	91,000
From Spanish Banks	16	160	0.01	2.0	75,000
From Belgian Banks	4.3	11	0.002	2.3	506
From Euronext Banks	16.5	213	0.01	2.4	67,000
Firm Characteristics					
# of Bank Relationships					
Total Period	6.9	31.5	1	3	1,961
Yearly average	3.2	14.2	1	2	1,326
Length of the Relationship (quarters)	17.3	15.2	1	13	51
Size of the Relationship (million)	666	11,200	0.001	47.2	$1.7 * 10^6$
Bank Characteristics - German Banks					
Total Assets (billion euros)	196	333	0.14	56	1,870
Equity Ratio (in %)	4.1	1.9	0.9	3.9	15.8
ROA (in %)	0.4	0.6	-1.5	0.4	2.7
Doubtful Ratio (in %)	3.1	2.8	0.03	2.5	17.5
% Listed	48	-	-	-	-
Bank Characteristics - Treated Banks					
Total Assets (billion dollars)	299	514	0.3	22	1,870
Equity Ratio (in %)	8.5	7.2	1.2	7	15.9
ROA (in %)	0.7	0.8	-1.5	0.7	2.7
Doubtful Ratio (in %)	4.6	3.3	0.05	4.1	17.5
% Listed	59	-	-	-	-
Bank Characteristics - Other Foreign Banks					
Total Assets (billion dollars)	198	341	0.14	47	1,870
Equity Ratio (in %)	4.5	2.4	0.9	4	15.9
ROA (in %)	0.5	0.6	-1.5	0.4	2.7
Doubtful Ratio (in %)	3.1	2.9	0.03	2.4	17.5
% Listed	52	-	-	-	-

This table reports summary statistics for characteristics of all bank-firm exposures, bank-firm relationships and bank accounting data over the 1994-2013 period.

Table 3. The Introduction of the ACE for Banks in Italy in 2000 and Bank Lending by Italian Banks in Germany

Model	*All Bank-Firm Exposures*			*Intensive Margin*		*Extensive Margin*			*Aggregate Borrowing*	
Dependent Variable	Δ log(Loan Exposure)			Δ log(Loan Exposure)		New Loan Dummy			Δ log(Total Exposure)	
	OLS			*OLS*		*OLS*		Logit	OLS	
Sample	All	Multibank Firms	Foreign Lending	Ex-ante Treated Firms	Ex-ante Treated Multibank Firms	All	Foreign Lending	All	All Firms	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treated	0.76***	0.12	0.79***	0.93***	0.98***	0.02	0.01	0.18	0.6***	
	(0.21)	(0.28)	(0.24)	(0.32)	(0.27)	(0.02)	(0.02)	(0.15)	(0.08)	
Share Treated										1.15***
										(0.26)
Firm FE	-	Yes	-	-	Yes	-	-	-	-	-
Firm Characteristics	Yes	-	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes
Bank Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Relationship Ch.	-	-	-	Yes	Yes	-	-	-	-	-
Observations	121,581	106,983	18,013	14,259	14,221	121,581	18,013	121,581	38,438	33,380
R^2	0.072	0.344	0.087	0.057	0.219	0.106	0.108	0.094	0.199	0.046

This table reports the coefficients of OLS and Logit estimations. The dependent variable in columns (1) to (5) is the change in the log of bank-firm exposure as described in section 3, in columns (6) to (8) a dummy variable that is equal to one if a new loan is granted to a firm with currently zero exposure to the credit granting bank and is equal to zero otherwise, in columns (9) and (10) the change in the log of aggregate lending exposure at the firm level. The initial sample comprises all bank-firm exposures involving firms that borrow from at least two banks headquartered in different countries during the 1994-2013 period. In columns (2) and (5) the sample is restricted to firms that borrow from several banks, in columns (3) and (7) to firm exposure to **foreign banks** and in columns (4) and (5) this sample is restricted to bank-firm exposures that both involve relationship firms, i.e., firms with a strictly positive exposure to *treated bank* and the year prior to shock, and that are strictly positive in the first period. Standard errors are clustered at the bank and firm level in columns (1) to (8) and at the firm level in columns (9) and (10) and reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.

Table 4. The Phasing out of the ACE in Italy in 2002 and Bank Lending by Italian Banks in Germany

Model	*All Bank-Firm Exposures*			*Intensive Margin*		*Extensive Margin*			*Aggregate Borrowing*	
Dependent Variable	Δ log(Loan Exposure)			Δ log(Loan Exposure)		New Loan Dummy			Δ log(Total Exposure)	
	OLS			*OLS*		*OLS*		Logit	OLS	
Sample	All	Multibank Firms	Foreign Lending	Ex-ante Treated Firms	Ex-ante Treated Multibank Firms	All	Foreign Lending	All	All Firms	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treated	-1.47**	-1.83***	-1.62**	-0.64	-0.91**	-0.12***	-0.13***	-0.84**	0.05	
	(0.62)	(0.57)	(0.64)	(0.43)	(0.37)	(0.04)	(0.03)	(0.36)	(0.69)	
Share Treated										-0.89***
										(0.24)
Firm FE	-	Yes	-	-	Yes	-	-	-	-	-
Firm Characteristics	Yes	-	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes
Bank Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Relationship Ch.	-	-	-	Yes	Yes	-	-	-	-	-
Observations	139,751	123,466	20,067	11,856	11,816	139,751	20,067	139,751	43,062	36,113
R^2	0.088	0.411	0.110	0.055	0.244	0.138	0.155	0.114	0.269	0.050

This table reports the coefficients of OLS and Logit estimations. The dependent variable in columns (1) to (5) is the change in the log of bank-firm exposure as described in section 3, in columns (6) to (8) a dummy variable that is equal to one if a new loan is granted to a firm with currently zero exposure to the credit granting bank and is equal to zero otherwise, in columns (9) and (10) the change in the log of aggregate lending exposure at the firm level. The initial sample comprises all bank-firm exposures involving firms that borrow from at least two banks headquartered in different countries during the 1994-2013 period. In columns (2) and (5) the sample is restricted to firms that borrow from several banks, in columns (3) and (7) to firm exposure to **foreign banks** and in columns (4) and (5) this sample is restricted to bank-firm exposures that both involve relationship firms, i.e., firms with a strictly positive exposure to *treated bank* and the year prior to shock, and that are strictly positive in the first period. Standard errors are clustered at the bank and firm level in columns (1) to (8) and at the firm level in columns (9) and (10) and reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.

Table 5. The Introduction of the ACE in Belgium in 2006 and Bank Lending by Belgian Banks in Germany

Model	*All Bank-Firm Exposures*			*Intensive Margin*		*Extensive Margin*			*Aggregate Borrowing*	
Dependent Variable	Δ log(Loan Exposure)			Δ log(Loan Exposure)		New Loan Dummy			Δ log(Total Exposure)	
	OLS			*OLS*		*OLS*		Logit	OLS	
Sample	All	Multibank Firms	Foreign Lending	Ex-ante Treated Firms	Ex-ante Treated Multibank Firms	All	Foreign Lending	All	All Firms	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treated	0.74**	0.66**	0.58*	0.57*	0.44**	0.07**	0.06**	0.33**	0.27	
	(0.35)	(0.27)	(0.35)	(0.30)	(0.21)	(0.03)	(0.03)	(0.14)	(0.24)	
Share Treated										-0.60***
										(0.19)
Firm FE	-	Yes	-	-	Yes	-	-	-	-	-
Firm Characteristics	Yes	-	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes
Bank Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-
Relationship Ch.	-	-	-	Yes	Yes	-	-	-	-	-
Observations	127,831	110,759	22,162	6,314	6,183	127,831	22,162	127,831	48,068	38,792
R^2	0.110	0.399	0.207	0.048	0.320	0.129	0.141	0.103	0.309	0.065

This table reports the coefficients of OLS and Logit estimations. The dependent variable in columns (1) to (5) is the change in the log of bank-firm exposure as described in section 3, in columns (6) to (8) a dummy variable that is equal to one if a new loan is granted to a firm with currently zero exposure to the credit granting bank and is equal to zero otherwise, in columns (9) and (10) the change in the log of aggregate lending exposure at the firm level. The initial sample comprises all bank-firm exposures involving firms that borrow from at least two banks headquartered in different countries during the 1994-2013 period. In columns (2) and (5) the sample is restricted to firms that borrow from several banks, in columns (3) and (7) to firm exposure to **foreign banks** and in columns (4) and (5) this sample is restricted to bank-firm exposures that both involve relationship firms, i.e., firms with a strictly positive exposure to *treated bank* and the year prior to shock, and that are strictly positive in the first period. Standard errors are clustered at the bank and firm level in columns (1) to (8) and at the firm level in columns (9) and (10) and reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.

Table 6. The Introduction of the ACE for Banks in Italy in 2000 and Bank Equity Ratios

Dep. Variable	Ln(Equity Ratio)	Average Ln(Equity Ratio)	Ln(Equity)	Ln(Total Assets)
Treated x Post	0.057**	0.067*	0.019	0.007
	(0.026)	(0.040)	(0.045)	(0.031)
Post	-0.033***	-0.029	-0.026**	-0.016
	(0.008)	(0.023)	(0.011)	(0.017)
Bank FE	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes
Cluster	Bank	Bank	Bank	Bank
Observations	6,212	4,535	6,212	6,212

This table analyzes the impact of the introduction of the ACE on the capital structure of Italian banks in a differences-in-differences setup. The sample period is 1998-2001. Column (1), (3) and (4) show the regression of the logarithm of respectively the equity ratio, total equity and total assets, on a dummy variable *Post* that equals one in 2000-2001, and an interaction term *Post* × *Treated* where *Treated* indicates whether the bank is an Italian bank to captures the impact of the tax reform. Column (2) compares the difference in the average equity ratio over the 1998-1999 period with the average ratio over the 2000-2001 period between the treatment and the control group. The control group is obtained through a matching procedure described in Section 3. Models are estimated using OLS with bank fixed effects. Standard errors are clustered at the bank level and reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.

Table 7. The Phasing Out of the Dual Income Tax in Italy in 2002 and Bank Equity Ratios

Dep. Variable	Ln(Equity Ratio)	Average Ln(Equity Ratio)	Ln(Equity)	Ln(Total Assets)
Treated x Post	-0.051*	-0.095**	0.035	0.046
	(0.030)	(0.047)	(0.037)	(0.028)
Post	0.044**	0.044	0.263***	0.203***
	(0.019)	(0.043)	(0.026)	(0.025)
Bank FE	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes
Cluster	Bank	Bank	Bank	Bank
Observations	1,281	514	1,281	1,281

This table analyzes the impact of the phasing out of the ACE on the capital structure of Italian banks in a differences-in-differences setup. The sample period is 2000-2003. Column (1), (3) and (4) show the regression of the logarithm of respectively the equity ratio, total equity and total assets, on a dummy variable *Post* that equals one in 2002-2003, and an interaction term *Post* × *Treated* where *Treated* indicates whether the bank is an Italian bank to captures the impact of the tax reform. Column (2) compares the difference in the average equity ratio over the 1998-1999 period with the average ratio over the 2000-2001 period between the treatment and the control group. The control group is obtained through a matching procedure described in Section 3. Models are estimated using OLS with bank fixed effects. Standard errors are clustered at the bank level and reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.

Table 8. The Introduction of the Equity Tax Shield in Belgium in 2006 and Bank Equity Ratios

Dep. Variable	Ln(Equity Ratio) (1)	Average Ln(Equity Ratio) (2)	Ln(Equity) (3)	Ln(Total Assets) (4)
Treated x Post	0.178***	0.150**	0.187**	0.043
	(0.053)	(0.065)	(0.076)	(0.062)
Post	0.013	-0.084	0.199***	0.205***
	(0.018)	(0.054)	(0.033)	(0.038)
Bank FE	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes
Cluster	Bank	Bank	Bank	Bank
Observations	660	264	660	660

This table analyzes the impact of the introduction of the ACE on the capital structure of Belgian banks in a differences-in-differences setup. The sample period is 2003-2007. Column (1), (3) and (4) show the regression of the logarithm of respectively the equity ratio, total equity and total assets, on a dummy variable *Post* that equals one in 2006-2007, and an interaction term *Post* $\times$ *Treated* where *Treated* indicates whether the bank is an Belgian bank to captures the impact of the tax reform. Column (2) compares the difference in the average equity ratio over the 1998-1999 period with the average ratio over the 2000-2001 period between the treatment and the control group. The control group is obtained through a matching procedure described in Section 3. Models are estimated using OLS with bank fixed effects. Standard errors are clustered at the bank level and reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.

Table 9. External Validity: The Introduction of Dynamic Loan Provisioning in Spain in 2000 and Bank Lending by Spanish Banks in Germany

Model	*Total Exposure*			*Intensive Margin*			*Extensive Margin*		
Dependent Variable	Δ log(Loan Exposure)			Δ log(Loan Exposure)			New Loan Dummy		
	OLS			*OLS*			*OLS*		Logit
Sample	All		Multibank Firms	Treated Firms		Treated Multibank Firms	All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treated	-2.52***	-1.62***	-1.90***	-1.68***	-0.52	-1.45***	-0.10***	-0.05**	-0.41***
	(0.27)	(0.35)	(0.50)	(0.51)	(0.57)	(0.51)	(0.02)	(0.02)	(0.15)
Firm FE	-	-	Yes	-	-	Yes	-	-	-
Firm Characteristics	Yes	Yes	-	Yes	Yes	-	Yes	Yes	Yes
Bank Characteristics	-	Yes	Yes	-	Yes	Yes	-	Yes	Yes
Relationship Ch.	-	-	-	Yes	Yes	Yes	-	-	-
Observations	162,949	137,882	122,522	17,605	16,816	16,808	162,949	137,882	137,882
R^2	0.094	0.102	0.422	0.011	0.057	0.381	0.132	0.142	
Pseudo R^2									0.119

This table reports the coefficients of OLS and Logit estimations. The dependent variable in columns (1) to (6) is the change in the log of bank-firm exposure as described in section 3, in columns (7) to (9) a dummy variable that is equal to one if a new loan is granted to a firm with currently zero exposure to the credit granting bank and is equal to zero otherwise. The initial sample comprises all bank-firm exposures involving firms that borrow from at least two banks headquartered in different countries during the 1994-2013 period. In columns (4) to (6) this sample is restricted to bank-firm exposures that both involve relationship firms, i.e., firms with a strictly positive exposure to *treated bank* and the year prior to shock, and that are strictly positive in the first period. Standard errors are clustered at the bank and firm level in columns (1) to (9) and reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.

Table 10. External Validity: The Modification of Dynamic Loan Provisioning in Spain in 2005 and Bank Lending by Spanish Banks in Germany

Model	*Total Exposure*			*Intensive Margin*			*Extensive Margin*		
Dependent Variable	Δ log(Loan Exposure)			Δ log(Loan Exposure)			New Loan Dummy		
	OLS			*OLS*			*OLS*		Logit
Sample	All		Multibank Firms	Treated Firms		Treated Multibank Firms	All		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treated	1.00***	0.72***	0.79***	0.60**	1.73**	1.61**	0.14***	0.05*	0.25
	(0.21)	(0.23)	(0.30)	(0.27)	(0.69)	(0.67)	(0.03)	(0.03)	(0.26)
Firm FE	-	-	Yes	-	-	Yes	-	-	-
Firm Characteristics	Yes	Yes	-	Yes	Yes	-	Yes	Yes	Yes
Bank Characteristics	-	Yes	Yes	-	Yes	Yes	-	Yes	Yes
Relationship Ch.	-	-	-	Yes	Yes	Yes	-	-	-
Observations	161,161	130,361	114,029	3,176	3,002	2,950	161,161	130,361	130,361
R^2	0.099	0.106	0.368	0.020	0.057	0.168	0.150	0.147	
Pseudo R^2									0.118

This table reports the coefficients of OLS and Logit estimations. The dependent variable in columns (1) to (6) is the change in the log of bank-firm exposure as described in section 3, in columns (7) to (9) a dummy variable that is equal to one if a new loan is granted to a firm with currently zero exposure to the credit granting bank and is equal to zero otherwise. The initial sample comprises all bank-firm exposures involving firms that borrow from at least two banks headquartered in different countries during the 1994-2013 period. In columns (4) to (6) this sample is restricted to bank-firm exposures that both involve relationship firms, i.e., firms with a strictly positive exposure to *treated bank* and the year prior to shock, and that are strictly positive in the first period. Standard errors are clustered at the bank and firm level in columns (1) to (9) and reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.