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Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
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Abstract

Does the relative cost of equity determine the composition of bank balance sheets and credit supply? To answer this question, we exploit the staggered introduction of tax reforms in Europe from 2000 to 2012 as exogenous sources of changes in the cost of equity. We investigate the effect on credit supply using loan-level data in a country where firms are not affected by these reforms, and where foreign banks affected by the reforms are lending actively: Germany. We find that the relative decrease in the cost of equity leads banks to rely more on equity financing and to increase lending to firms while decreasing security and interbank asset holdings. Overall, we show that taxation can be an effective tool to contain bank leverage while maintaining credit supply.

JEL Classification: E51, E58, G21, G28

Keywords: credit, bank capital, regulation

Claire Célérier - claire.celerier@rotman.utoronto.ca
Rotman School of Management

Thomas Kick - thomas.kick@bundesbank.de
Bundesbank

Steven Ongena - steven.ongena@bf.uzh.ch
University of Zurich, SFI, KU Leuven and CEPR

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Changes in the Cost of Bank Equity and the Supply of Bank Credit*

Claire Célérier † Thomas Kick ‡ Steven Ongena §

This Draft: July 13, 2017

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†Claire Célérier - Rotman School of Management, E-mail: claire.celerier@rotman.utoronto.ca

‡Thomas Kick - Bundesbank, E-mail: thomas.kick@bundesbank.de

§Steven Ongena - University of Zurich, SFI, KU Leuven and CEPR, E-mail: steven.ongena@bf.uzh.ch.

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). There is growing empirical evidence, however, that tightening capital requirements leads banks to contract lending, which in turn negatively affects the real economy (Aiyar et al., 2014; Fraisse et al., 2015; Jiménez et al., 2016). At the same time, while capital requirements have been significantly tightened since the financial crisis, tax systems in most countries seem to act in the opposite direction: by allowing the deduction of interest but not of equity returns, they provide incentives for banks to borrow more than they otherwise would.

To reduce bank leverage there exists therefore an alternative to tightening capital requirements: decreasing the relative cost of equity. Such a decrease should make equity more attractive, thereby reducing bank leverage (Schepens, 2016; Devereux et al., 2017). But what is the effect on the composition of bank balance sheets? Does a decrease in cost of equity also affect bank lending? The objective of this paper is to investigate to which extent fiscal policy can be an efficient tool to contain bank leverage while maintaining credit supply.

To address this question, we study the staggered introduction of tax reforms in Europe from 2000 to 2012 that lead to a decrease in the relative cost of equity. The first set of reforms, an *Allowance for Corporate Equity* (ACE), took place in Italy and Belgium in 2000 and 2006, respectively. The objective of the ACE was 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. An ACE might affect the balance sheet of banks and credit supply through two channels: the cost of capital, and bank capital structure. Subsidizing equity, on the one hand, results in a lower total cost of capital, which might lead banks to expand their balance sheet, and lend more. On the other hand, decreasing the

relative tax advantage of debt might induce banks to hold more equity, thereby relaxing the regulatory constraints on equity ratios. 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.

The second set of reforms we consider is the introduction of a *tax on bank liabilities net of equity* in seven European countries from 2010 to 2012. By raising the cost of borrowed funds, this tax is designed to increase stability in the financial sector by inducing banks to rely more on own equity. The effect of this reform on lending is ambiguous. On the one hand, because the tax increases the cost of capital for banks, banks might contract their balance sheet and then lending. On the other hand, the change in bank capital structure might relax the regulatory constraints on lending. This paper studies how credit supply responded to these two reforms with the ultimate aim of assessing whether inducing banks to hold more equity can have a positive effect on lending through a shift in the capital structure.

We first explore the effect of these reforms on the structure of bank balance sheet in a panel analysis using financial data from Bankscope.[1] (Schepens, 2016) and (Devereux et al., 2017) find that banks exposed to, respectively, an ACE and a liability tax increase their reliance on equity financing. The objective of this paper is to identify whether banks shift the composition of their balance sheet to assets that are more costly to hold in terms of capital charge, i.e corporate loans, away from security holdings or interbank assets. We exploit the staggered adoption of the tax reforms in Europe from 2000 to 2012 as a rich natural experiment: among the 15 European countries with the largest banking system, 7 countries adopted one of the reforms, while the remaining 8 countries did not.[2]

We then investigate further the effect on credit supply using loan level data in a country where firms are not affected by these reforms, and where foreign banks affected by the reforms are lending actively: Germany. We exploit the German

[1] De Jonghe et al. (2016) investigate the effects of capital requirements on the balance sheet structure of banks.

[2] We restrict our analysis to the 15 countries with the highest total banking assets: Belgium, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Denmark, United Kingdom, Switzerland, Spain, Portugal, Austria, Sweden, Norway

credit register, which includes *all* bank-firm exposures that initially surpassed 1.5 million euros. We study the entire 1993-2013 period and, to get balanced treated and control groups, restrict the sample to firms that borrowed at least once during this sample period from banks headquartered in two different countries, including Germany.[3] With a share of total assets higher than 12%, the presence of foreign banks is important in Germany. 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 - the intensive margin - and the likelihood that a new loan is granted - 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 and restrict our analysis to lending by foreign banks.

Our estimations are lined up as follows. First, we show that banks shift the composition of their balance sheet to assets that are more capital demanding, i.e. corporate loans. While an ACE has no significant effect on the total size of bank balance sheet, the liability tax leads banks to shrink their balance sheet. However, for both reforms, the share of corporate loans to total assets increases, while the share of security holdings and interbank assets decreases. Overall, banks seem to increase credit supply to firms after fiscal reforms that decrease the relative cost of equity.

Second, we confirm that banks affected by these policy reforms expand lending using the German credit register. The magnitude of the effect is large, and is also observed for the tax on bank liabilities that increases the cost of capital, suggesting that the effect is mostly driven by the fact that equity is a binding constraint for 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 increase in the probability of granting a new loan is less significant, but up to 6 percentage points for Belgian banks after the introduction of the ACE in Belgium.

[3]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

As a robustness check, we provide additional uniquely clean evidence that negative shocks to bank lending are amplified abroad. Jiménez et al. (2016) show that the introduction of dynamic provisioning in Spain in 2000 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. 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 of the negative effect of tightening capital requirements 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 real effects of regulations aiming at reducing bank leverage. 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; Gornall and Strebulaev, 2013; Kashyap et al., 2010), we investigate the effect of a decrease in the relative cost of equity through changes in taxation. 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. We also extend Devereux et al. (2017)'s result showing that the increase in portfolio risk they observe comes from a higher participation of banks in the real economy. Our results are also relates to the debate on whether equity is cheap or not for large financial institutions (Admati et al., 2013; Gandhi et al., 2016; Baker and Wurgler, 2015). The moderate effect we observe on bank equity in contrast with the strong effect we find on bank lending suggests that equity is expensive and that capital requirements are binding.

Our paper also adds to the literature on cross-border banking showing that the effect of domestic shocks are amplified abroad after controlling for demand with firm fixed effects (Peek and Rosengren, 1997, 2000; Ongena et al., 2013). Looking at the impact of changes in regulation abroad, also allows us to better control for the inevitable endogeneity in regulation. 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. Our empirical framework allows us to better for credit demand with firm fixed effects.

Finally, our study complements the literature on the impact of taxation on bank capital structure (Keen and de Mooij, 2012; Gu et al., 2015; Gambacorta et al., 2016; Schepens, 2016; Devereux et al., 2017), intermediation costs (Capelle-Blancard and Havrylchyk, 2017), deposit rates (Buch et al., 2016) and cross-state lending (Smolyansky, 2016). Following the Bank Recovery and Resolution Directive adopted in 2013, the European Union has implemented a Single Resolution Fund funded on a tax on bank liabilities net of equity starting from 2016. Our paper helps understanding the possible balance sheet impacts of this new policy.

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 How to Decrease the Relative Cost of Equity?

This section describes two tax reforms that decrease the relative cost of equity and their implementation in the various settings we exploit in our empirical analysis.

2.1 ACE

An ACE supplements the current deductibility of interest payments on debt with a similar deduction for some "normal" return on equity. The deduction is derived by multiplying the ACE base by an ACE rate. The base of the ACE is either the entire equity stock, or the increment relative to some base year. In the latter case, the ACE base is formed by new equity issues plus retention of after-tax profits, relative to last year. To obtain full tax neutrality between debt and equity under the ACE, the ACE rate must be equal to the rate at which shareholders discount the tax savings from the company's future ACE allowances, i.e., the interest on the company's long term debt IMF (2010). However, for administrative reasons, using

a single notional rate of return for all companies rather than applying firm-specific rates seems more realistic.

An ACE has several important neutrality properties. First, an ACE neutralizes the debt-bias. Evidence suggests significant reductions in debt ratios as result of ACE, consistent with theoretical predictions (Princen, 2012; Hebous and Ruf, 2017; Panier et al., 2013). Second, an ACE renders the corporate income tax neutral with respect to marginal investment decisions. As the ACE system charges no tax on projects whose return equals the cost of capital, the effective marginal tax rate is zero. Finally, an ACE removes investment distortions induced by differences between economic depreciation and depreciation for tax purposes. In particular, accelerated depreciation for tax purposes reduces the book value of assets in the tax accounts, thereby also reducing the ACE in later years. This exactly offsets the benefits from earlier depreciation in present-value terms. One major concern with the ACE, however, is its revenue cost for the State and its effect on public finances.

The Belgian ACE (2006)

Belgium, in 2006, introduced a full ACE for all corporations, including financial institutions. The ACE base was the full equity stock - i.e. common equity and retained earnings. The ACE rate was based on the average rate on 10-year bonds the preceding year, with some restrictions.[4] Finally, the Belgian ACE applies to both resident companies and non-resident companies with a permanent establishment or holding immovable properties in Belgium.

The reform was voted two years after the European Commission put an end to a unique Belgian fiscal advantage for subsidiaries of non-Belgian multinationals, the *coordination center* regime created in 1983.[5] The objective of the *coordination center* regime was to attract profitable service centers, the *coordination centers*,

[4]In each year, the rate cannot exceed by more than 1 percentage point the rate applied in the previous year, and it could not be in any case larger than 6.5% until 2011, 3% after (Zangari, 2014; Schepens, 2016). The ACE rate was equal to 3.4%, 3.8%, 4.3%, 4.5%, 3.8%, 3.4% respectively in 2006, 2007, 2008, 2009, 2010, and 2011. Starting in 2012, the interest rate deduction was capped at 3%, and in 2013 the limit was further revised to 2.7%.

[5]The European Commission took the decision to ban this fiscal regime on February, 17 2003

with minor cost structures. These *coordination centers* were specialized in financial, accounting and administrative services, and benefited from a fixed tax rate, ranging from 4 to 10%, based on expenses less financial and salary costs rather than on profits. With this fiscal advantage, Belgium became a popular destination for a significant number of *coordination centers*. The fear of losing profit centers to other countries following the dismantlement of the *coordination center* regime in February 2003 lead to the 2006 ACE tax reform. The 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.

The Belgian ACE regime has being weakened over the last years, with the progressive reduction of the ACE notional rate, the elimination of the carry-forward for the unutilized ACE in 2011, and, in August 2013, with the introduction of the fairness tax which has basically transformed the Belgian ACE in a partial ACE scheme.

The Italian ACE (2000)

In December 1997, Italy introduced a partial ACE mechanism for corporations.[6,7] One of the objective of this tax reform was to reduce the strong incentives to debt-funding in Italy. In 1996, before the reform, every additional euro of interest costs made possible a tax saving of 0.53 cents at the corporate level, while there was no tax saving for equity costs. In addition, the tax treatment of the return on equity and debt at the personal level either exacerbated this tax advantage to debt, or mitigated it only to a limited extent. This strong tax-related debt bias, coupled with the importance of family firms, partly contribute to the traditionally high reliance of Italian firms on debt finance.

The Italian ACE implemented in 1998 is partial for three reasons. First, the

[6]See the legislative decree n.466, December 15, 1997. `http://www.camera.it/parlam/leggi/deleghe/97446dl.htm`, `http://www.finanzaefisco.it/agenziaentrate/cir_ris_2001/cir61-01.htm`.

[7](Zangari, 2014) compares the Italian and Belgian ACE experiences for firms.

notional return on equity is not fully deducted, but taxed at a reduced tax rate of 19% rather than at the ordinary corporate tax rate of 37%. Second, the ACE base is the book value of new equity, taking the year 1996 as a reference. Third, the resulting average rate of tax on profits could not fall below 27%.

However, starting from 1998 onwards, the ACE has been progressively converging to a full ACE. Because companies did not seem to be properly discounting the *Dual Income Tax* benefit on new investments, they pressed the Government for clearer, more immediate tax reductions instead. As a result, in 1999 the Ministry of Finance included in the ACE base any new equity relatively to 1996 multiplied by 1.2 in 2000 and by 1.4 from 2001 onwards. The objective was to speed up the transition to a system in which the ordinary return will be computed on all equity capital, and reduces further the cost of capital on a new equity financed investment (Bordignon et al., 1999, 2001).

After the 2001 elections, the Italian government has progressively withdrawn the ACE. In 2002, the book value is cut again to 100%, only equity increases until June 2001 are taken into account, the notional interest rate is decreased down to 3.5%, and the corporate tax rate is decreased from 37 to 33%. Apparently, one of the reasons for the repeal by the new government is the reduction of the tax revenues following the 1996 tax reform, for which the ACE is considered mostly responsible .

We will exploit the phasing out of the Italian ACE in 2002, which implies an *increase* in the cost of equity, coupled with a decrease in the "local income tax", to investigate the effect of an *increase* in the relative cost of equity when the overall cost of capital *decreases*. This "local income tax", *Imposta Regionale sulle Attivita' produttive* (IRAP), was introduced in 1998 to replace a tax levied on profits at a flat rate of 16.2% and had a very broad tax base and a low tax rate equal to 5.4%. The IRAP decreased significantly starting from 2000, hence decreasing the cost of capital for banks (Bond et al., 2016; Gambacorta et al., 2016).

2.2 The Tax on Bank Liabilities Net of Equity

In June 22 2010, following a recommendation by the IMF, the UK, France and Germany issued a joint statement saying the three countries wanted financial institutions to make a "fair contribution to reflect the risk they pose to the financial system and wider economy, and to encourage banks to adjust their balance sheets to reduce this risk". In the wake of the financial crisis, the IMF promoted levies on bank liabilities as a tool to increase revenue collection from the financial sector while at the same time contributing to financial stability by incentivizing banks to adopt less risky capital structures (IMF, 2010). The simultaneous move by the UK, France and Germany aimed at preventing banks from avoiding the levy by shifting operations between countries. If this bank levy did not garner universal support, several other European countries applied a levy between 2011 and 2012, such as Austria, Belgium and the Netherlands.

The levy we exploit in this paper is a tax on bank liabilities net of equity and customer deposits. Because equity is deducted from the tax base, this levy reduces the cost of equity relatively to debt. Only one country in our sample, France, adopted a bank levy that is conceptually different: the taxable base is the minimum level of capital requirements based on risk weighted assets. Because this tax should have no effect on bank capital structure, we consider French banks as not treated. In a robustness check, we also exclude French banks from our analysis.

While several European countries adopted this bank levy over the 2010-2012 period, "the specific design of each levy (...) reflect (...) different domestic circumstances and tax systems". The European levies vary along four dimensions: the treatment of long term liabilities, the increase in the rate relatively to bank size, some specific deductions, and the use of revenues (Devereux et al., 2017).[8] While in Germany and Sweden, the revenues go to a special reserve fund to ensure that taxpayer's money will not be used for future bailouts, in the UK, the government has decided against a resolution fund because of moral hazard concerns and, hence, revenues go to the budget. Table 1 describes the key characteristics of the levies

[8]Most levies treat short-term and long-term liabilities symmetrically, but two countries, Netherlands and the UK, apply a reduced rate to liabilities with a maturity exceeding one year (Devereux et al., 2017).

we exploit.

INSERT TABLE 1

Over the same period, from 2010 to 2012, several regulations or state interventions are likely to have affected both bank balance sheet composition and credit supply. First, banks might have anticipated the implementation of Basel 3 starting in 2013, which increased minimum capital requirements in terms of risk weighted assets and introduced a minimum leverage ratio in terms of total consolidated assets. Second, in the aftermath of the financial crisis, many governments provided distressed banks with new equity and/or guaranteed their debt. EU banks, however, are likely to all have anticipated Basel 3. We also identify banks that benefited from state support in our sample to control for these possible confounding effects.

3 Data and Summary Statistics

3.1 Bank Level Data

Bank level data is from the Bureau van Dijk Bankscope database. We select all commercial, savings and cooperative banks from the 15 largest banking sectors in Europe, i.e., Belgium, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Denmark, United Kingdom, Switzerland, Spain, Portugal, Austria, Sweden and Norway. We restrict our analysis to these 15 countries because we want banks that face similar credit markets and macroeconomic conditions. We also do not restrict our analysis to the EU or the Eurozone, because we want to include UK or Swiss banks as they are comparable in size and business models with other European banks, and because they lend actively in Germany (See Table 2). Finally, we know that the coverage of these European countries is very good (Duprey and Lé, 2012).

For each bank, we collect information on total assets, equity ratio, return on equity and return on assets, as well as on the composition of the assets. We keep only consolidated data when available, and drop banks with negative equity or

missing information on equity, which amounts to less than 1.4% of the available information. We convert data into constant 2007 dollars.

We also employ a number of country-level control variables including inflation rates, real GDP growth rates, and GDP per capita from Eurostat.

3.2 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 exceeded 1.5 million euros when granted. Important for our purposes, and in contrast to a number of other credit registers, this data is requested from both German and foreign banks. Also essential for our estimations, the German credit 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.

Because our identification strategy relies in the differentiated credit supply by banks from several countries in Germany, we extract from the credit register 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.

To track changes in bank-firm exposures, we construct a balanced quarterly panel of bank-firm pairs, including 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 credit 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.[9]

One concern with these loan-level data is that, by construction, our findings

[9]When two banks merge, we artificially create a third bank for the time period after the merger.

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.

We then merge our loan level data with the bank level data from Bankscope.[10]

3.3 Summary Statistics

Table 2 illustrates the dynamics of foreign lending in Germany by providing a list of the main countries with banks active in Germany. From 1993 to 2014, 10 countries had banks that made loans amounting to more than 1.5 million euros to more than 1,000 firms in Germany. Within our sample, 5 Belgian banks and 17 Italian banks have been affected by an ACE and 71 banks (excluding German banks) by a tax on bank liabilities net of equity.

INSERT TABLE 2

Table 3 provides descriptive statistics on bank-firm exposures, firm and bank characteristics over our sample period for firms and banks that are respectively not treated and treated by each shock. We find that treated banks are larger and more capitalized than the average German bank in our sample, whereas their exposure to German firms is lower. We control for these differences in the empirical analysis.

INSERT TABLE 3

[10] Our loan level analysis also includes bank level data from the Bundesbank as controls.

4 Identification Strategy

4.1 Tax Reforms and the Composition of Bank Balance sheets

Several papers in the literature have provided some evidence that the implementation of tax reforms that decrease the tax advantage of debt leads to more balanced capital structures for banks (Schepens, 2016; Devereux et al., 2017). The objective of this paper is to investigate to which extent it leads banks to change the composition of their bank balance sheet.

To estimate the effect of the tax reforms on bank asset composition, we use a difference-in-differences analysis. We compare the change in the growth rate of the balance sheet items of each treated banks with the change in the growth rate of the balance sheet items of non-treated European banks. For each event, we collect data over a five-year period, and test the following equation:

$$\Delta log(Balancesheet\ Item_{b,t}) = \alpha + \beta Treated_b \times \text{Post}_t + \lambda Y_{b,t-1} + \gamma C_{c,t} + \mu_b + \mu_t + \epsilon_{b,t}$$

Where $Balancesheet\ Item_{b,t}$ is the balance sheet item of bank b at time t, $Treated_b$ is a dummy that is equal to 1 for all treated banks and $Post_t$ is a dummy indicator equal to one in the post-treatment period. The model also includes a vector of time varying-country characteristics ($C_{b,t-1}$), i.e., GDP per capita growth rate and the log of the CPI, and a vector of time-varying bank characteristics ($Y_{b,t-1}$) that are typically seen as important bank capital structure determinants, i.e., bank profitability (return on assets), bank business model (loan to asset ratio, non interest income share), bank size (log of total assets) and bank capital structure (Equity to Asset) in the previous period. μ_b and μ_t stand respectively for bank and year fixed effects. The main coefficient of interest is the coefficient β for the interaction variable. Standard errors are clustered at the bank level.

Our objective is to investigate to which extent changes in the cost of equity affect bank capital structure and, as a consequence, the composition of its balance

sheet. We therefore focus on two types of balance sheet items. The first one concerns the capital structure: we look at the total amount of common equity (in log), the equity to asset ratio, and total assets. The second one reflects the composition of the assets. We look at the share of assets that are securities, interbank assets and loans, and, when data are available, we also focus on the ratio of corporate loans to total assets and mortgage loans to total assets.

In this model, because we investigate the effect of the policy reform on the growth rate of each balance sheet items controlling for bank and year fixed effects, we are able to capture bank-specific trends as well as year-specific evolutions. However, to assess the robustness of our analysis, we also use a propensity score matching procedure to construct a control group of European banks for each shock, based on their characteristics in the pre-treatment period (see e.g. Angrist and Krueger (1999), Roberts and Whited (2012)). The propensity score is calculated on the following variables with their value the year before the shock: growth rate of total assets, loan to asset, contemporaneous and lagged equity ratio, growth rate of the equity ratio. We take the closest five non-treated financial institutions for each treated financial institution, with possible replacement to maximize comparability (Rosenbaum and Rubin (1983), Smith and Todd (2005)). These replacements happen frequently, which explains the small size of the control group for each of our shocks.

4.2 Tax Reforms and Bank Credit Supply

We estimate the effect of the changes in the tax treatment of equity on lending by affected banks in Germany for the following reasons. First, our empirical settings allows us to exploit a treatment that is exogenous both to bank characteristics - as the treatment is only driven by the home country of the foreign banks - and to the German economic situation. The state of the economy in Germany is indeed unlikely to have affected the adoption of the ACE in Belgium, or the end of the ACE in Italy. Both reforms were if anything driven by the situation of non financial firms in these countries. Second, the adoption of the taxes on bank total liabilities net of equity was the result of a joint move by the main European economies

following a recommendation of the IMF (IMF, 2010). In addition, because we compare lending by treated banks versus non-treated German and foreign banks we can control for demand. Germany hence offers a setup that is totally free of any lingering concerns about the endogeneity of changes in banking regulation. Third, Germany has an active bank credit market with a large but reasonnable presence of foreign banks from multiple countries. The significant number of banks active in Germany that are affected by the shock we exploit allows us to measure how the magnitude varies with bank characteristics. Finally, the strength of the German economy implies that banks can easily expend lending, and its stability limits the possible effects of confounding factors on our results.

Our empirical analysis unfolds in five steps. First, we look at the effects of each event on all bank-firm exposures. We then focus on firm exposures to foreign banks only. Third, we 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*. Fourth, 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.

4.2.1 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:

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

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 and Y_b is a vector of bank controls. Error terms are clustered at the bank and firm levels.[11]

Bank controls include the logarithm of total assets, the equity ratio, and the return on assets (ROA) at date $t-1$, and bank type fixed effects. Banks are divided into four categories: commercial banks, savings and cooperative banks, and other financial institutions, which includes mortgage banks, 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).

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.[12]

In order to comprehensively account for the firm demand for credit, we saturate the specification 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.

We finally restrict our sample to firm exposures to foreign banks. The objective is to control for any effect that would be driven by changes in the lending policies of German banks. For example, if the GDP in Germany goes down, German banks may reduce lending, and our effect may only be driven by the higher demand for loans to foreign banks.

[11] Note that to investigate the effect of the tax on total liabilities net of equity we use a panel model with bank-firm fixed effects because the implementation is staggered across states

[12] We do not control for relationship characteristics in this specification because for new borrowers the value is automatically zero, which may bias our results downwards.

4.2.2 Intensive Margin

In a second step, we restrict our analysis 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, and controlling for relationship characteristics:

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

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.

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.

4.2.3 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 model:

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

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 estimate this model in both a linear probability and a logit specifications.

4.2.4 Aggregate Firm Borrowing

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. The objective is to investigate whether treated banks are substituting or not to other banks when they increase lending.

In a first specification, our variable of interest $Treated$ indicates firms that are borrowing from at least one treated bank. We then estimate the following model:

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

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

5 Results

5.1 Tax Reforms and the Composition of Bank Balance sheets

Tables 4, 5 and 6 illustrate the effect of changes in the cost of equity resulting from policy reforms on the composition of bank balance sheets.

First, Table 4 illustrates how a decrease in the relative cost of equity, resulting from the implementation of an ACE in Belgium in 2006, is affecting bank capital structure. Consistent with Schepens (2016), we find that banks tend to accumulate more equity in absolute terms (column 1) and relatively to total assets (column 3). More precisely, bank equity growth is around 5 percentage points higher in the three years following the introduction of the ACE for Belgian banks relative to other European banks. The result is robust whether we use the total sample or the matched sample. Because we are regressing the change in equity with bank fixed effects, we also control for trends. Figure 1 illustrates the time dimension of

the result: We find that the effect on the level of equity is persistent, as growth slightly decreases but does not become negative to years after. This is consistent with the idea that the change in the cost of equity would have potentially moved the target capital structure. In level, Belgian banks increase their equity ratio by more than 15 percent on average after the ACE reform, which corresponds to 1 percentage point higher equity ratio and is similar to the estimates in Schepens (2016).[13] These are economically very relevant changes in equity ratios that may lead to large swings in lending volumes.

INSERT TABLE 4

Table 4 then shows the effect of the implementation of the ACE on bank asset composition. Column (2) indicates that banks have increased the share of loans in total assets (column 4), while they have decreased the share of interbank assets (column 5) and securities (column 6). Belgian banks seem to have therefore switched part of their assets away from both interbank assets and securities to loans.

INSERT FIGURE 1

Second, Table 5 illustrates the effect of an increase in the relative cost of equity, resulting from the end of the ACE, on bank capital structure and balance sheet composition in Italy. We find that the end of an ACE has the opposite effect to its implementation: Italian banks have decreased equity ratios and total equity more rapidly than other European banks. Our results are consistent with Bond et al. (2016) who show that while the leverage of Italian banks leverage has been sensitive to changes in regional tax rates over the 1998-2011 period, the effect was lower during the period of the ACE in Italy. At the same time, banks have been holding more securities, while decreasing the share of loans to total assets.

INSERT TABLE 5

[13]Panier et al. (2013) investigate the effects of the introduction of the ACE on the capital structure of non-financial firms and find effects of similar magnitude in percentage. Non-financial firms increased equity-to-total asset ratios from 32.8% on average between 2002 and 2004 up to 38.2% on average between 2006 and 2008. leading to an increase in equity ratios of 17%.

INSERT FIGURE 2

Finally, Table 6 shows the effect of the bank liability taxes adopted in a sub sample of European countries over the 2010-2012 period. While the levies decrease the cost of equity relatively to debt, it increases the total cost of capital. This therefore explains why affected banks significantly reduce the size of their assets after the tax is implemented (column 2). However, affected banks also accumulate more equity (column 1), resulting in higher equity ratios (column 4). The composition of the assets also significantly changes: banks seem to switch away from interbank assets and securities to corporate loans (columns 4, 5 and 6). These results are consistent with Devereux et al. (2017). Devereux et al. (2017) find a positive effect on the equity ratio, but a negative effect on the risk weighted asset ratio. They interpret this result as an increase in bank portfolio risk. We show that this increase in the risk weighted ratio is driven by banks switching their assets to corporate loans, which on average, bear more weight in risk weighted measures.

INSERT TABLE 6

5.2 Tax Reforms and Credit Supply

We next turn to the effect of the changes in the cost of equity on bank lending.

Figure 3 shows the (non-conditional) evolution of German firms' percentage exposure to Belgian banks in the years around the introduction of the ACE in Belgium in 2006. The introduction of the ACE is followed by an increase in lending by Belgian banks. This result is confirmed by Table 7, which shows the results of conditional regressions, and the magnitudes are large. The coefficient in column (1) indicates that changes in exposure to Belgian banks would have been 70 pp higher after the introduction of the ACE. When restricting the sample to multibank firms, and after including firm fixed effects to control for demand, the effect is only slightly reduced (column 2). When we restrict the analysis to firm exposures to all foreign banks - hence excluding borrowing from German banks - the effect is reduced but still large (columns 3 and 4), which implies that exposure to Belgian banks have increased even relative to foreign banks only. The

coefficients in columns (5) to (9) suggest that the effect is both at the intensive and extensive margins.

One concern would be that the effect is driven by a lower demand for credit from Belgian firms, as Belgian firms are also affected by the introduction of the ACE. Panier et al. (2013), however, do not find any evidence of a decrease in the amount of total debt for non financial firms in Belgium following the introduction of the ACE.

INSERT FIGURE 3

INSERT TABLE 7

Finally, the introduction of the taxes on bank liabilities net of equity in Europe from 2010 to 2012 allows us to further point to the key effect of capital structure on bank lending. This new tax indeed resulted in an increase in the cost of capital for banks. We can therefore investigate to which extent our previous results were driven only by a decrease in the cost of capital due to the ACE, or by a change in the capital structure. The results are of the same magnitude, which confirm the results from the previous analyses based on the ACE. Banks affected by the liability tax significantly increase lending, both at the intensive and the extensive margins, and the result is robust to restricting our analysis to lending by foreign banks.

6 Discussion

6.1 External Validity: Are Domestic Shocks Amplified Abroad?

In order to investigate whether, in general, domestic shocks are amplified 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. We here extend the results from Jiménez et al. (2016).

Dynamic provisioning was introduced in Spain in 2000.[14] The objective was to accumulate more provisions in good times to serve as a buffer in bad times.

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

Dynamic provisions were defined by a formula and included in Tier 2 capital. This therefore leads to a tightening of capital regulation for banks. Jiménez et al. (2016) find that this average increase in provisions leads to a 10% decrease in lending in total, and of around 18% for commercial banks. Columns 3 and 4 in Table indicate their results. The average value of the treatment variable "Dynamic Provision" is 0.5 for large commercial banks.

Table shows the changes in bank lending by Spanish banks relatively to lending by non-treated banks after the introduction of dynamic provisioning. We find that loan exposure by Spanish banks decreases substantially after the introduction of dynamic provisioning. 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. Our findings are hence consistent with De Haas and Van Horen (2012) who show that banks may cut back dramatically on foreign lending when being hit at home.

INSERT TABLE

Two mechanisms might be driving this result. On the one hand, dynamic provisioning leads to an increase in requirements for Tier 2 capital, as loan loss provisions are counted as part of Tier 2 capital. We would therefore observe the effects of higher Tier 2 capital requirements on lending. On the other hand, dynamic provision funds are subtracted from earnings, which therefore increases the opportunity cost of common equity, as it becomes more difficult for banks to retain earnings. In addition, the relative cost of Tier 1 capital also increases, as, in 2000, dynamic provisions are tax deductible. In this scenario, the decrease in lending would result from a decrease in equity ratios, resulting from the relative higher cost of Tier 1 capital. Consistent with this hypothesis, we find that Spanish banks decrease common equity ratios after the introduction of dynamic provisioning. Columns 1 and 2 show in Table that the effect of the introduction of tax deductible dynamic provisions on equity ratios is of the same magnitude as the effects of the other shocks we have investigated.

6.2 The Cost of Equity for Banks

Our results contribute to the debate to which extent equity is expensive for banks. We find two types of evidence indicating that indeed equity is expensive for banks. First, when the tax advantage of debt is totally neutralized, as it is the case with the Belgian ACE, we find that banks increase equity, but in a moderate magnitude. It confirms the existing results that the main costs to issuing equity are due to information asymmetries rather than taxes. Second, however, when banks only slightly move the amount of equity, the effect on lending are very large. This shows that Tier 1 capital ratio are indeed binding, and that minor changes in regulation can have a large effect on the real economy. Finally, our paper identifies how banks funding risk could be managed without affecting lending to the firms.

6.3 Robustness Checks

We confirm the robustness of our analysis on the effect of the changes in the cost of equity induced by policy reforms on lending by performing the following analyses: we exclude lending to financial firms, we run a panel model, and we also exclude banks that enter or exit the sample. Our results still hold.

7 Conclusion

We study the impact of shocks to the cost of bank equity on bank asset composition and credit supply. Using a difference-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.

Our paper contributes to the debate on bank capital regulation by investigating the effects of policy reforms that monitor the cost of equity. The positive effect of lending of the tax on liabilities net of equity shows that bank funding risk can be monitored without a negative effect on bank lending to firms.

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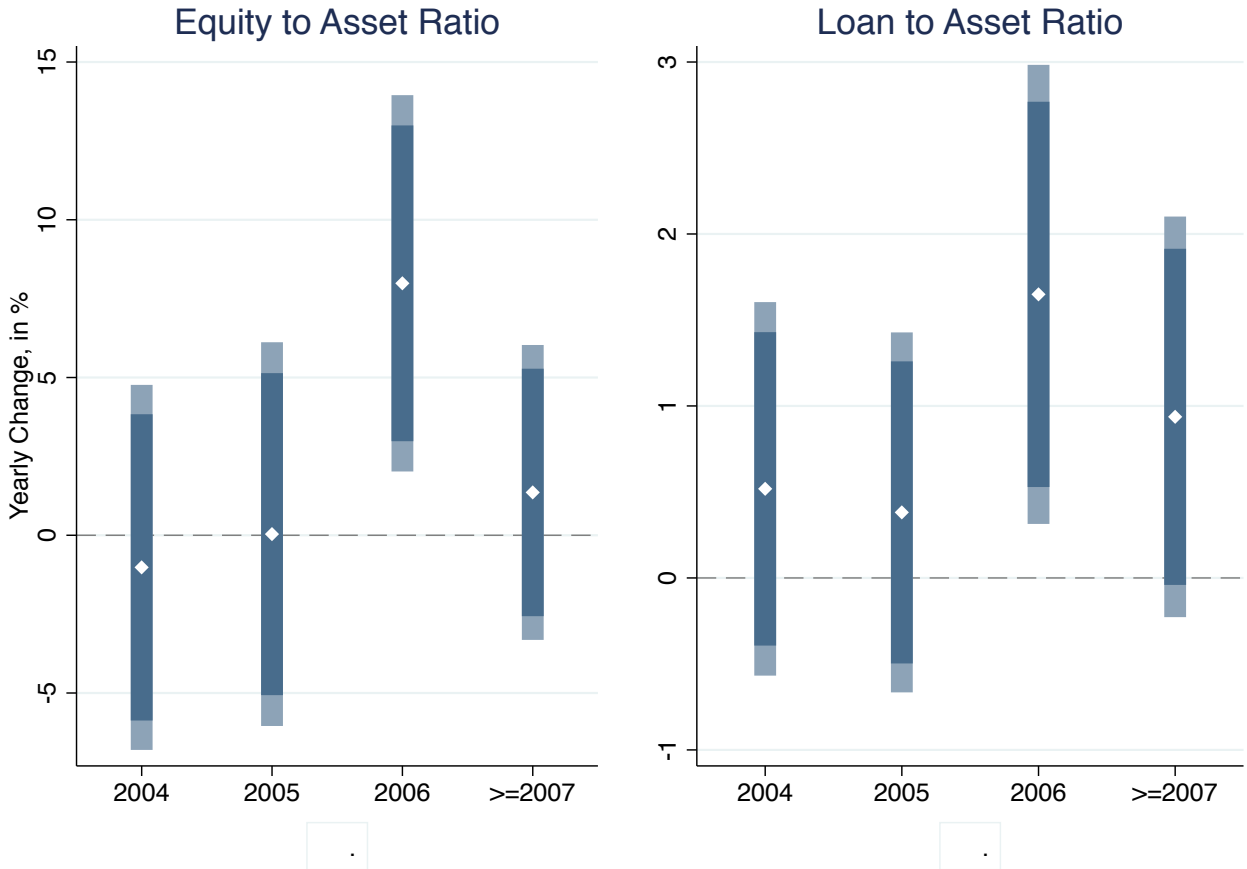
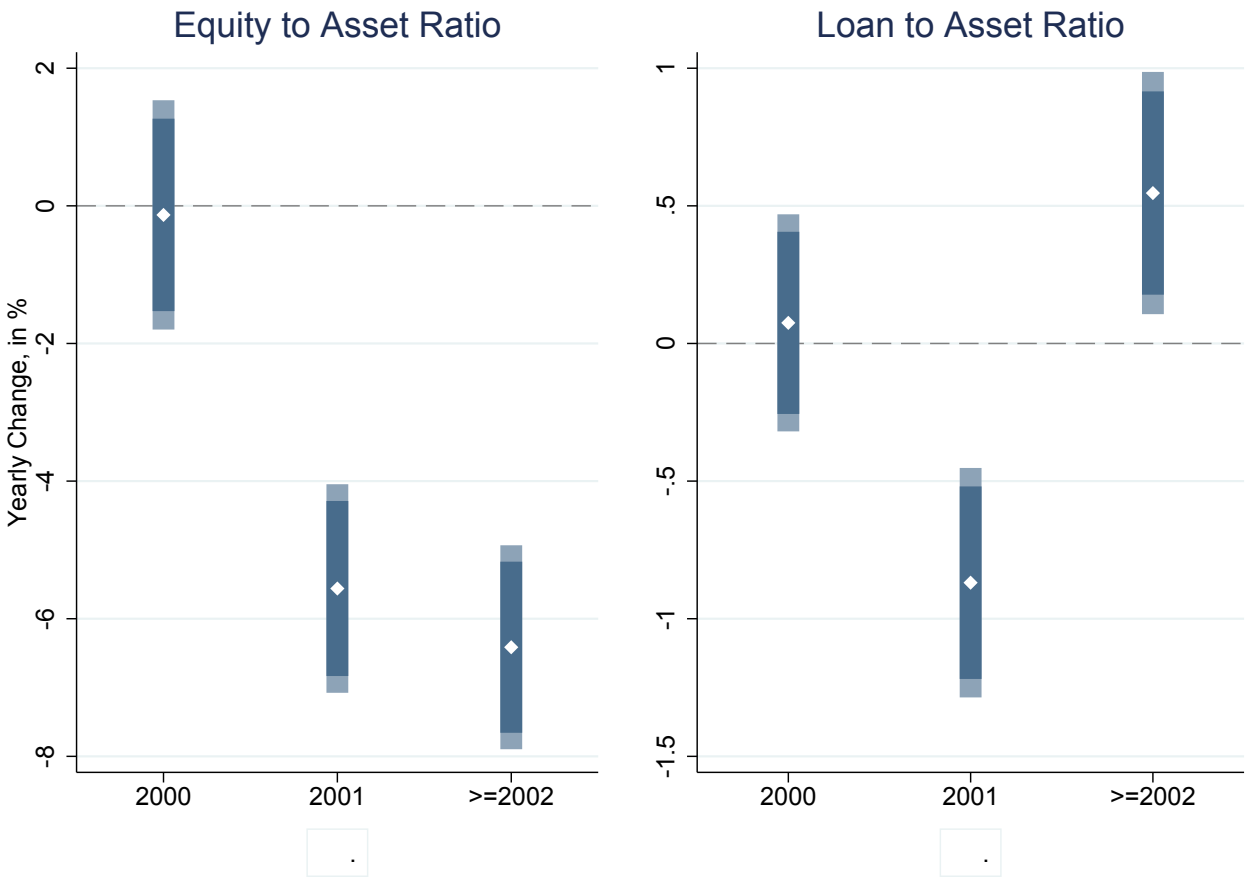
A Figures

Figure 1. Changes in Growth Rates after the Implementation of an ACE in Belgium in 2006



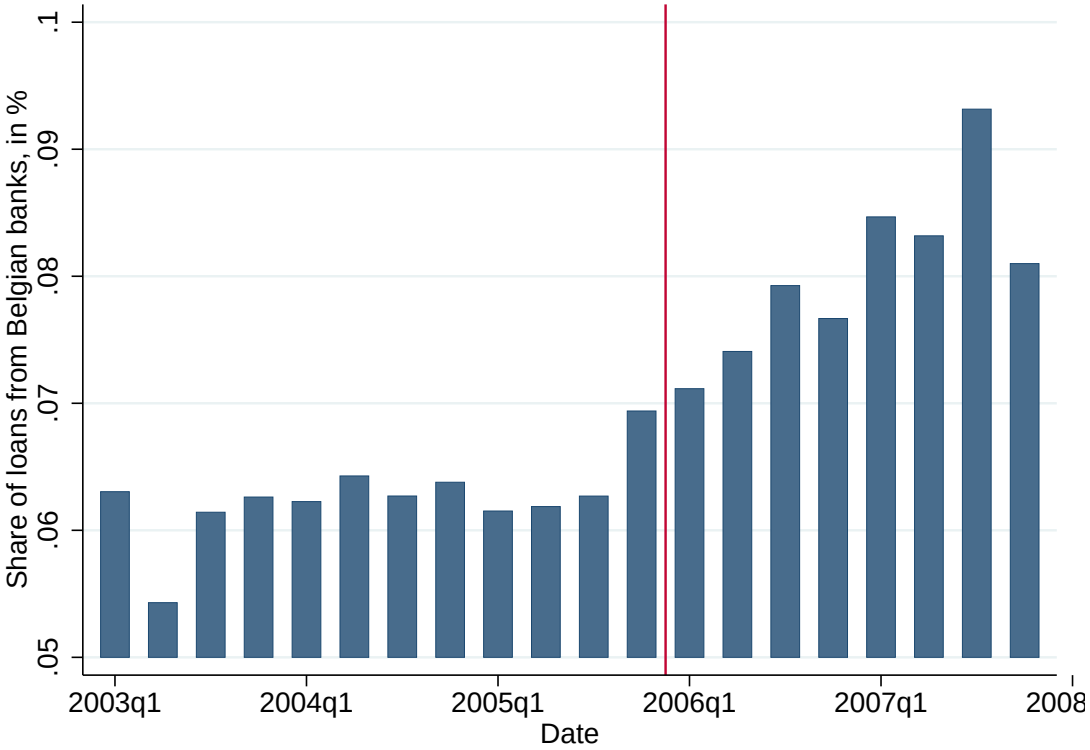
This figure shows the evolution of the growth rate in equity ratios and loan to assets ratios for Belgian banks relatively to other European banks over the 2004-2007 period. The red vertical line corresponds to the introduction of the ACE in Belgium in 2006.

Figure 2. Changes in Growth Rates after the End of an ACE in Italy in 2002



This figure shows the evolution of the growth rate in equity ratios and loan to assets ratios for Italian banks relatively to other European banks over the 2000-2003 period. The red vertical line corresponds to the end of the ACE in Italy in 2002.

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 ACE in Belgium in 2006. The relative exposure is computed as the ratio of loans from Belgian banks to loans from other banks (in volumes).

Figure 4. Evolution of German Firm Exposure to Italian Banks around the phasing out of the ACE if Italy in 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 end of the ACE in Italy in 2002. The relative exposure is computed as the ratio of loans from Italian banks to loans from other banks (in volumes).

B Tables

Table 1. Description of the Policy Reforms

Country	Base	Rate	Entry into Force
		Allowance for Corporate Equity	
Belgium	Statutory equity and retained earnings	The average rate on 10-year government bonds is applied to equity and deducted from taxes	2006
Italy	New equity compared to the existing equity at the end of the year 1996, multiplied by 1.2 in 2000 and 1.4 in 2001	The rate of 7% is applied to the base and taxed at a reduced rate of 19%	1998 End: 2002
		Tax on Bank Liabilities Net of Equity	
Austria	Total liabilities net of equity and insured deposits	0.085% for large banks (total liabilities above 20 billion euros)	2011
Belgium	Total liabilities net of equity and insured deposits	0.035%	2012
Germany	Total liabilities net of equity and insured deposits	Between 0.03% and 0.06% for large banks (total liabilities above 100 billion euros)	2011
Portugal	Total liabilities net of equity and subordinated debt	0.05%	2011
Sweden	Total liabilities net of equity and insured deposits	0.036%	2010
Netherlands	Total liabilities net of equity and insured deposits	0.044% for large banks (total liabilities above 20 billion euros)	2012
United Kingdom	Total liabilities net of equity and insured deposits	0.088% for large banks (total liabilities above 20 billion pounds)	2011
		Dynamic Loan-loss Provisioning	
Spain	Loan Portfolio	Function of general and specific provisions	2000 (Q3)

This table reports for each policy reforms we exploit the base, the rate and the start and end dates. We focus on the Eurozone + UK. Sources: Panier et al. (2013), Devereux et al. (2017), OECD.

Table 2. Foreign Lending in Germany (1994 - 2013)

Country	Number of Banks Active in Germany	Number of German Firms Borrowing from Banks HQed in this Country	ACE	Tax on Liabilities net of Equity
USA	40	10,893	-	-
Netherlands	27	6,509	-	Yes
France	32	6,221	-	-
Sweden	7	5,779	-	Yes
UK	16	4,442	-	Yes
Austria	16	1,865	-	Yes
Belgium	5	1,579	Yes	Yes
Japan	30	1,422	-	-
Italy	17	1,206	Yes	-
Switzerland	16	1,121	-	-
Spain	9	779	-	-
Denmark	5	703	-	-
Turkey	8	458	-	-
China	5	258	-	-
Canada	3	173	-	-
Iran	4	121	-	-

This table reports statistics on foreign lending in Germany over the 1994-2013 period. Columns 2 and 3 indicate respectively the number of banks active in Germany HQed in this country and the number of German firms borrowing from these banks over the total period.

Table 3. Summary Statistics

	Panel A: Implementation of the Belgian ACE (2006)											
	Control Banks				*Treated Banks*				*Matched Control Banks*			
	Mean	**p50**	**p10**	**p90**	**Mean**	**p50**	**p10**	**p90**	**Mean**	**p50**	**p10**	**p90**
Total Assets	14,420	779	154	9,770	41,151	1,504	162	26,813	48,072	1,138	182	45,047
Equity Ratio (in %)	8.4	6.7	4.2	14.3	9.4	5.9	2.7	14.2	9.3	6.3	2.9	15.6
Composition of the Assets	**(ratio to total assets, in %)**											
Loans	60	63	34	81	46	47	12	77	45	47	10	77
Corporate Loans	38	36	2	76	15	15	15	15	26	21	1	62
Interbank Assets	14	9	2	31	23	13	5	72	25	15	3	66
Securities	21	20	3	39	30	28	0	58	25	23	2	50
Profitability Ratios, in %												
Return on Equity	6.9	5.8	2.1	15.1	10.2	11.5	0.6	16.5	9.0	9.0	2.5	16.5
Non Performing Loans	3	2	0	6	4	2	1	12	2	1	0	5
Observations	2,411				43				252			

	Panel B: Bank Taxes on Liabilities Net of Equity (2010-2012)							
	Control Banks				*Treated Banks*			
	Mean	**p50**	**p10**	**p90**	**Mean**	**p50**	**p10**	**p90**
Total Assets	22,593	661	150	17,642	15,095	505	98	4,512
Equity Ratio	9.7	9.0	2.8	15.5	9.1	6.7	4.4	13.0
Composition of the Assets	**(ratio to total assets, in %)**							
Loans	68.6	74.6	36.7	89.3	54.8	56.5	31.3	76.5
Corporate Loans	20.9	7.7	1.7	69.7	8.6	0.9	0.0	42.0
Interbank Assets	12.8	7.5	1.8	32.2	16.6	12.0	3.8	31.1
Securities	13.6	10.7	0.3	31.0	24.5	23.3	5.6	42.2
Profitability Ratios, in %								
Return on Equity	6.4	5.6	5.0	1.0	10.5	4.9	4.1	9.8
Non Performing Loans	5.2	4.0	0.5	11.1	5.1	2.5	0.6	10.3
Observations	1,242				1,640			

This table reports summary statistics for European banks in 2005, before the implementation of the ACE in Belgium, and in 2009, before the introduction of taxes on bank liabilities net of equity.

Table 4. The Effect of the Introduction of the ACE in Belgium in 2006 on Bank Balance Sheet Composition

	Panel A: Standard OLS					
	Δ Log					
	Equity	**Assets**	**Ratio to Total Assets**			
			Equity	Loans	Interbank Assets	Securities
	(1)	(2)	(3)	(4)	(5)	(6)
Treated × Post	0.057**	0.016	0.045**	0.012***	-0.012*	-0.003
	(0.028)	(0.024)	(0.022)	(0.004)	(0.007)	(0.004)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,955	16,955	16,955	16,954	16,829	16,825
R^2	0.651	0.652	0.348	0.347	0.162	0.135
	Panel B: Matched Sample					
	Δ Log					
	Equity	**Assets**	**Ratio to Total Assets**			
			Equity	Loans	Interbank Assets	Securities
	(1)	(2)	(3)	(4)	(5)	(6)
Treated × Post	0.046**	0.020	0.033**	0.013***	-0.009	-0.007
	(0.025)	(0.026)	(0.019)	(0.005)	(0.007)	(0.005)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,553	1,553	1,553	1,552	1,543	1,530
R^2	0.493	0.494	0.174	0.329	0.160	0.163

This table analyzes the impact of the introduction of an ACE reform in Belgium in 2006 on the capital structure and balance sheet composition of treated banks in a differences-in-differences setup. The sample period is 2002-2008. The dependent variable is the change in the log of the balance sheet items that we regress on a dummy variable *Post* that equals one in the period after the ACE reform, and an interaction term *Post* × *Treated* where *Treated* indicates whether the bank is a treated bank. In Panel B, the control group is obtained through a matching procedure described in Section 3. Models are estimated using OLS with bank fixed effects, year fixed effects, time varying bank controls (Return on assets, total assets, loan to total assets, non interest share of total income, cpi, equity to asset ratio). All these variables are lagged - and equity to asset ratio is lagged twice). Standard errors are clustered at the bank level and reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.

Table 5. The Effect of the End of the ACE in Italy in 2002 on Bank Balance Sheet Composition

	Panel A: Standard OLS					
	Δ *Log*					
	Equity	**Assets**	**Ratio to Total Assets**			
			Equity	Loans	Interbank Assets	Securities
	(1)	(2)	(3)	(4)	(5)	(6)
Treated × Post	0.008	0.059***	-0.048***	-0.002	0.002	-0.006**
	(0.007)	(0.007)	(0.006)	(0.002)	(0.004)	(0.003)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,573	7,573	7,573	7,573	6,828	7,502
R^2	0.456	0.597	0.376	0.627	0.346	0.320
	Panel B: Matched Sample					
	Δ *Log*					
	Equity	**Assets**	**Ratio to Total Assets**			
			Equity	Loans	Interbank Assets	Securities
	(1)	(2)	(3)	(4)	(5)	(6)
Treated × Post	-0.019*	0.036***	-0.046***	-0.003	0.009**	-0.000
	(0.010)	(0.010)	(0.009)	(0.002)	(0.004)	(0.003)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,218	3,218	3,218	3,218	3,203	3,165
R^2	0.471	0.612	0.393	0.631	0.412	0.337

This table analyzes the impact of the end of an ACE reform in Italy in 2002 on the capital structure and balance sheet composition of treated banks in a differences-in-differences setup. The sample period is 19998-2003. The dependent variable is the change in the log of the balance sheet items that we regress on a dummy variable *Post* that equals one in the period after the ACE reform, and an interaction term *Post* × *Treated* where *Treated* indicates whether the bank is a treated bank. In Panel B, the control group is obtained through a matching procedure described in Section 3. Models are estimated using OLS with bank fixed effects, year fixed effects. Time varying bank controls include Return on assets, total assets, loan to total assets, non interest share of total income, cpi, equity to asset ratio). All these variables are lagged - and equity to asset ratio is lagged twice. Standard errors are clustered at the bank level and reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.

Table 6. The Effect of the Introduction of Taxes on Bank Liabilities Net of Equity in Europe from 2010 to 2013 and Bank Balance Sheet Composition

	Δ *Log*							
	Equity	**Assets**	**Ratio to Total Assets**					
			Equity	Loans	Corporate Loans	Mortgage Loans	Interbank Assets	Securities
	(1)	(2)	(3)	(4)	(5)	(6)		
Treated × Post	0.058***	-0.019***	0.077***	0.013***	0.007**	0.010***	-0.004**	-0.012***
	(0.005)	(0.005)	(0.004)	(0.001)	(0.003)	(0.004)	(0.002)	(0.002)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,400	10,400	10,400	10,395	5,808	4,792	10,053	10,284
R^2	0.530	0.596	0.540	0.509	0.416	0.422	0.282	0.319

This table analyzes the impact of the staggered introduction of taxes on bank liabilities in Europe from 2010 to 2012 on the capital structure and balance sheet composition of treated banks in a differences-in-differences setup. The sample period is 2009-2013. The dependent variable is the change in the log of the balance sheet items that we regress on a dummy variable *Post* that equals one in the period after the ACE reform, and an interaction term *Post* × *Treated* where *Treated* indicates whether the bank is a treated bank. Models are estimated using OLS with bank fixed effects, year fixed effects. Time varying bank controls include Return on assets, total assets, loan to total assets, non interest share of total income, cpi, equity to asset ratio). All these variables are lagged - and equity to asset ratio is lagged twice. Standard errors are clustered at the bank level and reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.

Table 7. The Introduction of the ACE in Belgium in 2006 and Bank Lending by Belgian Banks in Germany

Model	*All Bank-Firm Exposures*		*Foreign Lending*		*Intensive Margin*		*Extensive Margin*		
Dependent Variable	Δ log(Loan Exposure)		Δ log(Loan Exposure)		Δ log(Loan Exposure)		New Loan Dummy		
	OLS		*OLS*		*OLS*		*OLS*		Logit
Sample	All	Multibank Firms	All	Multibank Firms	All	Multibank Firms	All	Foreign	All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treated	0.74**	0.66**	0.58*	0.39**	0.57*	0.44**	0.07**	0.06**	0.33*
	(0.35)	(0.27)	(0.35)	(0.25)	(0.30)	(0.21)	(0.03)	(0.03)	(0.14)
Firm FE	-	Yes	-	Yes	-	Yes	-	-	-
Firm Characteristics	Yes	-	Yes	-	Yes	-	Yes	Yes	Yes
Bank Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relationship Ch.	-	-	-	Yes	Yes	-	-	-	
Observations	127,831	110,759	22,162	22,162	6,314	6,183	127,831	22,162	127,831
R^2	0.110	0.399	0.207	0.207	0.048	0.320	0.129	0.141	0.103

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 (2) and (4) the sample is restricted to firms that borrow from several banks, in columns (3) and (4) to firm exposure to **foreign banks** only and in columns (5) and (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 reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.

Table 8. The end of an ACE in Italy in 2002 and Bank Lending by Italian Banks in Germany

Model	*All Bank-Firm Exposures*		*Foreign Lending*		*Intensive Margin*		*Extensive Margin*		
Dependent Variable	Δ log(Loan Exposure)		Δ log(Loan Exposure)		Δ log(Loan Exposure)		New Loan Dummy		
	OLS		*OLS*		*OLS*		*OLS*		Logit
Sample	All	Multibank Firms	All	Multibank Firms	All	Multibank Firms	All	Foreign	All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treated	-0.61***	-0.58***	-0.63***	-0.97***	-0.66***	-0.59***	0.01	0.01	0.07
	(0.14)	(0.16)	(0.19)	(0.19)	(0.16)	(0.16)	(0.02)	(0.02)	(0.27)
Firm FE	-	Yes	-	Yes	-	Yes	-	-	-
Firm Characteristics	Yes	-	Yes	-	Yes	-	Yes	Yes	Yes
Bank Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relationship Ch.	-	-	-	Yes	Yes	-	-	-	
Observations	1,706,486	1,515,328	253,673	125,160	255,964	255,485	1,708,955	254,024	1,708,955
R^2	0.600	0.722	0.563	0.730	0.582	0.659	0.031	0.026	0.084

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 (2) and (4) the sample is restricted to firms that borrow from several banks, in columns (3) and (4) to firm exposure to **foreign banks** only and in columns (5) and (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 reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.

Table 9. The Introduction of the Liability Taxes Net of Equity and Bank Lending by Affected Banks in Germany

Model	*All Bank-Firm Exposures*		*Foreign Lending*		*Intensive Margin*		*Extensive Margin*		
Dependent Variable	log(Loan Exposure)		log(Loan Exposure)		log(Loan Exposure)		New Loan Dummy		
	OLS		*OLS*		*OLS*		*OLS*		Logit
Sample	All	Multibank Firms	All	Multibank Firms	All	Multibank Firms	All	Foreign	All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treated × Post	0.83***	0.55***	0.82**	0.56*	0.58***	0.55***	0.00**	0.00	0.12*
	(0.20)	(0.15)	(0.41)	(0.31)	(0.19)	(0.15)	(0.00)	(0.00)	(0.06)
Bank-Firm Exposure FE	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-
Firm × Quarter FE	-	Yes	-	Yes	-	Yes	-	-	-
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Characteristics	-	-	-	-	-	-	Yes	Yes	Yes
Bank Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Relationship Ch.	-	-	-	-	-	-	Yes	Yes	Yes
Observations	3,392,091	3,007,207	657,049	148,234	3,183,166	2,998,801	3,392,093	657,049	3,392,093
R^2	0.583	0.700	0.621	0.776	0.577	0.700	0.017	0.021	0.060

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 (2) and (4) the sample is restricted to firms that borrow from several banks, in columns (3) and (4) to firm exposure to foreign banks only and in columns (5) and (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 reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.

Table 10. External Validity: The Introduction of Dynamic Provisionning in Spain in 2000, Bank Capital Structure, and Lending

Model	*Capital Structure*		*Domestic Lending (Jiménez et al., 2016)*		*Lending in Germany*			
Sample	*EU Banks*		*Bank-Firm Exposures in Spain*		*Bank-Firm Exposure in Germany*			
Dependent Variable	Δ log(Equity to Assets)		Δ log(Loan Exposure)		Δ log(Loan Exposure)		Δ log(Exposure to Foreign Banks)	
Sample	All	Commercial Banks	All	Multibank Firms	All	Multibank Firms	All	Multibank Firms
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated × Post	- 0.039***	-0.066**	-	-	-1.25***	-0.85***	-1.00***	-0.99***
	(0.013)	(0.029)			(0.09)	(0.14)	(0.18)	(0.23)
Dynamic Provision	-	-	-0.394***	-0.357***				
	-	-	(0.186)	(0.124)	-	-	-	-
Bank FE	Yes	Yes	-	-	Yes	Yes	Yes	Yes
Firm FE	-	-	-	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	-	-	-	Yes	-	-
Quarter FE	-	-	-	-	Yes	Yes	Yes	Yes
Quarter × Firms FE	-	-	-	-	-	Yes	-	Yes
Firm Characteristics	-	-	Yes	-	Yes	-	Yes	-
Bank Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Characteristics	Yes	Yes	-	-	-	-	-	-
Relationship Ch.	-	-	Yes	Yes	Yes	Yes	Yes	Yes
Observations	237,905	416,611	9,190	3,461	1,714,215	1,530,389	257,596	128,321
R^2	0.483	0.499	-	-	0.610	0.729	0.573	0.720

This table reports the coefficients of OLS and Logit estimations. The dependent variable in columns (1) and (2) is the change in the log of bank equity ratios, and, in columns (3) to (8) bank-firm exposures as described in section 3. Results in columns (3) and (4) are directly reported from **?**. Standard errors are clustered at the bank level in columns (1) and (2) and at the bank and firm level in columns (3) to (8) and reported in brackets, * p<0.10, ** p<0.05, *** p<0.01.