Taxing Banks Leverage and Syndicated Lending: A Cross-Country Comparison

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Abstract

Between 2010 and 2012, five European countries implemented a tax levy on banks' liabilities increasing the cost of debt relatively to the cost of equity with banks' stability as the ultimate target. The objective of this paper is two-fold. First we assess the impact of this tax levy on banks' credit supply, measured by banks' participation, in the syndicated loan market using a difference-in-differences approach. Then we further investigate the impact of the tax levy depending on banks' characteristics such as size, or capital structure. Our results show an increase in credit supply provided by banks located in countries where the tax levy was implemented.

Keywords : Banks, Tax Levy, Syndicated Loans.
JEL Classification: F34, G21, G28.

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1 Introduction

In a distressed context, highly leveraged banks can generate negative externalities. The financial turmoil of 2008 sheds light on the importance of the banking sector stability for the overall economy. The collapse of Lehman Brothers, one of the largest U.S. banks raises issues regarding the role and level of banks' capital requirements, contributing to the debate on macro prudential measures and policy actions to implement. Basel agreements aim at lowering banks' leverage by increasing capital requirements. However, this may have a negative impact on bank lending and risk-taking (Aiyar et al., 2014; Fraisse et al., 2020; Gropp et al., 2019; Juelsrud and Wold, 2020; De Jonghe et al., 2020) and it may push banks to transfer their lending activities to the shadow banking system (Kashyap et al., 2010).

As an alternative to this regulation through quantities and following a recommendation of the International Monetary Fund (IMF), several European governments implemented a tax levy on the debt of their financial institutions starting in 2010. The objective was to make these financial institutions contribute to the fiscal cost of a potential government intervention aiming at supporting the industry. As a consequence, this tax levy altered the relative cost of debt compared to the cost of equity rendering the equity relatively less expensive after the implementation of the new tax and ultimately encouraging banks to raise more equity than debt. Making equity relatively cheaper than debt "creates headroom" for banks to lend to corporate clients that are considered more risky for capital requirement purposes (Celerier et al., 2019). Hence at first sight counter-intuitively a tax imposed on banks may actually spur corporate lending!

The objective of this paper is to empirically investigate the impact of the tax levy in a cross-country analysis. We are not the first to empirically investigate the consequences of the tax levy. Devereux et al. (2019) for example study how this tax levy affected banks' choices in terms of funding and portfolio allocation of assets and show a shift from a less risky capital structure more oriented towards equity to a riskier portfolio of assets. Celerier et al. (2019) revisit these conclusions highlighting a decrease in leverage associated with an increase in the weights of loans in banks' portfolios. The authors show evidence that the tax levy can represent a good alternative to capital requirement regulation as it contributes to support credit supply reducing the impact of banks' regulation on the real economy. This paper can as such be considered as an extension of Celerier et al. (2019) who derive testable hypotheses from a stylized framework and focus their study on Germany.

We draw on detailed information from the syndicated loan market to answer the following question: What is the effect of the tax levy implementation on syndicated lending across the different countries where banks are headquartered? Syndicated loans are an important source of corporate finance which represents one third of the international financing which gathers together not only syndicated loans but also commercial paper, bond and equity issues (Gadanecz, 2004). A syndicated loan is a debt instrument provided to one corporation by a group of lenders (Esty and Megginson, 2003; Carey and Nini, 2007). This specificity allows us to pursue a two-fold objective. First we assess the impact of this tax levy on banks' credit supply, measured by banks' participation, on the syndicated loans market using a difference-in-differences approach. Then we further investigate the

impact of the tax levy depending on banks' characteristics.

Our findings are in line with the literature. We show that banks exposed to the tax levy of between 2 bps and 8.5 bps tend to lend more than untaxed financial institutions, with an annual change in participation in the syndicated loan market rising by 0.006 percentage points following the implementation of the tax levy, a sizeable increase with a semi-elasticity of 13.4 percent from its unconditional standard deviation (equal to 0.0448 percent). Moreover, we show that this effect is particularly significant for lead lenders, lenders with large participation, and banks that are capital constrained. Finally, we do not find any transfer of this new cost to borrowers.

This paper also contributes to the debate dealing with the impact of bank taxation on banks' lending behavior. The literature on this topic is rather thin,[2] and does not highlight a general agreement regarding the consequences of an increase in taxation of banks' balance sheet on their credit supply. In contrast to Buch et al. (2016) and Capelle-Blancard and Havrylchyk (2017), we enlarge the sample of countries under study by considering the syndicated loan market, a highly competitive international loan market. While Haskamp (2018) discusses the regional competition and Biswas et al. (2021) the country specific Belgium ACE, our analysis allows us to focus on international competitors for different geographic area. To the best of our knowledge, it is the first project to investigate the impact of these tax levies on the syndicated loan market and to consider an international dataset rather than a country specific loan market, allowing us to simultaneously analyze the implementation of such policy in all European countries. In addition, this paper sheds light on potential drawbacks of banks levies initially aiming at strengthening the national banking sector but ending with a comparative disadvantage and potential long term difficulties for untaxed banks to the benefit of taxed institutions.

The remainder of this paper is structured as follows. Section 2 presents the literature review. Section 3 describes the method while the database construction is developed in Section 4. We show the descriptive statistics and the results in Sections 5 and 6 respectively. Robustness tests are displayed in Section 7 while Section 8 concludes.

2 Literature Review

One objective of the regulatory institutions and policymakers, starting in the 1980s, has been to determine the optimal minimum level of bank capital considering the risk of bank assets. Bank capital is one of the most significant regulatory tools as it allows not only to reduce moral hazard behaviors of banks (Hellmann et al., 2000) but also to absorb production and monetary shocks (Gambacorta and Mistrulli, 2004) such as decreases in loans' values (Jiménez et al., 2017). The financial crisis of 2008 reopened the debate on additional increases in bank capital to improve banks' capacity to face financial shocks. Basel III provided a new regulatory framework with the implementation of time-varying capital requirements to increase provisions in boom phases to mitigate credit crunches in

[2]To a larger extent, a strand of the literature studies the impact of changes in corporate income taxes on banks (Albertazzi and Gambacorta, 2010 and Caminal, 2003 from a theoretical perspective; Demirgüç-Kunt and Huizinga, 2001, Chiorazzo and Milani, 2011 and Sobiech et al., 2021 from an empirical perspective).

bust phases, and smoothing credit supply cycles (Aiyar et al., 2014; Jiménez et al., 2017).

However, as higher capital requirements influence banks' balance sheet structures, they tend to reduce the credit supply (Gropp et al., 2019, Juelsrud and Wold, 2020) especially to firms with a higher level of debt and representing a higher credit risk (Jiménez et al., 2017). This change in portfolio allocation is stronger for small banks that face difficulties to absorb the shock and that look for yield enhancement. Additionally, this policy tends to increase the bank risk-taking behavior following the increase in capital requirements during the boom phase (Laeven and Levine, 2009; Jiménez et al., 2017 and Gornall and Strebulaev, 2018).

An alternative to this policy measure is to decrease the relative cost of equity over debt, using the so-called bank levies. These levies affect banks' capital structure, portfolio allocation, lending activities and interest rates settings. The literature provides evidence that changes in taxes affect the cost of debt, and lead to adjustments in banks' leverage and capital structure (Gu et al., 2015; De Mooij and Keen, 2016; Schepens, 2016; Gambacorta et al., 2017). Horváth (2020) illustrates these conclusions, highlighting a positive relationship between levels of taxation and leverage while the assets riskiness decreases when taxes increase. Sobiech et al. (2021) also highlight a significant impact of bank taxation onto banks management of assets and liabilities using the quasi-natural experiment of the Ishihara tax levied on the gross profit of Japanese commercial banks active in Tokyo between 2000 and 2002. The newly implemented tax leads banks not only to increase leverage but also to decrease their credit supply and the risk-weighted assets. Moreover, Bremus et al. (2020) show that bank levies improve the robustness of banks' capital structure. However, this effect is weakened for banks located in countries with a high level of corporate income tax.

Devereux et al. (2019) and Horváth (2020) focus their analyses on banks risk-taking behavior following a tax shock. They both find an increase in regulatory risk-weights for initially weakly-capitalized banks, proving a risk transfer from banks' balance sheet liabilities to its assets. Celerier et al. (2019) study the effect of both the Belgium Allowances for Common Equity (ACE) implemented in 2005 (Panier et al., 2015) and banks tax levies to identify the impact of these two reforms on banks' portfolios of loans. The authors provide a theoretical framework to explain changes in the allocation of bank lending and show that taxed banks decrease their level of debt. The model's main intuition is that banks use the decrease in the relative cost of equity (and the "headroom" it provides) to re-balance their asset side towards those assets for which the capital requirements exceed the actual risk of the asset the most. This is particularly the case for corporate loans, while for sovereign bonds the opposite is the case (their risk exceeds the zero capital charge).

Focusing on lending terms, Capelle-Blancard and Havrylchyk (2017) study the Hungarian tax levy imposed in 2010 on banks' assets excluding interbank assets and distinguishing between small and large banks. Using a difference-in-differences approach, the authors show that banks experiencing an increase in taxes pass this higher cost on their borrowers. However, this transmission is not symmetric to all economic agents as banks tend to raise interest rates and fees to captive borrowers, i.e. with a low credit demand elasticity.

At the European level, Kogler (2016) also finds an increase of interest rates on deposits in addition to an increase of lending rates, supporting a path-through of the tax from lenders to borrowers. Buch et al. (2016), studying the German tax levy of 2011 on banks' liabilities excluding equity and deposits, find a decrease of the total loan stock of impacted banks but no differences in the design of new loans. Unlike Capelle-Blancard and Havrylchyk (2017) and Kogler (2016), they do not find changes in loans rates. Impacted banks rather increase their deposit rates to attract additional funds from sources that are not subject to the tax levy. Haskamp (2018), also focusing on the German case, confirms both the previously discussed increase of interest rate and the relative decrease of loan issuance. However, the decrease of loan growth from taxed banks is compensated by their un-taxed competitors.

At the international level, Biswas et al. (2021) and Celerier et al. (2019) suggest an increase in cross-border lending by taxed banks relative to non-impacted banks. Importantly, the Belgian ACE supports international lending without negative spillovers for domestic lending or firms demand for credit (Biswas et al., 2021). However, in the United-States, Smolyansky (2019) demonstrates that banks experiencing tax-cut tend to reallocate small-business lending to states with lower tax rates, creating credit outflows for the other states.

3 Method

3.1 The Liability Tax Experiment

To investigate banks' lending behavior following the implementation of a tax levy, we study the liability tax implemented in 5 European countries, i.e., Austria, Belgium, Germany, the Netherlands, and Portugal.[3] The tax was implemented through either (i) the annual budget law for Austria and Portugal[4] or (ii) a specific law in Belgium, Germany and the Netherlands.[5] For two countries, Belgium and Germany, the tax is used to finance a newly created fund to support banks' stability and limit their systemic risk. In Austria and Germany, the tax was passed at the end of the year 2010 and implemented during the same year. However, as banks' credit supply was already decided, they were not able to adjust their behavior accordingly for the year 2010. Therefore, we consider in your analysis 2011 as the implementation year for these two countries. For Portugal, the law was voted in 2010 for an application in 2011. In Belgium and the Netherlands, the laws were voted in 2011 and implemented in 2012. This liability tax does not result from a European agreement but is country-specific. The rate varies from one country to another from 2 bps up to 8.5 bps while the base, i.e., Total liabilities net of equity and insured deposits, is similar in all countries. Table 1 below provides a precise description

[3]Slovakia also implemented this liability tax but we exclude this country from our sample as banks are mostly subsidiaries of foreign financial institutions.

[4]Article 56 of the Budget Accompanying Act 2011 (23/12/2010) in Austria and Article 141 of the 2011 Budget Law n.55-A/2010 (31/12/2010) in Portugal.

[5]Law establishing a financial stability contribution n.2011003450 (30/12/2011) and Royal Decree 2012-873 (23/02/2012) for Belgium, German Bank Restructuring Act published in Bundesgesetzblatt Jahrgang 2010 Teil I Nr. 63 (14/12/2010) for Germany and Parliamentary documents II 2011/12, 33 121, Nos. 1-4. for the Netherlands.

of the tax rate per country.

Insert Table 1 about here.

This liability tax represents an ideal experimental setting because it only affects banks. This new tax does not impact firms in other industries that are potential borrowers. As such, there is no change in credit demand induced by the implementation of the tax levy allowing us to correctly identify and investigate the change in credit supply. Nevertheless, we still control for credit demand in our estimations. Moreover, the magnitude of the tax levy can be seen as significant when considering the low interest rate environment. Finally, it allows us to use loan-level data from the syndicated loan market to run a cross-country analysis of the tax levy effects.

3.2 A Difference-in-Differences Approach

In this paper, we implement a difference-in-differences approach to investigate the impact of the liability tax levy on banks' lending behavior. We aggregate our database at the bank-year level to estimate the following model:

$$\Delta Participation_{b,t} = \alpha Treated_{b,t} + \beta \Delta Loan_{b,t} + \delta \Delta Macro_{c,t} + D_b + D_t + \epsilon_{b,t} \quad (1)$$

where $\Delta Participation_{b,t}$ represents the annual growth rate of bank b participation in syndicated loans. This annual growth rate represents the variation in the amount lent by one bank on the syndicated loan market taken as a percentage of the total amount lent on the market between two consecutive years. Our variable of interest, $Treated_{b,t}$ is a dummy variable equal to 1 after the implementation of the new tax levy if bank b is located in a country c where the tax levy is implemented and 0 otherwise.

We introduce additional explanatory variables in our model (taken as annual growth rates as the dependent variable) to control for the characteristics of the loan ($\Delta Loan_{b,t}$) (i.e., maturity, type, objective, secured, currency, spread, syndicate size, borrower's credit rating, and the risk of the borrower's industry) as well as for the macroeconomic features of the borrower's country ($\Delta Macro_{c,t}$) (i.e., GDP, Inflation, Rule of law, and the share of domestic credit to private sector by banks). We saturate our model with bank (D_b) and year (D_t) fixed effects and we use standard errors clustered at the bank level (Bertrand et al., 2004, Schepens, 2016). Table 2 provides the description of all variables.

Insert Table 2 about here.

4 Data

We use LPC Dealscan to collect data on syndicated loans issued between 2009 and 2015. We start in 2009 to limit the impact of the financial crisis on our analysis. We restrict our sample of commercial banks to the 10 largest banking economies in the Eurozone, i.e., Austria, Belgium, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain to ensure the homogeneity of our control group with respect to our

treated group of countries. As such, all banks face the same macroeconomic conditions, have the same currency and are subject to the same regulation.

We adopt the following procedure to build our final sample of bank-year-level data. LPC Dealscan provides data at the loan-lender level, i.e. we have for each loan, the characteristics of the loan, some information about the borrower such as its name, its position, its industry and its rating[6] as well as the amount each bank has invested in one syndicated loan and the role of this bank in the syndicate. First, we manually clean the database to remove duplicates and outliers, correct banks' names for typos, and we fill the database with the country of banks' headquarters considering each bank as a separate entity except if the name of the banking group appears in the bank's title. Second, we remove not only loans to the financial sector (SIC 6) because financial institutions face different and even stronger regulations than other sectors but also loans to the public sector (SIC 9) because of their unique characteristics (very large amounts, not frequent, different objectives). Third, we complement the database with the Value-at-Risk per industry computed on a yearly basis using daily returns of World indices as benchmarks for each industry. We collect data from Datastream. We also add macroeconomic information of the borrower's country such as the GDP, the inflation, the rule of law, and the share of domestic credit to private sector by banks. We extract this data from the World Bank database to control for the macroeconomic conditions of the borrower. Finally, we collapse the database at the lender-year level to create our panel dataset by considering the sum of each lender's share invested in all syndicated loans for one specific year and the average of all control variables per year. We ultimately backfill the database with zero when a lender does not lend during a specific year.

5 Descriptive Statistics

Between 2009 and 2014, the database includes 22,706 syndicated loans to 7,218 different borrowers from 793 different lenders located in the 10 European countries. Each syndicated loan has on average 12 lenders for an average amount of 459.22 Million USD. Table 3 provides the distribution of our sample of banks per country. In addition, we display the number of banks that have been actively lending on the syndicated loan market with at least one loan every year between 2009 and 2014. Finally, we include the number of loans per country. From Table 3, we can observe that the four main European economies, i.e., France, Germany, Italy and Spain, gather the largest number of banks and the largest number of loans. The Netherlands also displays a relatively large number of banks and of loans while the other countries are less active with a relatively smaller number of banks providing a smaller number of syndicated loans. However, the number of banks that are actively lending on this market every year significantly decreases for all countries while the general trend remains similar.

[6]LPC DealScan provides credit ratings produced by the three leading U.S. Credit-Rating Agencies (CRAs): Standard & Poor's, Moody's, and Fitch. These ratings are automatically reported in the database when they appear. In our sample, we consider for each loan the rating each time it is provided by one of the three CRAs. For rated loans with more than one rating, we apply the 'worst of 2 and median of 3 ratings' rule (Bongaerts et al., 2012). We then categorise borrowers as investment grade, junk grade, or unrated.

Insert Table 3 about here.

In Table 4 we provide the descriptive statistics of the lendesr share (in Million of USD) by country while in Table 5 we compare the lenders share invested in syndicated loans between treated and control groups of banks. We observe that Germany and France provide the largest number of loans while loans amounts are larger on average when granted by French and Dutch banks. Combining Tables 3 and 4, we can conclude that the number of banks located in the Netherlands is relatively smaller than in the other main European economies. However, Dutch banks are actively lending on the syndicated loan market with an average loan amount being the largest one. We do not observe a significant difference in the average loan amount provided by the treated and control banks while taking into consideration that the variance is unequal. Meanwhile, the ttest conclusions are based on a statistical comparison of means and do not include any control variables nor bank fixed effects.

Insert Tables 4 and 5 about here.

Finally, Table 6 displays the descriptive statistics of all variables included in our empirical analysis. On average, we can observe a decrease of the growth rate of banks participation in the syndicated loan market over the period while the trend is increasing when we focus our variable to bank participation as a percentage of the total amount lent by the syndicates in which the bank has participated. Moreover, the growth rate of lender share (taken in level) is positive between 2009 and 2014, with 47.84% of lenders granting a loan over the period. In our sample, 28.48% are treated banks, while 28.23% are identified as lead lenders. Finally, the Tier1 ratio of banks is equal to 11.02% on average between 2009 and 2014.

Insert Table 6 about here.

6 Results - Bank-Year Specification

6.1 Main Analysis

Table 7 displays the results of Equation (1) by first considering in our baseline model the period 2009 to 2014, i.e., two years before 2011 when the tax levy was first implemented and three years after (except in Belgium and Netherlands where the tax is implemented in 2012). In a second specification, we remove the loan characteristics as some of these characteristics may be jointly determined (Dennis et al., 2000). In columns (3) and (4), we test the sensitivity of our results by considering two alternative sample periods : 2009-2013 and 2009-2015 respectively. We then modify the set of fixed effects using banks' country fixed effects instead of bank fixed effects (column (5)) to control for banks' country characteristics, such as the level of spreads on sovereign debt and financials or other levies implemented at the national level, which may have a potential influence on syndicated loan activities. Finally, we add to our main model the corporate tax rate of the bank's country (column (6)) to account for fiscal competition in Europe. Knowing that during the sample period, the corporate tax rate went up in France, Luxembourg, and Portugal, while it went down in Italy, and the Netherlands, and remained flat in the other countries, we want to ensure that these corporate tax reforms do not affect our

conclusions.

Insert Table 7 about here.

We observe a positive and significant coefficient associated to the variable *Treated*. In other words, banks located in countries where the tax levy is implemented tend to increase their participation in the syndicated loan market at the expense of other banks. Table 7 displays an annual change in participation rising by 0.006 percentage points, a sizeable increase with a semi-elasticity of 13.4 percent from its unconditional standard deviation (equal to 0.0448 percent). Our conclusions remain strictly identical in all the different specifications highlighting the positive impact of the tax levy on banks lending behaviour in line with the literature (Biswas et al., 2021, and Celerier et al., 2019). It is interesting to see that treated banks tend to significantly increase their participation in the syndicated loan market, while the general trend is negative over the period under study. This result reinforces the positive impact of the tax levy on banks lending behaviour.

6.2 Alternative samples of countries

Our main analysis provides evidence of an increase in the annual growth rate of treated banks participation in syndicated loans when compared to untreated banks. The sample of countries used to run the empirical estimations excludes Sweden, and the UK from the treated group because of their geographical location which significantly differs in terms of political, legal, and economic environments despite the fact that these two countries also implemented the same tax levy at the same time. Moreover, France belongs to the control group as the tax levy implemented in France differs from the other countries by considering the minimum level of capital requirements based on risk weighted assets as the taxable base, hence without any effect on banks' capital structure. As such, and to control for these specificities, we assess the robustness of our results by estimating Equation (1) using two alternative samples of countries, i.e., including Swedish and UK banks in the treated group, and excluding French banks from the control group. Finally, we also control for potential sample bias due to asymmetric bank participation in the syndicated loan market, by removing the two main players, i.e., Germany and the Netherlands. Results remain the same and are displayed in Table 8.

Insert Table 8 about here.

6.3 Alternative samples of banks

In the previous section, we underline the fact that banks participation in the syndicated loan market may be significantly different from one country to another, having in our sample Germany and the Netherlands dominating the other treated countries. This conclusion can also be drawn at the institutional level, with banks investing more or less in syndicated loans. As such, in this section we control for these differences in bank lending behaviour by running our estimations on alternative samples of countries. More precisely, we first restrict our initial sample of banks to the institutions participating in the syndicated loan market both before and after the implementation of the tax levy.

We then consider only the banks lending every year. These two specifications allow us to focus our analysis on the main players of the syndicated loan markets. In the third specification, we focus our attention on the bank role in the syndicate and we estimate the following equation :

$$\Delta Participation_{b,t} = Treated_{b,t} + Lead_{b,t} + Lead.\ Treated_{b,t} + \Delta Loan_{b,t} + \Delta Macro_{c,t} + D_b + D_t + \epsilon_{b,t} \quad (2)$$

where $Lead_{b,t}$ is a dummy variable equal to 1 if the bank is identified as a lead lender in LPC Dealscan, i.e., if the bank is either an arranger, an agent or a lead manager of the syndicate, and O otherwise. The literature (Sufi, 2007 among others) highlights the particular importance and role played by the lead lender in the negotiations with the borrower, and the design of the loan, both aiming at reducing information asymmetry for other participant lenders. The lead lender may then be considered as the intermediary between the borrower and the other participants to the syndicate, this strategic position having a potential impact on his lending decision. As such, we want to control whether the impact of the tax levy differs across banks depending on their role in the syndicate. Table 9 displays the results of the three specifications presented above.

Insert Table 9 about here.

Our conclusions do not change with more restrictive sample of banks. More interestingly, we observe that the positive effect of the tax levy on bank participation to syndicated loans significantly varies depending on the role of the bank. More precisely, the marginal effect of being a lead lender in the syndicate is positive with a semi-elasticity of 13.4 percent from its unconditional standard deviation (equal to 0.0448 percent). In other words, the implementation of the tax levy supports bank lending in the syndicated loan market, and this effect is even more economically significant if the treated bank is identified as lead lender.

6.4 Asymmetric effects of the tax levy depending on banks characteristics

While the tax levy successfully stimulates treated banks participation in syndicated loans, the literature (Horváth, 2020 among others) shows that banks response to tax reforms may be asymmetric across banks of different size or different level of capital. In line with this literature, our results on lead banks tend to support this hypothesis considering that lead banks generally are also considered as large banks. In this section, we go one step further in our analysis and we investigate if the positive impact of implementing a tax levy on bank lending is similar regardless of banks characteristics. More precisely, we group banks according to their level of participation in syndicated loans, used as a proxy for bank size. Moreover, we control for bank capital structure to assess whether banks' response to the tax levy varies for different levels of capital. As such, we first estimate Equation (1) on a restricted sample of banks, focusing on institutions heavily involved in the syndicated loan market, i.e., being in the top quartile of lenders in terms of market share. Second, we estimate the following model:

$$\Delta Participation_{b,t} = Treated_{b,t} + Charac_{b,t} + Charac.\,Treated_{b,t} + \Delta Loan_{b,t} + \Delta Macro_{c,t} + D_b + D_t + \epsilon_{b,t} \quad (3)$$

where $Charac_{b,t}$ measures either bank size or bank capital structure. We have two alternative specifications to control for bank size, based on bank sample splits in two subsamples (using the median), and in tercile. In the first specification, $Charac_{b,t}$ is a dummy variable equal to one if the lender is above the median and 0 otherwise. In the second specification, $Charac_{b,t}$ contains two dummies for the bottom and top terciles of banks. Finally, we measure bank capital structure through bank capital constraint, which is equal to bank tier 1 ratio minus the regulatory requirement, i.e., 8%.

Insert Table 10 about here.

Table 10 provides the results for the different models. First, disregarding the specification related to bank size, we can confirm the positive impact of the tax levy on the annual growth rate of bank participation, especially when considering large banks. In the three alternatives (restricted sample, median, and tercile sample splits), we observe a positive and significant coefficient associated to large lenders with significant economic impact on their lending behaviour, i.e., 29.9, 20.1, and 31.1 percent of the standard deviation of the annual growth rate of banks participation in the syndicated loan market respectively. In line with our conclusions on the lead lender, we emphasize our conclusion that the tax levy provides large lenders with an incentive to invest more in syndicated loans. In addition, we highlight that the treatment is losing its effects when banks are far away from the capital constraints. For banks close to the capital constraints, the relative cost of equity is lower and so a tax levy provides a "stronger" incentive to adjust their capital structure, leading to significant changes in their lending behaviour.

7 Robustness Tests

In the two following subsections, we test the robustness of our conclusions, and assess whether the tax levy effects vary when studying different outcomes of the syndicated loan market, considering first alternative measures of bank lending shares, and second, a potential transfer of costs on borrowers.

7.1 Alternative measures of bank participation

In a first robustness test, we extend our analysis of the tax levy to alternative measures of banks participation in syndicated loans to estimate Equation (1). We use four different variables to measure this change in credit supply. First, we run the test on a dummy variable equal to 1 if bank b grants loans during a specific year and 0 otherwise. Second, we use the change in loan amounts granted by bank b between 2 consecutive years. Finally, we study bank b participation in syndicated loans (as a percentage of the total amount lent by the syndicates bank b has participated to during a specific year) and the annual growth of this more focused measure, i.e., towards relevant syndicates rather than

the whole syndicated loan market. Results are provided in Table 11.

Insert Table 11 about here.

We observe a positive and significant coefficient associated to the variable *Treated* in all specifications except the annual growth rate of banks participation to specific syndicates. In other words, banks located in countries where the tax levy is implemented tend to grant more credit. The probability of having a bank lending money increases by 27.6 percent for a one percent change in the standard deviation of the dependent variable. Moreover, following the implementation of the tax levy, treated banks tend to increase the loan amounts they grant as well as their lending share into the syndicates they participate to. Overall, we can conclude that, disregarding the way we measure banks participation in the syndicated loan market, the tax levy provides banks with an incentive to participate more.

7.2 Risk of transferring costs onto borrowers

The literature shows that, following an increase in taxes, banks may have the incentive to transfer this additional cost onto borrowers through an increase in loan fees for example (Capelle-Blancard and Havrylchyk, 2017, among others). To address this issue, we estimate our main model in which we change the dependent variable to study the change in loan spread (in level and in logarithm). We show in Table 12 that there is no significant change in the loan spread during the post-tax levy period for treated banks. In the last specification, studying the change in the logarithm of loan spread and including the change in the loan amount as a control variable, we even display a negative and significant coefficient supporting the absence of costs transfer to borrowers after the implementation of the tax levy. This decrease in the loan spread is consistent with a supply increase (shifting to the right) rather than a decrease of the demand (shifting to the left, and also confirmed by our other results on the change in loan amounts).

Insert Table 12 about here.

8 Conclusion

The objective of this paper is to study the impact of taxing bank leverage on banks' lending behavior. We use a difference-in-differences approach with fixed effects to investigate how the liability tax experiment implemented in 5 European countries in 2011-2012 has impacted the lending behavior of banks located in these countries. To run our analysis, we define a control group of banks located in 5 other European countries to ensure the homogeneity between treated and untreated banks.

We show that bank participation increases for banks located in countries where the tax levy was implemented. Not only banks are more willing to grant credit but they also significantly increase the loan amounts. The most significant increase concerns large banks and banks that are more capitally-constrained. In addition, we provide evidence

that treated banks do not transfer the additional costs onto their borrowers through an increase in loan spread.

Our findings highlight that the fiscal policy can be considered as a new alternative for banking regulation, to complement capital requirements, in line with the existing literature (Celerier et al., 2019). We show that the tax levy promotes financial and economic stability having banks lending more hence reducing the impact of regulation constraints on the real economy. However, we also provide evidence of the necessity to improve the international coordination in the implementation of fiscal levies as differences across countries may generate competitive advantage to the benefit of taxed banks.

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Table 1: Liability Tax Experiment

Country	Rate	Implementation year
Austria	From 5.5 to 8.5 bps if Base $>$ €1 billion	2011
Belgium	3.5 bps	2012
Germany	From 2 to 6 bps if Base $>$ €0.3 billion	2011
Netherlands	From 2.2 to 4.4 bps if Base $>$ €20 billion	2012
Portugal	5 bps	2011

Notes: The tax base represents the total liabilities of banks net of equity and insured deposits.

Table 2: Variables Description

	Dependent Variables*
$Participation_{b,t}$	The total amount granted by bank b in syndicated loans as a percentage of the total amount lent on the market during year t
$Entry_{b,t}$	Dummy variable equal to one if bank b grants loans during year t
$Amount_{b,t}$	The total amount granted by bank b in syndicated loans during year t
$Synd.Part._{b,t}$	The total amount granted by bank b in syndicated loans as a percentage of the total amount lent by the syndicates bank b has participated to during year t
	Treated Variable
$Treated_{b,t}$	Dummy variable equal to one after the implementation of the new tax levy if bank b is located in a country c (i.e. Austria, Belgium, Germany, Netherlands, Portugal) where the levy is implemented
	Loan Characteristics*
$Maturity_{b,t}$	Average maturity of loans granted by bank b during year t
$Revolver_{b,t}$	Average share of revolver loans granted by bank b during year t
$Term_{b,t}$	Average share of term loans granted by bank b during year t
$Corporate_{b,t}$	Average share of corporate purpose loans granted by bank b during year t
$Secured_{b,t}$	Average share of secured loans granted by bank b during year t
$USD_{b,t}$	Average share of loans denominated in USD granted by bank b during year t
$Euro_{b,t}$	Average share of loans denominated in euro granted by bank b during year t
$All-in-spread_{b,t}$	Average spread of loans in which bank b has participated during year t
$Syndicate_{b,t}$	Average syndicate size of loans granted by bank b during year t
$Investment_{b,t}$	Average share of investment grade loans granted by bank b during year t
$VaR_{b,t}$	Average annual Value-at-Risk of the 2-digit SIC code sectors to which the loans are granted by bank b during year t
	Bank Characteristics*
$Lead_{b,t}$	Dummy variable equal to one if bank b is designated as lead lender, i.e., identified in LPC Dealscan as lead manager or with arranger or agent title in loan syndication documentation (Calomiris and Pornrojnangkool, 2009)
$D > 50\%_{b,t}$	Dummy variable equal to one if bank b participation in the syndicated loans is above the median over the period 2009-2014
$D < 33\%_{b,t}$	Dummy variable equal to one if bank b participation in the syndicated loans is in the bottom tercile over the period 2009-2014
$D > 66\%_{b,t}$	Dummy variable equal to one if bank b participation in the syndicated loans is in the top tercile over the period 2009-2014
$CapConstraint_{b,t-1}$	The distance to capital constraint, i.e., the difference between the Tier1 ratio of bank b during year $t-1$ and the regulatory minimum of 8%
	Macroeconomy*
$GDP_{c,t}$	The natural logarithm of the GDP per capita of the borrower country c during year t
$Inflation_{c,t}$	The inflation (GDP deflator) of the borrower country c during year t
$Ruleoflaw_{c,t}$	The rule of law of the borrower country c during year t
$Private_{c,t}$	The share of domestic credit to private sector by banks as a percentage of the GDP of the borrower country c during year t
$Corptaxrate_{c,t}$	The corporate tax rate of country c during year t, computed as the ratio of taxes on income, profits and capital gains to total revenue

Notes: *taken as annual growth rate, i.e., the difference between two consecutive years.

Table 3: Sample Description per Country - 2009-2014

Number of	Banks	Banks lending each year	Loans
Austria	37	5	1,484
Belgium	16	6	1,640
France	171	30	20,746
Germany	222	31	17,134
Ireland	8	4	1,155
Italy	116	17	5,755
Luxembourg	5	1	104
Netherlands	65	16	9,015
Portugal	19	7	819
Spain	134	26	14,229
Total	793	143	72,081

Table 4: Descriptive Statistics per Country - 2009-2014

Lender share (Million USD)	Obs	Mean	St Dev	Min	Max
Austria	222	217.72	707.54	4.54	5,073.59
Belgium	96	605.27	1,270.48	5.10	7,076.53
France	1,026	1,183.38	7,255.39	1.27	102,447.20
Germany	1,332	752.82	6,210.28	1.50	119,948.40
Ireland	48	711.45	914.00	9.97	3,055.96
Italy	696	451.14	2,668.22	2.09	29,829.34
Luxembourg	30	148.17	309.04	19.29	1,262.06
Netherlands	390	1,121.53	5,278.85	5.00	56,999.82
Portugal	114	184.44	451.53	3.81	2,770.16
Spain	804	624.29	2,897.41	0.21	26,227.79
Total	4,758	764.25	5,199.03	0.21	119,948.41

Table 5: Descriptive Statistics and t-test - 2009-2014

Lender share (Million USD)	Obs	Mean	St Dev
Treated group	1,355	768.70	6,171.91
Untreated group	3,403	762.47	4,757.61
Ttest[a] (Variance)			0.5942***
Ttest[ab] (Mean)		-0.0334	

Notes: The statistics provided in Table 5 focus on the 10 largest banking economies, i.e., Austria, Belgium, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain for the period 2009-2015. We run both the test of comparison for Variances and Means.

[a] We provide the t-statistic and the significance level, i.e. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

[b] We assume unequal variances.

Table 6: Descriptive Statistics of Variables - 2009-2014

Variable	Obs	Mean	St Dev	Min	Max
Dependent Variables					
$\Delta(Participation_{b,t})$	4,758	-0.0021	0.0448	-0.88	0.63
$Entry_{b,t}$	4,758	0.4784	0.4996	0	1
$\Delta(Amount_{b,t})$	4,758	20.5221	1,914.62	-42,199.86	42,684.56
$Synd.Part._{b,t}$	4,758	5.7390	9.9425	0	100
$\Delta(Synd.Part._{b,t})$	4,758	0.2080	12.4611	-100	100
Treated Variable					
$Treated_{b,t}$	4,758	0.2848	0.4514	0	1
Loan Characteristics					
$\Delta(Maturity_{b,t})$	4,758	-0.7400	18.9273	-185.48	198
$\Delta(Revolver_{b,t})$	4,758	0.0080	0.1686	-1	1
$\Delta(Term_{b,t})$	4,758	-0.0043	0.1820	-1	1
$\Delta(Corporate_{b,t})$	4,758	0.0125	0.2396	-1	1
$\Delta(Secured_{b,t})$	4,758	-0.0047	0.2331	-1	1
$\Delta(USD_{b,t})$	4,758	0.0013	0.1342	-1	1
$\Delta(Euro_{b,t})$	4,758	0.0001	0.1250	-1	1
$\Delta(All-in-spread_{b,t})$	4,758	3.5278	56.7164	-750	820.83
$\Delta(Syndicate_{b,t})$	4,758	0.0392	4.6862	-58	47.49
$\Delta(Investment_{b,t})$	4,758	0.0003	0.1102	-1	1
$\Delta(VaR_{b,t})$	4,758	0.0011	0.0042	-0.01	0.04
Bank Characteristics					
$Lead_{b,t}$	4,758	0.2823	0.4041	0	1
$CapConstraint_{b,t-1}$	726	3.0203	2.1989	-3	12
Macroeconomy					
$\Delta(GDP_{c,t})$	4,758	0.0062	0.1785	-2.73	2.67
$\Delta(Inflation_{c,t})$	4,758	-0.1227	1.39	-21.26	14.16
$\Delta(Ruleoflaw_{c,t})$	4,758	0.0046	0.24	-2.49	2.65
$\Delta(Private_{c,t})$	4,758	-0.7344	13.4443	-150.67	161.92
$\Delta(Corptaxrate_{c,t})$	4,758	0.0447	0.3062	-1.04	3

Notes: This table provides descriptive statistics for the main variables of interest included in the empirical analysis. The dependent variables, i.e., the five measures of credit supply, in addition to the main explanatory variable (i.e., $Treated_{b,t}$) are computed by the authors using data from LPC DealScan database. Our final sample consists of 793 ultimate lenders providing 7,218 borrowers with a total of 22,706 loans. The number of observations (4,758) results from the aggregation of the database at the lender-year level.

Table 7: Impact on banks' lending growth of a tax levy

	(1)	(2)	(3)	(4)	(5)	(6)
$Treated_{b,t}$	0.006***	0.006***	0.007***	0.005**	0.006***	0.006***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Economic Impact for Treated banks (in % of Dep. Variable S.D.)						
	13.4	13.4	15.6	11.2	13.4	13.4
Loan characteristics	Yes		Yes	Yes	Yes	Yes
Macroeconomy	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes		Yes
Bank Country FE					Yes	
Corporate Tax rate						Yes
R^2	0.122	0.119	0.214	0.110	0.017	0.123
N	4,758	4,758	3,580	5,943	4,758	4,758

The dependent variable is the annual growth rate of bank b participation in syndicated loans. The main explanatory variable, $Treated_{b,t}$, is equal to one after the implementation of the new tax levy if bank b is located in Austria, Belgium, Germany, Netherlands, or Portugal. We also control for loan characteristics and the macroeconomic features of the borrower's country using the variables described in Table 2. We first estimate Equation (1) over the period 2009-2014 using year and bank fixed effects (column (1)). In column (2), we remove the loan characteristics while in columns (3) and (4) we test the sensitivity of our analysis over different periods, i.e., 2009-2013 and 2009-2015 respectively. We then modify the set of fixed effects using banks' country fixed effects instead of bank fixed effects (column (5)). Finally, we add to our main model the corporate tax rate of the bank's country (column (6)). Standard errors in parentheses are clustered at the bank level; *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Below the coefficients, we provide the economic impact of the tax levy for Treated banks (in % of the standard deviation of the dependent variable).

Table 8: Impact on lending growth of a tax levy - Alternative Sample of Countries

	(1) Baseline	(2) w/ UK and SW	(3) w/o FR	(4) w/o DE and NL
$Treated_{b,t}$	0.006***	0.008***	0.005***	0.007*
	(0.002)	(0.002)	(0.002)	(0.004)
Economic Impact for Treated banks				
	13.4	17.9	11.2	15.6
Loan characteristics	Yes	Yes	Yes	Yes
Macroeconomy	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
R^2	0.122	0.162	0.148	0.115
N	4,758	5,280	3,732	3,036

The dependent variable is the annual growth rate of bank b participation in syndicated loans. The main explanatory variable, $Treated_{b,t}$, is equal to one after the implementation of the new tax levy if bank b is located in Austria, Belgium, Germany, Netherlands, or Portugal. We also control for loan characteristics and the macroeconomic features of the borrower's country using the variables described in Table 2. We first estimate Equation (1) over the period 2009-2014 using year and bank fixed effects (column (1)). In columns (2), (3), and (4), we run our model using different samples of countries, i.e., with banks located in the UK and Sweden, without banks located in France, and without banks located in Germany and Netherlands respectively. Standard errors in parentheses are clustered at the bank level; *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Below the coefficients, we provide the economic impact of the tax levy for Treated banks (in % of the standard deviation of the dependent variable).

Table 9: Impact on lending growth of a tax levy - Alternative banks selection

	(1) Loans bef. and aft. treatment	(2) Lending every year	(3) Lead
$Treated_{b,t}$	0.010***	0.017**	0.004***
	(0.003)	(0.009)	(0.001)
$Lead$			0.002*
			(0.001)
$Treated_{b,t} * Lead$			0.006*
			(0.003)
Economic Impact for Treated banks			
	22.3	17.1	8.9
$*Lead$			13.4
Loan characteristics	Yes	Yes	Yes
Macroeconomy	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
R^2	0.125	0.152	0.123
N	3,606	870	4,758

The dependent variable is the annual growth rate of bank b participation in syndicated loans. The main explanatory variable, $Treated_{b,t}$, is equal to one after the implementation of the new tax levy if bank b is located in Austria, Belgium, Germany, Netherlands, or Portugal. We also control for loan characteristics and the macroeconomic features of the borrower's country using the variables described in Table 2. We first estimate Equation (1) over the period 2009-2014 using year and bank fixed effects by focusing on banks that lend at least once before and after the treatment (column (1)) while in column (2) we restrict the sample to banks that lend at least once every year over the period under study. Finally, we introduce a dummy variable, equal to one if the bank is identified as lead lender in LPC Dealscan, and its interaction with our main variable of interest, i.e., $Treated_{b,t}$ (column (3)). Standard errors in parentheses are clustered at the bank level; *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Below the coefficients, we provide the economic impact of the tax levy for Treated banks (in % of the standard deviation of the dependent variable).

Table 10: Impact on lending growth of a tax levy - Banks of different size and capital

	(1)	(2)	(3)	(4)
$Treated_{b,t}$	0.038**	0.004***	0.003***	0.092**
	(0.017)	(0.001)	(0.001)	(0.045)
$D > 50\%_{b,t}$		0.005***		
		(0.002)		
$Treated_{b,t} * D > 50\%_{b,t}$		0.009*		
		(0.005)		
$D < 33\%_{b,t}$			0.003***	
			(0.001)	
$Treated_{b,t} * D < 33\%_{b,t}$			0.002	
			(0.001)	
$D > 66\%_{b,t}$			0.004	
			(0.003)	
$Treated_{b,t} * D > 66\%_{b,t}$			0.014*	
			(0.007)	
$Capital\ Const._{b,t}$				0.011**
				(0.005)
$Treated_{b,t} * Capital\ Const._{b,t}$				-0.014*
				(0.008)
Economic Impact for Treated banks				
	29.9	8.9	6.7	91.3
$*D > 50\%_{b,t}$		20.1		
$*D < 33\%_{b,t}$			4.5	
$*D > 66\%_{b,t}$			31.3	
$*Capital\ Const._{b,t}$				-13.9
Loan characteristics	Yes	Yes	Yes	Yes
Macroeconomy	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
R^2	0.207	0.125	0.126	0.172
N	511	4,758	4,758	629

The dependent variable is the annual growth rate of bank b participation in syndicated loans. The main explanatory variable, $Treated_{b,t}$, is equal to one after the implementation of the new tax levy if bank b is located in Austria, Belgium, Germany, Netherlands, or Portugal. We also control for loan characteristics and the macroeconomic features of the borrower's country using the variables described in Table 2. In this Table, we estimate Equation (3) over the period 2009-2014 using year and bank fixed effects and we distinguish banks according to their participation in the syndicated loans. First, we restrict our sample to banks heavily involved in the syndicated loan market, i.e., being in the top quartile of lenders in terms of market share (column (1)). Second, we split our sample of banks in two with the a dummy variable equal to one if the bank is above the median and 0 otherwise in column (2). In addition, we also create two dummies equal to one if the bank belongs either to the bottom tercile or the top tercile respectively in column (3). Finally, we interact our $Treated_{b,t}$ variable with a measure of bank capital constraint in column (4). Standard errors in parentheses are clustered at the bank level; *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Below the coefficients, we provide the economic impact of the tax levy for Treated banks (in % of the standard deviation of the dependent variable).

Table 11: Impact on lending growth of a tax levy - Alternative measures of banks participation

	(1) Entry	(2) $\Delta Amount$	(3) *Synd. Part.*	(4) Δ*Synd. Part.*
$Treated_{b,t}$	0.138***	102.242*	1.206**	0.457
	(0.026)	(55.094)	(0.549)	(0.508)
Economic Impact for Treated banks				
	27.6	5.3	12.1	3.7
Loan characteristics	Yes	Yes	Yes	Yes
Macroeconomy	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
R^2	0.433	0.125	0.301	0.084
N	4,758	4,758	4,758	4,758

The dependent variable is the annual growth rate of bank b participation in syndicated loans. The main explanatory variable, $Treated_{b,t}$, is equal to one after the implementation of the new tax levy if bank b is located in Austria, Belgium, Germany, Netherlands, or Portugal. We also control for loan characteristics and the macroeconomic features of the borrower's country using the variables described in Table 2. In this Table, we estimate Equation (1) over the period 2009-2014 using year and bank fixed effects to study the impact of a tax levy on alternative measures of banks participation in the syndicated loan markets, i.e., the probability to lend (column (1)), the change in the amount lent (column (2)), and the bank participation in specific syndicates as well as its annual growth rate (columns (3), and (4)) respectively. Standard errors in parentheses are clustered at the bank level; *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Below the coefficients, we provide the economic impact of the tax levy for Treated banks (in % of the standard deviation of the dependent variable).

Table 12: Impact on lending growth of a tax levy - Transferring costs to borrowers

	(1) ΔSpread	(2) Δ*log*(Spread)	(3) ΔSpread	(4) Δ*log*(Spread)
$Treated_{b,t}$	-1.010	-0.141	-0.750	-0.153*
	(2.982)	(0.086)	(2.967)	(0.085)
Economic Impact for Treated banks				
	-1.8	-5.6	-1.3	-6.1
Loan characteristics'	Yes	Yes	Yes	Yes
Macroeconomy	Yes	Yes	Yes	Yes
w/o $\Delta(Amount_{b,t})$	Yes	Yes		
Year FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
R^2	0.227	0.403	0.233	0.413
N	4,758	4,758	4,758	4,758

The dependent variable is the annual growth rate of bank b participation in syndicated loans. The main explanatory variable, $Treated_{b,t}$, is equal to one after the implementation of the new tax levy if bank b is located in Austria, Belgium, Germany, Netherlands, or Portugal. We also control for loan characteristics and the macroeconomic features of the borrower's country using the variables described in Table 2. In this Table, we estimate Equation (1) over the period 2009-2014 using year and bank fixed effects to study the impact of a tax levy on a potential transfer of these additional costs to borrowers with ΔSpread (columns (1), and (3)) and Δ*log*(Spread) (columns (2), and (4)) respectively. Moreover, we control for the potential simultaneity in the determination of loan spread and amount by estimating two versions of our model, i.e., without the loan amount as an explanatory variable in columns (1), and (2), and with the loan amount in columns (3), and (4). Standard errors in parentheses are clustered at the bank level; *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Below the coefficients, we provide the economic impact of the tax levy for Treated banks (in % of the standard deviation of the dependent variable).