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Taxing banks: an evaluation of the German bank levy

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Non-technical summary

Research Question

Bank distress can have severe negative consequences for public finances, which became obvious during the latest financial crisis. Bank levies can be one instrument to internalize the costs of bank distress. As they are not a common instrument in policymakers' toolkits, it is important to examine the consequences of their introduction. We focus on two main questions in the context of the German bank levy: What is the tax burden on different types of banks? How does the levy affect bank behavior?

Contribution

This is the first empirical study of the effects of the German bank levy. Moreover, the results not only give insights at the national level but are able to inform the debate about the design of the contribution to the single resolution fund at the European level.

Results

The descriptive analysis shows that low tax rates and high thresholds for tax exemptions limit the revenues raised through the bank levy. Moreover, systemically important banks are the main contributors. Our empirical regression approach exploits the retrospective nature of the introduction of the bank levy. The details of the tax were made public in 2011, but the bank levy was calculated based on balance sheet data of 2010. This represents an exogenous policy change and allows the effects of the bank levy on bank behavior to be studied in a difference-in-difference setting. The results show that the levy has a significant effect on lending and interest rate setting. Banks affected by the levy reduce their loan supply and increase deposit rates.

Nichttechnische Zusammenfassung

Fragestellung

Wie der deutliche Anstieg der Staatsverschuldung in einigen Ländern als Folge der Finanzkrise gezeigt hat, bedrohen wirtschaftlich angeschlagene Banken die öffentlichen Finanzen. Durch eine Bankenabgabe können Banken an den Kosten einer Bankenkrise beteiligt werden. Da Erfahrungen mit den Auswirkungen einer Bankenabgabe begrenzt sind, ist es wichtig, die Folgen ihrer Einführung zu analysieren. Wir konzentrieren uns auf zwei Fragen in Bezug auf die deutsche Bankenabgabe: Wie verteilt sich die Bankenabgabe auf verschiedene Bankengruppen? Wie wirkt sich die Bankenabgabe auf das Verhalten von Banken aus?

Beitrag

Dies ist die erste empirische Studie zu den Effekten der Bankenabgabe in Deutschland. Darüber hinaus liefern die Ergebnisse nicht nur interessante Einblicke auf nationaler Ebene, sondern stellen auch einen Beitrag für Diskussionen über die Ausgestaltung der Bankenabgabe im Rahmen der Errichtung eines einheitlichen Abwicklungsfonds auf europäischer Ebene dar.

Ergebnisse

Die Analyse zeigt, dass die niedriger als erwarteten Einnahmen aus der Bankenabgabe das Ergebnis von niedrigen Steuersätzen und hohen Steuerfreibeträgen sind. Die systemrelevanten Institute tragen dabei die Hauptlast der Bankenabgabe. Der von uns verwendete Regressionsansatz nutzt die Tatsache aus, dass die Einzelheiten der Bankenabgabe im Jahr 2011 veröffentlicht wurden, die Bankenabgabe allerdings rückwirkend und basierend auf den Jahresabschlusszahlen von 2010 erhoben wurde. Dadurch kann der Einfluss der Bankenabgabe auf das Verhalten der Banken im Rahmen eines aussagekräftigen ökonometrischen Ansatzes identifiziert werden. Es zeigt sich, dass die Bankenabgabe einen signifikanten Einfluss auf das Kreditvergabe- und Zinssetzungsverhalten hat. Banken, die die Abgabe zahlen, senken die Kreditvergabe und erhöhen die Zinsen für neue Einlagen.

BUNDESBANK DISCUSSION PAPER NO 38/2014

Taxing Banks: An Evaluation of the German Bank Levy[1]

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Abstract

Bank distress can have severe negative consequences for the stability of the financial system, the real economy, and for public finances. Regimes for the restructuring and resolution of banks, financed by bank levies and fiscal backstops, seek to reduce these costs. Bank levies attempt to internalize systemic risk and to increase the costs of leverage. This paper evaluates the effects of the German bank levy implemented in 2011 as part of the German Bank Restructuring Act. Our analysis offers three main insights. First, revenues raised through the bank levy are lower than expected, because of low tax rates and high thresholds for tax exemptions. Second, the bulk of the payments were contributed by large commercial banks and by the central institutions of savings banks and credit unions. Third, for the banks affected by the levy, we find evidence for a reduction in lending and higher deposit rates.

Keywords: Bank levy, bank lending, interest rates, German banks

JEL codes: G21, G28, C21

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1 Motivation

Bank distress can have severe negative consequences not just for the stability of the financial system but also for the real economy and for public finances. Systemic banking crises have imposed fiscal costs of up to 7% of gross domestic product in some countries, and output has fallen by 23% compared with long-run trends (Laeven and Valencia 2012). Crises increase public debt significantly, aggravating the risk of public sector default (Reinhart and Rogoff 2011, 2013). To reduce the probability of banking crises and to internalize the costs of bank distress, policymakers imposed various changes to the regulatory framework. For example, the new Basel III rules foresee higher capital requirements and the introduction of liquidity requirements. In addition, regimes for restructuring and resolution of banks have been established. They rely on fiscal backstops and bank levies, which seek to internalize systemic risk and to finance a restructuring fund (IMF 2010; Perotti and Suarez 2011; Shin 2010).

In this paper, we assess the effects of the German bank levy implemented in 2011 as part of the German Bank Restructuring Act. The levy applies to all credit institutions with a German banking license, and it is managed by the Federal Agency for Financial Market Stabilisation. The tax base for the levy are contribution-relevant liabilities. These are calculated by taking banks' total liabilities and deducting equity and retail deposits. Banks are exempt from paying the tax if their contribution-relevant liabilities are less than €300 million. For contribution-relevant liabilities exceeding €300 million, tax payments are increasing progressively but are capped at 20% of profits.

The levy has the objectives to generate resources for the Restructuring Fund and to internalize banks' contributions to systemic risk. Similar to a Pigouvian tax, the levy targets positions which are assumed to be more risky and to create negative externalities once a bank is in distress. To achieve these dual objectives, the German bank levy increases in the banks' contribution-relevant liabilities as well as in their derivative exposures.

We combine several data sets provided by the *Deutsche Bundesbank* to analyze whether the bank levy affected bank behavior. The design of the levy implies that banks' costs of wholesale funding increase. This provides incentives to adapt the business model towards relying more on equity and funding through customer deposits. While structural changes in business models are more likely to evolve in the long-run, banks might respond to the levy already in the short-run. For example, banks can adjust their lending decisions and interest rate policies. We thus focus on responses in terms of the total lending volume, the provision of new loans, the pricing of new loans and new deposits.

Our analysis is based on a difference-in-difference approach which exploits two features of the levy. First, the specific terms of the levy were uncertain until the Restructuring Fund

Regulation was actually passed. Second, the levy was imposed in 2011 but it was applied retrospectively to banks' balance sheets of 2010. This implies that banks could not adapt their behavior before the introduction of the levy. We exploit this exogenous policy change to distinguish the behavior of banks that paid the tax (the treated banks) from those that did not (the control group), and we focus on differences in banks' behavior before (2008–2010) versus after (2011) the introduction of the levy. This allows isolating the effect of the levy.

In analyzing the effects of the German bank levy, we focus on two main questions. First, what is the tax burden on different types of banks? The aim of the bank levy is to internalize banks' contributions to systemic risk. Larger banks, riskier banks, and banks with a high share of wholesale funding are thus supposed to pay higher levies. We find that the bank levies indeed correlate strongly with the size of banks. The largest commercial banks and central institutions of savings banks and credit unions account for the bulk of the payments, whereas smaller banks (77% of the total) do not contribute to the levy at all. Other bank-specific features, such as the capital ratio, liquidity ratio, or the profitability of banks, are only weakly correlated with the levy.

Second, we ask how the levy affects bank behavior. Banks can respond to higher costs by reducing lending rates or reducing lending. Effects on deposit rates are not clear cut. On the one hand, lower deposit rates would help banks to increase their interest rate margins. On the other hand, higher deposit rates would create incentives to switch to deposit financing and thus to a source of funding exempted from the levy.

To analyze the short-run responses of banks to the levy, we use data on a subsample of banks for which we have information about *new* loans, the interest rates on these *new* loans, and the interest rates paid on *new* deposits. We find that banks affected by the levy tend to reduce their lending and to increase the interest rate on new deposits obtained from non-financial firms. This suggests that banks try to attract funds which are not subject to the levy.

In the longer run, a bank levy might also affect banks' risk-taking behavior. For example, banks' might change their business models to more retail based funding or equity in order to pay lower taxes. Given the short time span following the introduction of the levy that we can analyze, we cannot identify such structural shifts in banks' business models though. First evidence suggests that banks did not adapt their business model to reduce their amount of contribution-relevant liabilities.

Our research contributes to four strands of literature. One strand of literature finds that banks pass higher taxes on to borrowers. Demirgüç-Kunt and Huizinga (1999, 2001) use bank-level data for 80 countries to show that higher taxes lead to higher pre-tax profitability of banks. That is, banks pass their corporate income taxes on to customers. This effect is stronger among local banks than among foreign banks. Albertazzi and Gamabcorta (2010) investigate 10 industrialized countries during 1981–2003. They find that almost 90% of corporate income

taxes are passed on to borrowers through increased interest rates and reduced lending. This high pass-through rate is confirmed by Chiorazzo and Milani (2011) with data on European banks over the period 1990–2005. Our findings contribute to this literature by revealing a negative impact of the bank levy on loan supply and a positive impact on deposit rates. We do not find that banks pass the levy on to borrowers by increasing interest rates on new loans.

A second strand of literature contains policy proposals which focus on regulatory measures designed to internalize banks' contributions to systemic risk (IMF 2010). Perotti and Suarez (2009) propose a liquidity charge. They argue that liquidity charges, increasing in the amount of short-term wholesale liabilities and weighted by the maturity mismatch between assets and liabilities, might discourage excessive reliance on short-term funding and generate emergency liquidity funds for crisis times. Shin (2010) raises the idea of a tax on banks' non-core liabilities, which might reduce their reliance on short-term wholesale funding as a means to finance excessive balance sheet expansions during booms.

A third strand of literature compares the effect of taxes on banks to alternative regulatory measures like capital and liquidity requirements from a theoretical point of view. Perotti and Suarez (2011) compare the effectiveness of Pigouvian taxes on short-term funding with the impact of liquidity ratios for reducing systemic externalities. In their model, an optimal allocation results from introducing Pigouvian taxes on short-term funding, given that banks differ only in their investment possibilities. This result vanishes with the introduction of heterogeneity in banks' risk-taking. In this scenario, bank taxes are no longer sufficient to align gambling incentives and excessive credit expansion. De Nicolò et al. (2012) take a broader perspective and use a dynamic model to study the effects of taxation, capital, and liquidity requirements on bank lending, efficiency, and welfare. Their results suggest that corporate income taxes prevail over a tax on non-deposit liabilities, because the former generates higher tax revenues but mitigates the negative effects on lending and social welfare. If we compare the design of the German bank levy with taxes proposed in theoretical models and policy proposals, we see that they all share the idea of targeting the liability side of banks' balance sheet and internalizing systemic risk due to excessive reliance on short-term wholesale funding.

A fourth and final strand of literature analyzes the relationship between bank levies and banks' contributions to systemic risk empirically. Although the time since the introduction of the German bank levy (2011) is too short to analyze long-run effects, Schweikhard and Wahrenburg (2013) show that, within the German tax scheme, banks that contribute more to systemic risk pay higher taxes. Using a sample of 41 large banks, they compare the effectiveness of bank levies in France, Germany, and the U.K. bank in terms of internalizing systemic risk. Specifically, they compare the levies these banks would have paid in 2007–2010 with their "too-big-to-fail" premium (i.e., the funding cost advantage of being large).

They find that none of the tax schemes fully internalize the negative externality; nevertheless, levies in all tax schemes correlate positively with banks' contributions to systemic risk. Unlike our research, their analysis focuses on a selected sample of large banks and on the link between systemic risk measures and hypothetical tax payments in different regulatory regimes. Our objective instead is to evaluate the immediate effects of the German levy on banks' interest rate setting and lending behavior. We calculate tax payments using confidential balance sheet data from the *Deutsche Bundesbank*, which are available for large commercial banks as well as smaller savings banks and credit unions.

The paper is structured as follows. In the next section, we describe the design and legal background of the German bank levy. In Section 3, we introduce our data and provide some descriptive statistics. Section 4 contains the empirical model and the regression results. We conclude in Section 5.

2 German Bank Levy: Design and Legal Background

The German bank levy was introduced in 2011 as part of a new regulatory framework for the restructuring and resolution of banks. It applies to all credit institutions with a banking license, as specified in the German Banking Act.[2] The levy finances the Restructuring Fund (*Restrukturierungsfonds*), which has a target size of €70 billion. The Restructuring Fund is managed by the Federal Agency for Financial Market Stabilisation (FMSA; *Bundesanstalt für Finanzmarktstabilisierung*), in association with the German Federal Ministry of Finance (*Bundesministerium der Finanzen*). These funds are earmarked as a financial backstop if the failure of banks or parts thereof were to endanger the systemic stability of the banking system. Unlike a deposit insurance fund that insures depositors of all banks, the rescue fund is designed to intervene only if systemically important banks are in distress. In the first three years after the introduction of the bank levy in Germany in 2011 €1.8 billion have been collected. The yearly revenues vary between €520 million in 2013 to €690 million in 2012.[3] The bank levy collected between 2011 and 2013 accounts for 1.5% of operating income and 2.2% of total profits before taxes of German banks in this period.[4]

2.1 Timing of the Legislation

To identify the effect of the bank levy on bank behavior, we use a difference-in-difference approach. This approach relies on the assumption that banks affected by the levy could not adjust their behavior *prior* to the introduction of the levy. For example, in anticipation of the

[2] The Appendix provides details on which banks are subject to the regulation.

[3] See information published by the German Bundestag in Drucksache 17/12339, http://dipbt.bundestag.de/dip21/btd/17/123/1712339.pdf.

[4] The German bank levy is considered as non-interest expenses in the profit and loss accounts of banks.

tax, banks might have had incentives to restructure their balance sheet in order to lower the tax base. If this would have been possible, the introduction of the levy would not qualify as an exogenous policy change. In this paper, we exploit two features in the timing of the legislation which help rule out related concerns.

First, the Restructuring Fund Act came into force in December 2010. Specific details about the design of the bank levy are contained in the Restructuring Fund Regulation, which was passed in July 2011. The annual bank levy is calculated based on the banks' balance sheets and income statement of the immediately *preceding* accounting year. In our empirical approach, we exploit the fact that banks could not adjust their annual statements, i.e. those referring to the year 2010, when the levy was first introduced in 2011. The levy is thus exogenous from the point of view of the individual bank, and it is applied retrospectively.

Second, the exact design of the levy has been the subject of a legislative debate. For the individual bank, there has been a substantial margin of uncertainty as to the outcome of this process. Hence, banks could not adjust activities *ex ante* in anticipation of a specific design. For example, it has been discussed whether savings banks should be exempt from the levy. The minimum threshold was thus lowered from €500 to €300 million, and the acceptability limit was raised from 15% to 20% of annual earnings. An additional issue in the debate was whether the regulation should be based on balance sheet quantities alone or whether risk weights should be applied.

2.2 Calculating the Bank Levy

The actual design of the German bank levy aims at internalizing banks' contributions to systemic risk. Credit institutions with a market-based funding strategy and with a high volume of derivatives trading are charged more, smaller banks are charged less. Accordingly, the levy has two main components.

The first component of the bank levy imposes a tax on contribution-relevant liabilities. These consist of funding sources other than customer deposits and bank equity. This avoids the possibility that banks make contributions twice, with respect to both deposit insurance and the bank levy. The contribution-relevant liabilities are obtained by taking total liabilities as defined in section 340a of the German Commercial Code and subtracting the following items

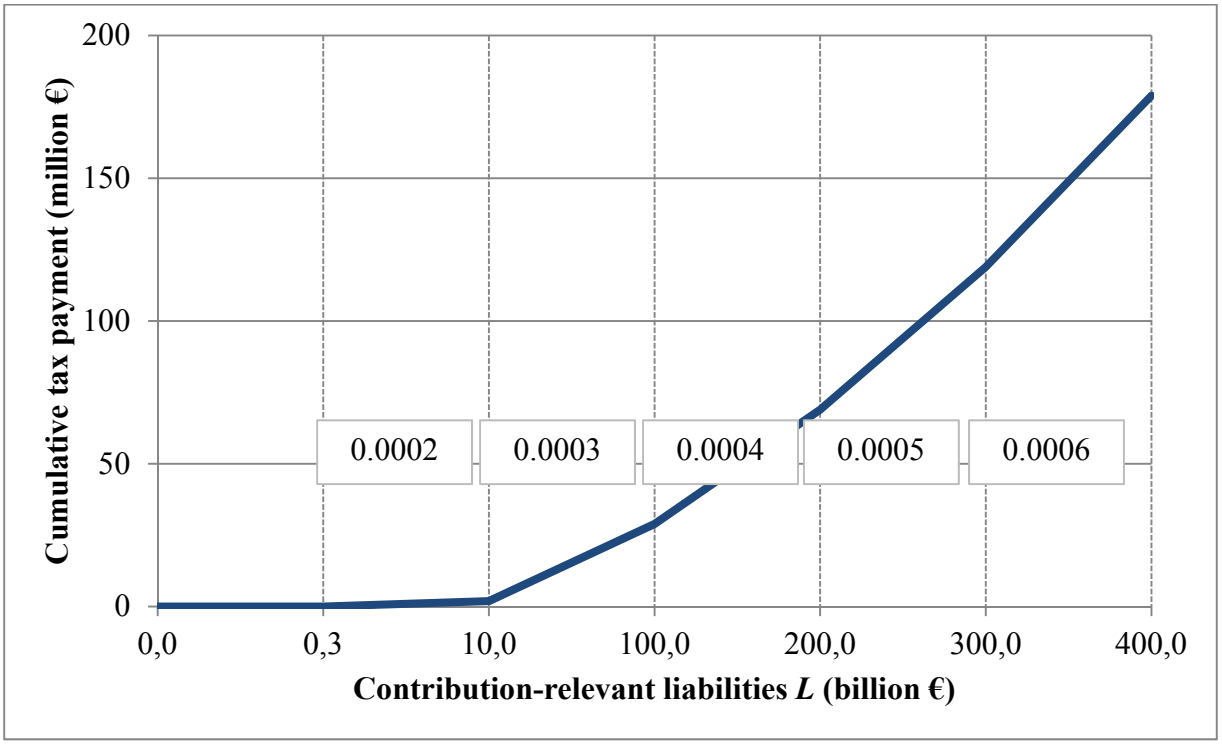
- liabilities toward customers, excluding liabilities issued as bearer securities (*Passivposten* 2)
- profit participation rights with a maturity of more than two years (*Passivposten* 10)
- reserve funds for general banking risk (*Passivposten* 11)
- equity (*Passivposten* 12)

= contribution-relevant liabilities (*L*).

The levy increases progressively with the volume of a bank's contribution-relevant liabilities. If the resulting contribution-relevant sum is smaller than or equal to €300 million, no levy applies to this component of the tax. Contribution-relevant liabilities (L) exceeding this value are subject to a progressive tax rate (Figure 1).

Figure 1: Tax Payments and Contribution-Relevant Liabilities

This graph plots the cumulative tax payments (in million €) resulting from the multiplication of contribution-relevant liabilities (in billion €) in different tax brackets with the respective tax rate. The tax rate for contribution-relevant liabilities (L) smaller than or equal to €300 million is 0. If a bank has contribution-relevant liabilities of more than €300 million, the amount exceeding this threshold is subject to the following progressive tax rate: 0.0002 (€300 million < L ≤ €10 billion), 0.0003 (€10 billion < L ≤ €100 billion), 0.0004 (€100 billion < L ≤ €200 billion), 0.0005 (€200 billion < L ≤ €300 billion), and 0.0006 (L > €300 billion).



Source: Restructuring Fund Regulation, own calculations.

The German system differs from those established in most other European countries, which impose a flat tax on banks of different sizes. Of the 14 European countries that have imposed taxes on banks in the past six years, most of them opted for bank levies rather than a financial transaction tax which imposes penalties on certain kinds of financial transactions, or a financial activity tax which charges levies on financial sector profits and remuneration (Gottlieb et al. 2012). The revenues from these bank levies range from 0.7% of GDP in Hungary to 0.02% of GDP in Germany. The German version differs in two main respects from other European bank levies. First, the German levy applies to foreign branches of German banks but not foreign subsidiaries. In most other countries, foreign affiliates are exempted from the levy. Second, Germany (and France) exempts small banks and development banks from the levy.

The second component of the tax is based on derivatives. Contribution-relevant derivatives refer to the aggregate notional volume of derivatives listed in the appendix of the last annual accounts and specified in section 36 of the Credit Institution Accounting Regulation (*Kreditinstituts-Rechnungslegungsverordnung*). The accrued levy from this component results from the multiplication of this amount by a factor of 0.000003. This number appears to be very small, but, as of December 2013, the notional volume of derivatives of those banks reporting to the BIS OTC Derivatives Statistics was €57 trillion.

The final contribution is the sum of the contribution-relevant liability positions, multiplied by the respective factors, and the amount referring to derivative exposures. Germany differs from most other European countries by imposing a cap on payments. The maximum levy to be paid is limited to 20% of the bank's annual earnings, which corresponds to an acceptability limit (*Zumutbarkeitsgrenze*). However, even if a credit institution has no annual surplus and irrespective of the acceptability limit, a minimum contribution has to be paid. The minimum contribution (*Mindestbeitrag*) corresponds to 5% of the calculated annual contribution.

3 Data and Descriptive Statistics

To analyze the questions of which banks have been affected most be the levy and how this has affected their behavior, we use supervisory data provided by the *Deutsche Bundesbank* on banks' balance sheets, income statements, and prudential indicators for the years 2008–2011. This time window allows analyzing the behavior of banks before (2008–2010) and after (2011) the introduction of the levy. All data are annual.

3.1 Data on Bank Loans and Interest Rates

In the short run, the most important channel of adjustment to the introduction of the bank levy is a reduction in loans and an increase in interest rate spreads to compensate for higher funding costs. The effect on deposit rates is not clear a priori. On the one hand, higher deposit rates might attract new customer deposits and funds exempted from the tax. On the other hand, lower deposit rates would compensate for higher funding costs through the levy.

To focus on banks' short-term adjustment, we use information for a sub-sample of banks covered in the interest rate statistics for monetary financial institutions (MFI statistics). For these approximately 200 banks, this data set provides information about the quantity of *new* loans, the interest rate charged across new loans, and interest rates paid for *new* deposits.

Table 1: Summary Statistics for Loan Volumes and Interest Rates

The table shows summary statistics for the loan volume, loan rate, and deposit rate variables. Descriptive statistics based on the full sample include all observations from 2008–2011 for all banks in our data set; those based on the subsample of banks reporting within the scope of the MFI interest rate statistics include all observations from this period for banks reporting from 2003 onward. The dependent variable is either newly granted loans ("New Loans," millions €) or the volume of existing loans ("Loans," millions €). "Loans" consists of loans to customers excluding interbank loans. "Loans/Assets" gives the total loan stock over total assets. "Loans (YoY change in %)" denotes the year-on-year change in the total loan stock. "New Loans HH (F)" refers to new consumer loans provided to households (non-financial firms). The loan and deposit rates (%) are end-of-year volume-weighted interest rates. Data on loan rates are available for three maturity brackets. Short-term loan rates are fixed for a maximum of one year. Medium-term loan rates are fixed for at least one year and up to a maximum of five years. Long-term loan rates are fixed for at least five years. "All maturities" is a weighted average of loan rates across the three maturity buckets. It can be broken down by sector: "All maturities HH (F)" refers to loan rates applying to households (non-financial firms). Deposit rates are available for three maturity brackets. Overnight deposit rates are paid for deposits with an overnight maturity. Short-term deposit rates are fixed for a maximum of one year. Medium-term deposit rates are fixed for at least one year. "All maturities" is a weighted average of deposit rates across the three different maturity buckets available. It can be broken down by sector: "All maturities HH (F)" refers to deposit rates applying to households (non-financial firms). For more details, see the description in the Data Appendix.

	(1) Full sample (7,174 bank-year observations)		(2) Reporting banks in MFI interest rate statistics (625 bank-year observations)	
	Mean	*Std. dev.*	*Mean*	*Std. dev.*
Loan volume				
New loans (million €)			4,221	14,005
Loans (million €)	1,628	11,053	13,739	34,746
Loans/Assets (ratio)	0.55	0.16	0.56	0.17
Loans (YoY change in %)	0.04	0.21	0.03	0.09
New loans HH (million €)			266	1,000
New loans F (million €)			4,117[5]	14,147
Loan rates (%)				
All maturities			3.87	1.40
Short-term			3.47	1.65
Medium-term			4.65	1.26
Long-term			4.66	1.28
All maturities HH			5.77	1.52
All maturities F			3.49	1.08
Deposit rates (%)				
All maturities			1.82	1.01
Overnight			0.84	0.66
Short-term			1.64	1.06
Medium-term			2.48	1.03
All maturities HH			1.93	1.01
All maturities F			1.60	1.02

[5] The mean in the new loans to non-financial firms ("New loans F") is affected by loans > 1 Mio. Euro with a fixed interest rate period < 3 months. If those loans are excluded from the calculation the mean reduces to 840 mn Euro.

Our main regression results are based on a (balanced) sample of banks having reported to the MFI interest rate statistics since 2003. Hence, the sample of banks is constant over time, and we cannot model a possible selection effect. The results are robust to the addition of approximately 40 banks which have been required to report since 2010. [6] To detect possible differences between the MFI banks and the German banking system as a whole, we provide the descriptive statistics for each group separately.

To assess the impact of the levy on loans, we use: (1) log of new loans from the MFI interest rate statistics, (2) log of total loans (stocks from the balance sheet statistics), (3) total loans scaled by total assets, and (4) log changes in the stock of loans. Interest rate data on new loans are available for all new loans issued by banks, as well as for loans with short-term (less than 1 year), medium-term (1-5 years), and long-term (over 5 years) maturity. In addition, we have interest rate data on new deposits for all newly received deposits, disaggregated by maturity (i.e., overnight, short-term (less than 1 year) or medium-term (over 1 year) deposits). Data on new loans and new loan or deposit rates can in addition be broken down by sector (households and non-financial firms).

Table 1 contains summary statistics for these variables. The banks in the MFI sample show significantly higher mean loans of €13,739 million, versus €1,628 million for the full sample. The results obtained from the MFI interest rate statistics are thus representative of larger banks in the market. Nevertheless, the two groups of banks are similar in other structural characteristics: The ratio of loans to total assets is almost identical (55%), as is the average annual growth rate of loans. Table 6 contains a comparison of key bank characteristics, such as capital and liquidity ratios or profitability, and shows similar patterns across the different samples of banks.

3.2 Data Used to Calculate the Bank Levy

An evaluation of the German bank levy can generally draw on three data sources.

First, we could use the annual reports of the credit institutions, which would provide information about each bank's actual payments and key banking indicators. However, not all German banks publish annual reports which would limit the data set to publicly listed banks. Confidential regulatory information collected by supervisors would not be available.

Second, the FMSA collects bank levies and therefore has data on payments by each bank. However, these data are not available to external researchers; they also do not contain information about banks' balance sheets and prudential indicators.

[6] For a detailed description of the bank selection procedure and the changes made to the MFI interest rate statistics in June 2010, see the *Deutsche Bundesbank*'s Monthly Reports (January 2004, pp. 45–59; June 2011, pp. 45–57).

Third, our data collection strategy relies on confidential data from the *Deutsche Bundesbank* pertaining to banks' balance sheets, income statements, and prudential indicators. In Germany, banking supervision is conducted jointly by the banking supervisor BaFin (*Bundesanstalt für Finanzdienstleistungsaufsicht*) and the *Bundesbank.* The *Bundesbank* collects the relevant data. In terms of coverage, quality, and depth, the *Bundesbank* data are the most comprehensive available, including information about the smaller savings banks and credit unions that dominate the retail market. Yet, these data lack direct information about the levies paid by banks. To circumvent this shortcoming, we combine information on the rules governing how to calculate the levy with high-quality information on banks' balance sheets and income statements. This enables us to calculate banks' contributions with a sufficient degree of precision.

The amount actually paid by a given bank and the amount we calculate may differ for three reasons. First, instead of development loans, which do not have a direct counterpart in the *Bundesbank*'s reporting scheme, we use the amount of trust liabilities as a proxy. Second, data on derivatives held by banks are not available for all banks within the sample. Instead we resort to the over-the-counter (OTC) derivatives statistics, which contain information about banks with derivatives exposures of more than €1,000 billion. Third, to avoid double taxation of banks in the same group, annual earnings are subject to adjustments that cannot be quantified with the available balance sheet and income statement data. Despite these potential deviations, our calculations are very similar to the publicly available information on bank levies (Table 3).

3.2.1 Contribution-Relevant Liabilities

Contribution-relevant liabilities can be calculated directly from the balance sheets reported to the *Bundesbank*. They amounted to €4.7 trillion across all banks at the end of 2010, which provides the basis for calculating the 2011 bank levy. Table 2 shows the distribution of contribution-relevant liabilities across banking groups (Panel (a) includes the full sample, and Panel (b) features the sub-sample of MFI banks). We combine the central institutions of savings banks (*Landesbanken*) and credit unions (*Genossenschaftszentralbanken*) in one group. Mortgage banks and building societies are grouped together.

The last two columns of Table 2, Panel (a), show that the majority of banks have contribution-relevant liabilities amounting to less than €300 million. More than 77% of all German banks, especially the credit unions, fall below this threshold. The large commercial banks and central institutions of savings banks and credit unions account for more than 73% of total contribution-relevant liabilities (Column 2). The banks reporting to the MFI interest rate statistics represent the bulk of the contribution-relevant liabilities (€4.3 trillion out of €4.7 trillion). Column 3 indicates the ratio of contribution-relevant to total liabilities. The large

commercial banks (60%) and central institutions of savings banks and credit unions (75%) have a weak deposit based and thus the highest ratios of taxable liabilities.

Table 2: Contribution-Relevant Liabilities by Bank Group

The table shows the amount of contribution-relevant liabilities (*L*) (in billion €) for both the full sample of banks and the subsample of banks reporting to the MFI interest rate statistics. Numbers are reported across all banks in the sample, as well as disaggregated by bank group, and refer to the year 2011. In column 1, the contribution-relevant liabilities are summed over all banks within a specific bank group of the respective sample. Contribution-relevant liabilities by bank group as a percentage of total contribution-relevant liabilities are shown in column 2. The ratio of contribution-relevant liabilities to total liabilities is reported in column 3. Column 4 gives the share of trust liabilities in total liabilities. The distribution of contribution-relevant liabilities across bank groups for the contribution year 2011 is shown for the full sample of banks only: Columns 5 and 6 of the first panel give the percentage share of banks with contribution-relevant liabilities below or equal to (above) €300 million. If a bank's contribution-relevant liabilities are smaller than or equal to this threshold, it is exempted from the payment of the bank levy.

(a) Full sample (1,803 bank-year observations)

	(1) Contribution-relevant liabilities (billion €)	(2) % of total contribution-relevant liabilities	(3) % of total liabilities	(4) Trust liabilities (% of total liabilities)	(5) Banks with $L \leq$ €300 million (% of total)	(6) Banks with $L >$ €300 million (% of total)
Large commercial banks	2,032	43.55	72.60	0.07	0.00	100.00
Other commercial banks	281	6.02	36.40	0.26	58.66	41.34
Central institutions	1,391	29.80	74.87	0.67	0.00	100.00
Savings banks	252	5.39	23.83	0.14	48.02	51.98
Credit unions	141	3.02	20.39	0.35	93.67	6.33
Mortgage banks	570	12.21	61.82	0.83	31.71	68.29
Total	*4,666*	*100.00*			*77.09*	*22.91*

(b) Reporting banks in MFI interest rate statistics (165 bank-year observations)

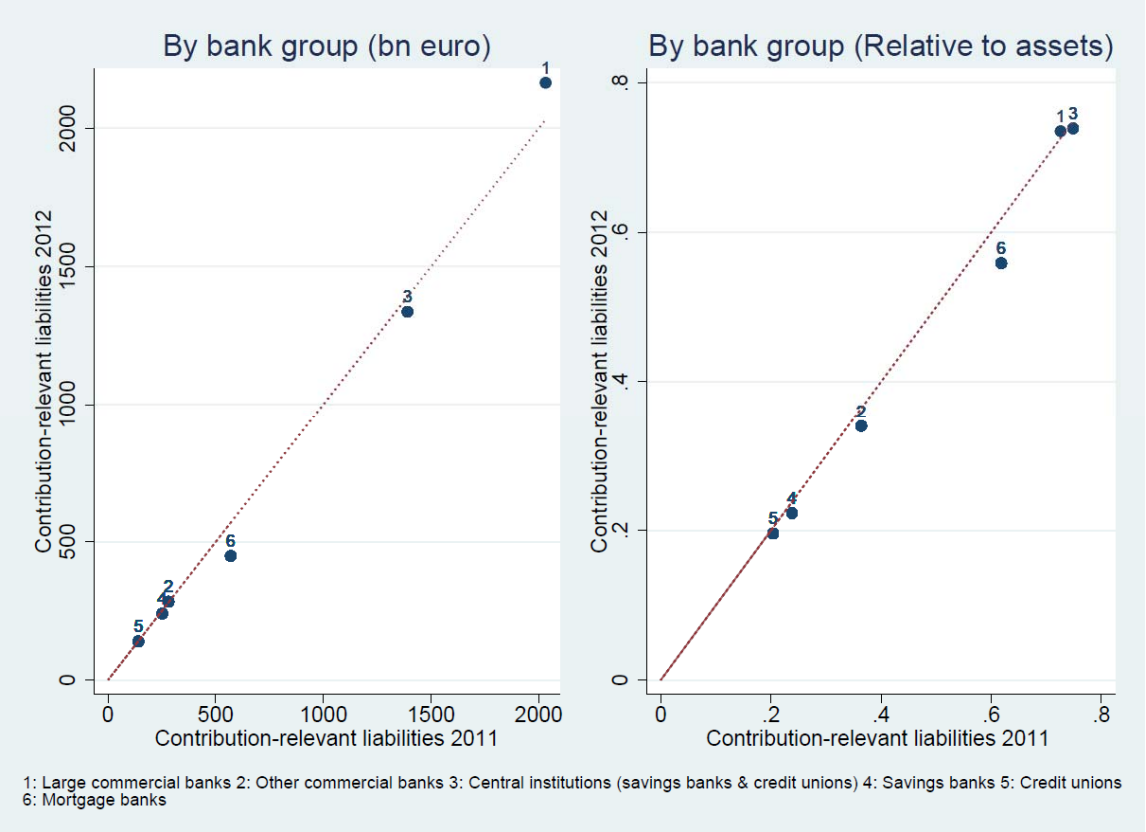
	(1) Contribution-relevant liabilities (billion €)	(2) % of total contribution-relevant liabilities	(3) % of total liabilities	(4) Trust liabilities (% of total liabilities)
Large commercial banks	2,032	47.57	72.60	0.07
Other commercial banks	171	4.01	33.55	0.03
Central institutions	1,391	32.56	74.87	0.67
Savings banks	119	2.80	24.40	0.07
Credit unions	49	1.15	24.83	0.12
Mortgage banks	509	11.91	64.33	0.95
Total	*4,271*	*100.00*		

In Figures 2 and 3, we investigate whether there are indications that the bank levy induced adjustment in banks' business models. Figure 2 plots the contribution-relevant liabilities for 2011 against those of 2012, by bank group. In the left panel, we find that the amount of contribution-relevant liabilities barely changed across years. Hence, banks did not adjust their balance sheets. Inspecting the contribution-relevant liabilities relative to total assets in the

right panel of Figure 2 yields similar results. This is not surprising, considering that most banks had contribution-relevant liabilities below the €300 million threshold, which exempted them from payments. However, even for large commercial banks (bank group 1) or central institutions of savings banks and credit unions (bank group 3), there are no visible adjustments.

Figure 2: Contribution-Relevant Liabilities, 2011 versus 2012

This graph plots contribution-relevant liabilities for the year 2011 against those of 2012. On the left, data from all banks included in the sample are aggregated to obtain contribution-relevant liabilities by bank group (in billion €). On the right, contribution-relevant liabilities by bank group are scaled by total assets of the respective bank group.

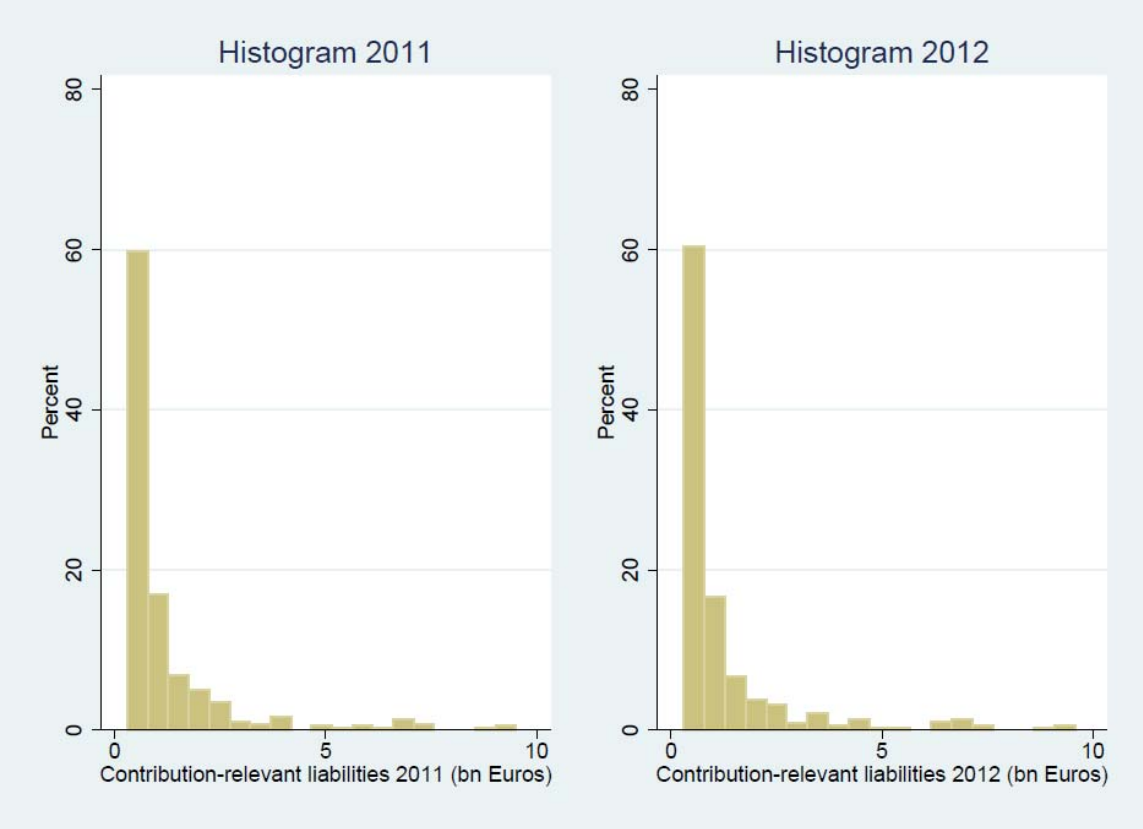


Source: *Deutsche Bundesbank*, own calculations.

The distribution of contribution-relevant liabilities in the second interval (€300 million $< L \leq$ €10 billion) confirms this finding. Had the bank levy had a significant effect, banks would have tried to reduce their contribution-relevant liabilities to below the €300 million threshold. Yet, Figure 3 shows that the share of banks coming close to the threshold did not change substantively between 2011 and 2012. In addition, we performed Kolmogorov-Smirnov tests to compare the distribution of each non-contribution relevant position (e.g., customer deposits or equity) underlying the computation of the bank levy for 2011 and 2012. These unreported tests show that the bank levy had no significant effect on the balance sheet structure.

Figure 3: Histogram of Contribution-Relevant Liabilities

This histogram shows the distribution of contribution-relevant liabilities (in billion €) in the second interval, €300 million < $L \leq$ €10 billion, for 2011 and 2012. According to the Kolmogorov-Smirnov test, we cannot reject the equality of the distribution functions for contribution-relevant liabilities in 2011 and 2012.



Source: *Deutsche Bundesbank*, own calculations.

3.2.2 Development Loans and Trust Liabilities

Development loans have no direct counterpart in the *Bundesbank*'s reporting scheme. As a proxy, we use the amount of trust liabilities. [7] Column 4 of Table 2 shows that trust liabilities account for less than 1% of total liabilities across all banking groups. The impact on the final tax payment is thus negligible.

3.2.3 Derivatives Positions

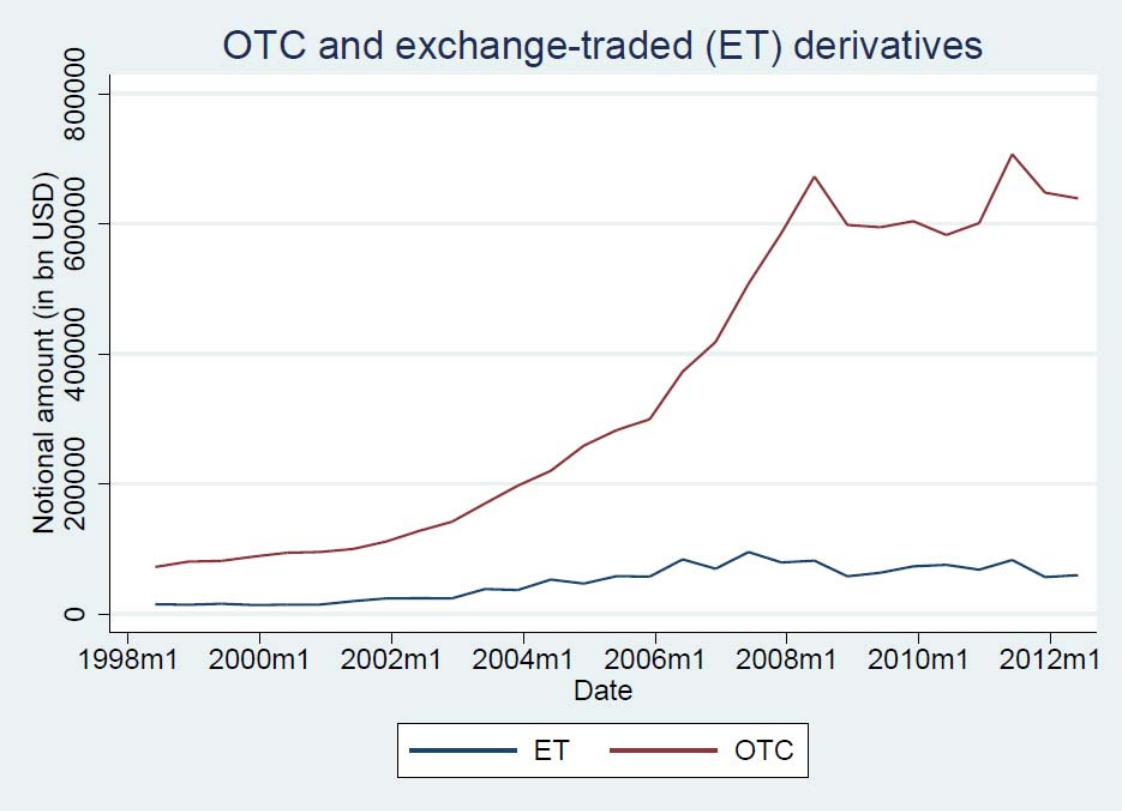
To obtain information on derivatives positions, we resort to the OTC derivatives statistics, which show the derivatives positions of banks reporting to the Bank for International Settlements (BIS). Only banks with nominal derivatives exposures of more than €1,000 billion have to report their exposures to the BIS. In 2010 and 2011, five German banks fell into this category, and we refer to these as "BIS banks".

[7] Development loans are not restricted to the "trust liabilities" position considered here. Instead, they could be included in the "liabilities vis-à-vis banks" or "other liabilities vis-à-vis non-banks" positions; the trust liabilities position might also contain positions that do not count as development loans.

The OTC derivatives positions provide a useful approximation for calculating the bank levy for three reasons. First, in 2008, more than 90% of the overall derivatives exposure was accounted for by the BIS banks. Second, among the BIS banks, the OTC derivatives accounted for almost 80% of total derivatives exposures. Third, the year 2008 has been the final year in which derivatives were reported under Section 36 of the German Credit Institution Account Regulation. Figure 4 shows that the OTC derivatives exposure of the BIS banks was almost unchanged between 2008 and 2010. Applying the tax rate to the derivatives exposure of non-BIS banks in 2008, we find that the effect on the size of the bank levy of a non-BIS bank would have been negligible.

Figure 4: Derivatives of BIS Banks

This figure shows the development of derivatives exposures (in billion US$) of German banks reporting to the Bank for International Settlements (BIS). Both over-the-counter (OTC) and exchange-traded (ET) derivatives positions are depicted.



Source: Semiannual OTC derivatives statistics and statistics on exchange traded derivatives, *Bank for International Settlements.*

3.2.4 Results from the Calculation of the Bank Levy

Table 3 shows the results from calculating the bank levy. We report total payments, average payments, and the number of contributing banks. The corresponding numbers are broken down by bank group for the full sample and the sample of MFI banks. The large commercial banks as well as the central institutions of savings banks and credit unions are the largest

contributors. Together, their contributions account for more than 79% of total revenues from the bank levy; the share increases to more than 82% for the subsample of MFI banks.

Column 1 of Table 3 shows that the total revenue of the bank levy in 2011 across all contributing banks amounted to €529 million. The average contributing bank pays about €1.3 million. The majority of German banks pay no levy at all, though. In 2011, overall proceeds from the tax were smaller than expected, accounting for only 4.85% of the banking system's profits. Of the 1,803 banks in our data set, only 81 were subject to the acceptability limit in 2011, according to our calculations. This limit constitutes the upper bound for a bank's contribution. Were we to ignore the acceptability limit, the total contribution across all banks would have been €1.9 billion, or more than four times higher. Considering the sample of MFI banks only, the revenues are similar (€504 million), with higher average contributions for each bank (€3.4 million). The reason for this is that the MFI banks are above-average in size (Table 6).

Table 3: Revenue from the Bank Levy in 2011 by Bank Group

In this table, we report the total contribution made by all banks in the sample (total levy, in million €), the average payment (average levy, in million €), and the corresponding number of contributing banks, which surpass the €300 million threshold and pay at least the minimum contribution of 5% of the computed bank levy (Columns 1–3). Columns 4–6 depict the same information for the subsample of banks reporting within the scope of the MFI interest rate statistics. All numbers refer to the contribution year 2011, so the balance sheet data come from 2010, and are reported for the full sample and by bank group.

	(1) Full sample (1,803 bank-year observations)			(2) MFI sample (165 bank-year observations)		
	Total levy (million €)	Average levy (million €)	Number of contributing banks	Total levy (million €)	Average levy (million €)	Number of contributing banks
Large commercial banks	210.5	52.6	4	210.5	52.6	4
Other commercial banks	31.5	0.4	74	17.9	1.1	17
Central institutions	206.3	17.2	12	206.3	17.2	12
Savings banks	29.3	0.1	223	19.6	0.3	67
Credit unions	10.0	0.1	72	8.6	0.3	27
Mortgage banks	41.5	1.5	28	40.6	2.1	19
Total	*529.1*	*1.3*	*413*	*503.5*	*3.4*	*146*

Because we calculate, rather than observe, the payments by each bank, the quality of our approximation method is crucial. In Table 4, we compare the results from our calculation of the bank levy with numbers from official government sources. There are some deviations in the absolute contributions for the group of commercial banks and central institutions of the savings bank sector. Yet, the *relative* contributions of each bank group to the total revenues of the bank levy are close to the official numbers. The deviations in the absolute values might arise because we lack data about the derivatives exposures for all banks.

Quantitatively, the average effect of the contribution arising from derivatives is of minor importance for the average German bank. Ignoring the bounds affecting the payments and considering only banks reporting to the BIS, we find that almost 90% of the total bank levy is attributable to contribution-relevant liabilities. Using 2008 data on the nominal derivatives exposure of non-BIS banks to approximate derivatives positions in 2010, we determine that approximately 35% of the bank levy would have been attributable to contribution-relevant liabilities and 65% to the nominal derivatives exposure. The reason is that non-BIS banks are mostly small banks that do not have contribution-relevant liabilities of more than €300 million. Their payments would be based solely on their derivatives positions. If we consider only those non-BIS banks with contribution-relevant liabilities of more than €300 million, the share of tax payments due to nominal derivatives declines to less than 4%.

Table 4: Revenues from the Bank Levy

This table compares the total contribution made by all banks in the sample (total levy, in million €) with numbers from official sources. Columns 1 and 2 refer to all banks that surpass the €300 million threshold and pay at least the minimum contribution of 5% of the computed bank levy, based on our own calculations and using balance sheet data collected by the *Deutsche Bundesbank*. Columns 3 and 4 contain the information published on p. 20 in Drucksache 17/12339 (German Bundestag, Answer by Parliamentary State Secretary Steffen Kampeter dated February 12, 2012).

	(1)	(2)	(3)	(4)
	Data set, total levy		Official data, total levy	
	(million €)	(% of total)	(million €)	(% of total)
All commercial banks	242	45.7	256	44.1
Central institutions	206	39.0	246	42.4
Savings banks	29	5.5	28	4.8
Credit unions	10	1.9	8	1.3
Mortgage banks	42	7.8	43	7.4
Total	*529*	*100*	*581*	*100*

3.2.5 How Does the Bank Levy Relate to Bank Characteristics?

The bank levy is disproportionately for banks that presumably impose negative externalities on financial stability. Larger banks and more interconnected banks tend to be systemically more important (Altunbas et al. 2011; Arinaminpathy et al. 2012; Drehmann and Tarashev 2011, 2013; Haldane 2012).

Table 5 relates the bank levy to bank sizes and other characteristics that might influence bank stability. Owing to the tax's design, we observe a positive relationship between bank size and tax payments. This is in line with the finding of Schweikhard and Wahrenburg (2013). The correlations by bank group in Table 4 reveal that the high correlation with bank size is driven by savings banks and credit unions. The correlations are lower for large commercial banks or central institutions of savings banks and credit unions, for which the levy is more likely to be

capped by the acceptability limit. Considering the share of funding through customer deposits, we find a negative relationship with tax payments. This reflects the design of the levy as customer deposits constitute a non-contribution-relevant balance sheet position and the objective of the bank levy is to tax market-based funding and, implicitly, leverage. For all other variables, the correlations are small. The patterns are similar across the full sample and the MFI sample.

Table 5: Correlations between the Bank Levy and Bank Characteristics

This table shows the correlation between various bank characteristics and the contribution to be made in 2011. The correlations are based on the contributed bank levy in 2011 (in million €) and bank characteristics as of 2010 as the tax payment results from balance sheet positions of the annual account corresponding to the year proceeding the contribution year, or 2010. Results are reported for all banks in the sample as well as for the subsample of banks reporting to the MFI interest rate statistics.

(a) Full sample (1,803 bank-year observations)

	(1) Total assets (million €)	(2) Customer deposits / total liabilities	(3) Loans / customer deposits	(4) Tier 1 capital ratio	(5) Liquidity ratio	(6) RoA	(7) NPL ratio
Large commercial banks	0.59	-0.73	0.66	0.08	-0.51	0.27	-0.27
Other commercial banks	0.69	-0.09	-0.02	-0.14	-0.13	-0.05	-0.08
Central institutions	0.54	0.04	0.07	0.48	-0.22	0.38	0.24
Savings banks	0.93	-0.22	0.17	-0.13	-0.10	-0.10	-0.08
Credit unions	0.84	-0.17	0.23	-0.06	-0.07	-0.07	-0.04
Mortgage banks	0.71	-0.56	0.13	-0.38	-0.12	-0.24	-0.09
Total	*0.79*	*-0.22*	*0.00*	*-0.04*	*-0.03*	*-0.07*	*-0.02*

(b) Reporting banks in MFI interest rate statistics (165 bank-year observations)

	(1) Total assets (million €)	(2) Customer deposits / total liabilities	(3) Loans / customer deposits	(4) Tier 1 capital ratio	(5) Liquidity ratio	(6) RoA	(7) NPL ratio
Large commercial banks	0.59	-0.73	0.66	0.08	-0.51	0.27	-0.27
Other commercial banks	0.58	-0.07	0.02	-0.25	-0.33	-0.05	-0.22
Central institutions	0.54	0.04	0.07	0.48	-0.22	0.38	0.24
Savings banks	0.93	-0.42	0.29	-0.36	-0.09	-0.48	-0.01
Credit unions	0.93	-0.49	0.20	-0.06	-0.31	-0.26	-0.04
Mortgage banks	0.74	-0.63	0.06	-0.45	0.09	-0.41	-0.01
Total	*0.78*	*-0.42*	*-0.01*	*-0.14*	*-0.05*	*-0.17*	*0.00*

3.3 Bank-Level Control Variables

We calculate the bank-level control variables on the basis of the CAMEL rating system employed by U.S. regulators to assess a bank's overall health:

- Capital adequacy (**C**) is measured through Tier 1 capital relative to risk-weighted assets (*Tier 1 capital ratio*).

- The quality of a bank's asset portfolio (**A**) is captured through write-offs relative to the size of its overall loan portfolio (*non-performing loans or NPL-ratio*). [8]
- Management quality (**M**) is proxied through the *cost-to-income ratio*.
- Earnings (**E**) and thus profitability are proxied through return on assets (*RoA*).
- Liquidity (**L**) is the sum of cash, deposits with the central bank, and overnight deposits relative to total assets (*liquidity ratio*).

In addition, we control for bank size by including the logarithm of *total assets*.

Table 6 contains summary statistics for these variables for the whole sample period. To winsorize the CAMEL variables, we replace the highest and lowest 1% of observations with the respective thresholds. For the cost-to-income ratio, only the highest 1% of all observations are replaced. Banks with missing values for total assets are excluded from the sample. Information on the subset of banks in the MFI interest rate statistics appears in the right panel of Table 6. The main difference between the two samples of banks is that the MFI banks are larger, with mean assets of €39.4 billion, compared with €4.3 billion for the full sample.

Table 6: Summary Statistics for Banking Variables

This table shows summary statistics for variables related to the bank levy used in subsequent regressions and other bank-specific variables, such as banks' total assets (billion €) and the CAMEL variables (i.e., Tier 1 capital ratio, NPL ratio, cost-to-income ratio, RoA, liquidity ratio) and market share. Descriptive statistics are based on the full sample and the subsample of banks reporting within the scope of the MFI interest rate statistics, over the period 2008–2011. The dummy variable *Bank levy (0/1)* is equal to 1 if in 2011 the bank had contribution-relevant liabilities higher than €300 million. The dummy variable *Bank levy$_{high}$ (0/1)* is equal to 1 if in 2011 the bank had contribution-relevant liabilities of more than €10 billion. *Total assets* denote bank assets in billion €. *Tier 1 capital ratio* is Tier 1 capital over risk-weighted assets. *NPL ratio* is non-performing loans over gross loan volume. *Cost-to-income ratio* relates the cost (excluding extraordinary items) to the revenues (excluding extraordinary items). *RoA* measures the earnings before tax relative to total assets. *Liquidity ratio* measures the liquidity held by a bank over total assets. *Market share* is defined as the total assets of bank *i* relative to the sum of total assets of all banks in the sample at time *t*. For more details, see the description in the Data Appendix.

	(1) Full sample (7,174 bank-year observations)		(2) MFI sample (625 bank-year observations)	
	Mean	*Std. dev.*	*Mean*	*Std. dev.*
Bank levy (0/1)	0.06	0.23	0.23	0.42
Bank levy$_{high}$ (0/1)	0.00	0.07	0.05	0.21
Total assets	4.26	48.98	39.35	161.29
Tier1 capital ratio	13.6%	0.08	12.1%	0.05
NPL ratio	4.4%	0.03	3.6%	0.03
Cost-to-income ratio	81.8%	0.09	83.7%	0.08
RoA	0.5%	0.00	0.3%	0.00
Liquidity ratio	5.9%	0.06	3.6%	0.03

[8] Before 2009, only loans to the non-financial private sector with specific provisions were considered; after 2009, loans to both the financial and non-financial private sectors were included.

4 Regression Results

Did German banks reduce the amount of (newly issued) loans to the private sector after the introduction of the bank levy? Did treated and non-treated banks adjust loan and deposit rates differently? To answer these questions, we analyze whether key activities of banks changed after the implementation of the levy in 2011, and we compare treated and non-treated banks. We employ a difference-in-difference approach to exploit the variation over two dimensions: the time before and after the introduction of the bank levy, and banks that had to pay and those that did not.

4.1 Baseline Empirical Model

Our baseline regression equation is given by:

$$y_{it} = \alpha_i + \gamma_t + \delta * ChargedBan\,k * After\ 2010 + \beta' x_{it-1} + \varepsilon_{it} \qquad (1)$$

where the dependent variable y_{it} refers to bank loans or bank interest rates. We include time-invariant bank fixed effects (α_i); γ_t captures time effects common to all banks. *Charged Bank* is an indicator variable, equal to 1 if the bank is subject to the tax (if it has contribution-relevant liabilities higher than €300 million) and 0 otherwise. *After 2010* is an indicator variable taking a value of 1 after the regulatory change (2011) and 0 otherwise (2008–2010). We define x_{it-1} as a vector of controls for time-varying bank characteristics, lagged by one period to avoid simultaneity. The coefficient of interest is δ. It reveals whether banks subject to the tax changed their behavior significantly after the regulatory change compared with banks that fall below the contribution threshold.

The difference-in-difference approach modeled in equation (1) requires two conditions to be fulfilled. First, the introduction of the bank levy should not have been anticipated by the banks. Otherwise, they could have adjusted their balance sheets *before* the introduction of the tax to pay smaller contributions or to evade the tax entirely. In this case, changes in banks' activities resulting from the imposition of the levy could not be identified. We exploit the substantial uncertainty surrounding the implementation of the tax, in terms of the banks that would be covered and the precise specification of the tax payments. In addition, the levy was applied retrospectively to banks' balance sheets (see Section 2.1).

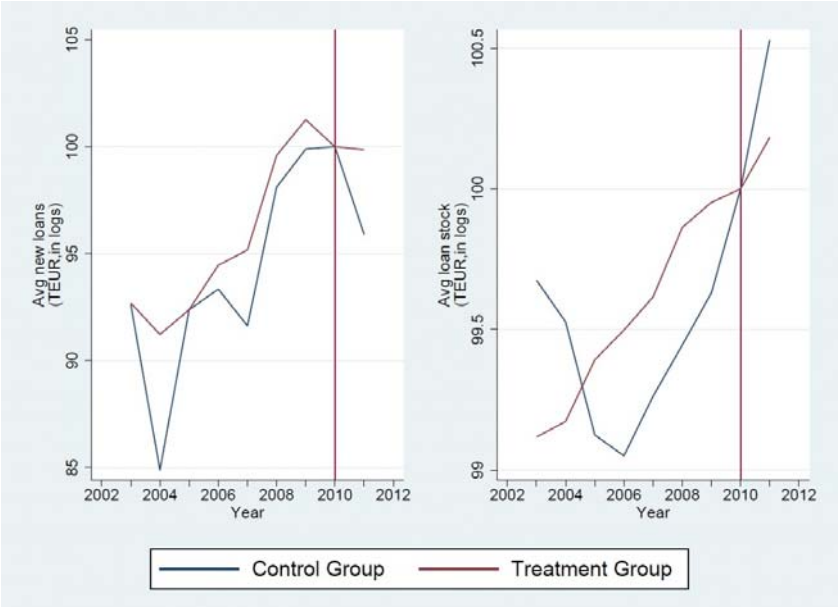
Second, we must assume that differences in the means between the control and the treatment group would have remained constant *without* this regulatory change. In the absence of the "treatment", the trend between the two groups should have remained the same. Hence, any differences in the behavior of banks in the control versus treatment group should be due solely to the tax. This common trends assumption cannot be tested; ideally, banks in the control and the treatment group show similar characteristics. A comparison of the explanatory variables for banks in the treated and control group revealed substantial homogeneity between

the two groups. The only exception is the variable total assets as banks in the control group are, on average, smaller. [9] To control for remaining differences and confounding factors across banks in the two groups, our empirical model allows for time and bank fixed effects as well as bank-specific controls. Furthermore, according to Figure 5, before the introduction of the levy, the loan volumes and interest rates of banks in both control and treatment group evolved similarly, which supports the common trend assumption.

Figure 5: Time Trends in Loan Volumes, Loan and Deposit Rates

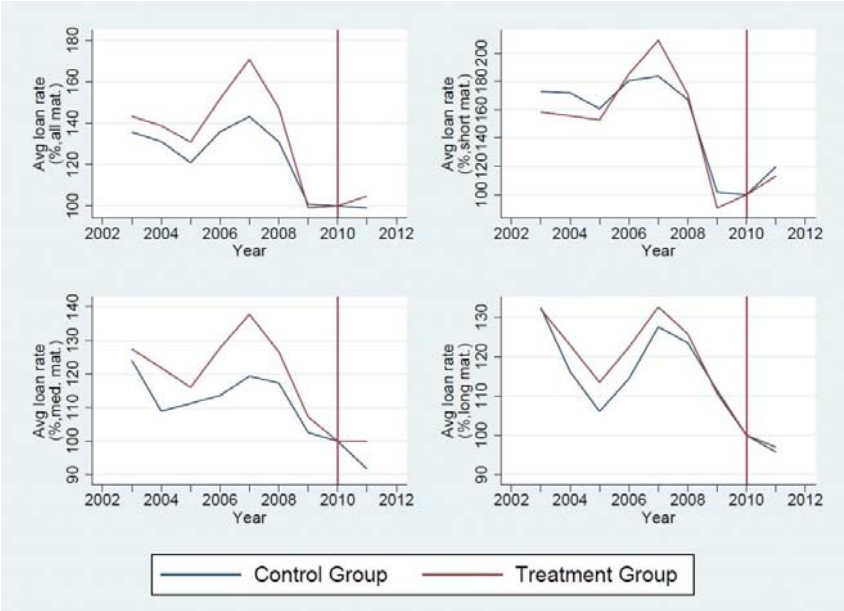
This figure compares the average pattern of (a) newly issued loans and total lending, (b) loan rates, and (c) deposit rates for the sample of banks reporting to the MFI interest rate statistics over 2003–2011. The series are normalized (2010=100). *Control group* refers to banks with contribution-relevant liabilities smaller than or equal to €300 million. *Treatment group* contains banks that must pay taxes on their contribution-relevant liability positions. Panel (a) shows the average pattern for the log of newly issued loans (in thousand €) and the log of the total loan volume (in thousand €) for the control and the treatment group. Panel (b) refers to average interest rates (%) on new loans with different maturities again for the control and the treatment group. Panel (c) corresponds to average interest rates (%) on new deposits with different maturities.

(a) Loan volumes

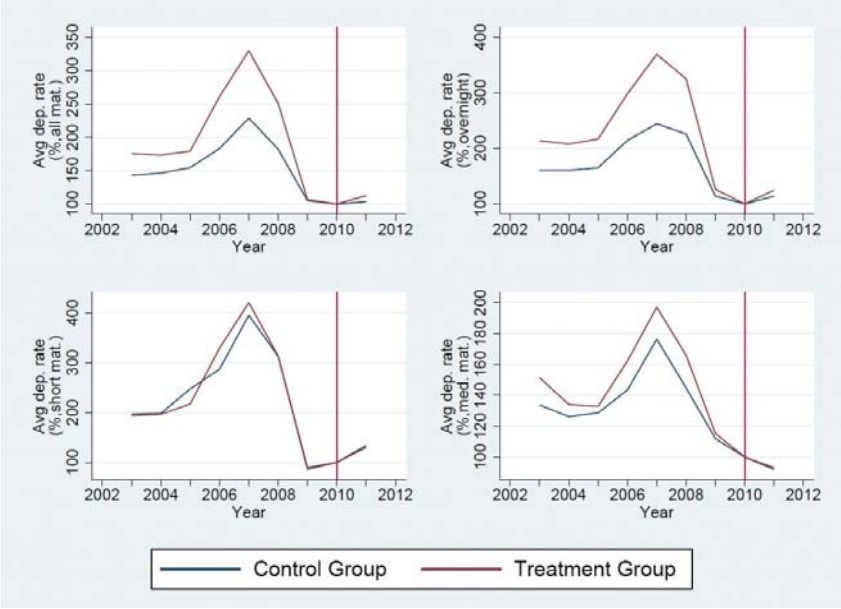


[9] These tables can be obtained from the authors on request.

(b) Loan rates



(c) Deposit rates



Source: MFI interest rate statistics and balance sheet reports, *Deutsche Bundesbank*.

Tables 7–9 show the results for estimating Equation (1) and pooling the data across all banks reporting to the MFI interest rate statistics. Wherever possible, data are broken down by sector (households, firms) and maturity.

Table 7 shows the baseline regression results for loan volumes. There is no significant effect of the levy on any of the measures reflecting changes in loans. Yet, the effect of the levy on (log) loans is negative and significant. For total loans relative to assets, the point estimate is negative as well, but insignificant. The negative effect of the levy on (log) loans is consistent with a contraction of banks' business in response to the (marginally) higher costs of

operations due to the levy. Such a downward adjustment in the levels could be expected to be reflected also in changes in new lending.

Table 7: Baseline Regression Results: Loan Volumes

This table shows the regression results of the estimation specified in Equation (1). The estimations are based on the sample of banks that report to the MFI interest rate statistics and cover 2008–2011. The dependent variable is either newly granted loans ("New Loans") or the volume of existing loans ("Loans"). "New Loans households (firms)" refers to new loans to households (to non-financial firms). The effect of the bank levy ("Bank levy (0/1)") is the coefficient on the dummy "*Charged Bank * After2010*," equal to 1 in the year 2011 if the bank had contribution-relevant liabilities higher than €300 million. Total assets are expressed in million €. The independent variables comprise the CAMEL variables, as defined in Section 3.3, included with a lag. The merger dummy is equal to 1 if a merger took place in a given year and 0 otherwise. Time and bank fixed effects are included but not reported. The standard errors are robust to heteroskedasticity. *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) New Loans (log)	(2) Loans (log)	(3) Loans / Assets	(4) Loans (YoY change)	(5) New loans households (log)	(6) New loans firms (log)
Bank levy (0,1)	0.060	-0.061**	-0.011	-0.019	0.299	0.099
	(0.173)	(0.025)	(0.010)	(0.013)	(0.225)	(0.366)
Log total assets	-0.443	-0.907	-0.469***	-0.384	0.028	0.031
	(1.541)	(0.807)	(0.177)	(0.845)	(2.748)	(2.340)
Log total assets²	0.061	0.067	0.023***	0.008	0.041	0.053
	(0.076)	(0.043)	(0.009)	(0.042)	(0.136)	(0.112)
Tier1 capital ratio	0.592	-0.492	-0.564***	-0.011	1.095	2.194
	(1.842)	(0.562)	(0.215)	(0.521)	(5.367)	(2.066)
NPL ratio	-0.437	-0.243	-0.133	-0.411*	-4.850**	-0.034
	(0.734)	(0.383)	(0.153)	(0.239)	(2.293)	(0.814)
Cost-to-income ratio	-1.136**	-0.353***	-0.009	0.100	-1.354	-0.932
	(0.492)	(0.127)	(0.084)	(0.190)	(1.144)	(0.603)
RoA	20.234	6.532**	1.805*	3.555	17.669	23.628
	(16.052)	(2.674)	(1.011)	(2.160)	(19.418)	(19.441)
Liquidity ratio	-1.214	-0.030	0.402	-0.149	-0.372	0.029
	(1.405)	(0.261)	(0.288)	(0.363)	(2.079)	(1.351)
Merger dummy	0.148	0.111**	0.028	0.136***	0.577***	0.195
	(0.101)	(0.048)	(0.018)	(0.049)	(0.201)	(0.119)
Constant	13.115	18.304***	2.957***	2.767	7.577	8.783
	(8.064)	(3.712)	(0.921)	(4.312)	(14.408)	(12.211)
Observations	464	464	464	464	402	449
R^2	0.067	0.426	0.275	0.194	0.191	0.061
Number of banks	162	162	162	162	141	159

How can we thus reconcile a negative effect of the levy on *total* loans with an insignificant impact on *new* loans? One explanation is that new loans (i.e. flows) are more volatile than total loans (i.e. stocks). Hence, even if the downward adjustment in the levels of loans has been associated with a negative flow of new loans, this effect might not be statistically significant due to a high volatility of new loans. A second explanation is that the stock of

loans would decline if loans that expire are not replaced by new loans. A downscaling of activities might thus be consistent with constant or even increasing volumes of new loans being issued.

Tables 8 and 9 show how banks adjust their pricing policies in response to the imposition of the levy. [10] With regard to loans rates, there is no significant effect (Table 8).

Table 8: Baseline Regression Results: Loan Rates

This table shows the regression results of the estimation in Equation (1). The estimations are based on the sample of banks that report to the MFI interest rate statistics and cover 2008–2011. The dependent variable is the interest rate charged on newly granted loans for different maturities and sectors: short-term: < 1 year; medium-term: ≥ 1 year & < 5 years; long-term: ≥ 5 years & < 10 years. The effect of the bank levy ("Bank levy (0/1)") is the coefficient on the dummy "*Charged Bank * After2010*," which is equal to 1 in 2011 if the bank had contribution-relevant liabilities higher than €300 million. Total assets are expressed in million €. The independent variables comprise the CAMEL variables, defined in Section 3.3, included with a lag. The merger dummy is equal to 1 if a merger took place in a given year and 0 otherwise. Time and bank fixed effects are included but not reported. The standard errors are robust to heteroskedasticity. *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) All maturities	(2) Short-term	(3) Medium-term	(4) Long-term	(5) All maturities households	(6) All maturities firms
Bank levy (0,1)	0.305	0.073	0.131	0.131	-0.123	0.313
	(0.198)	(0.263)	(0.285)	(0.187)	(0.421)	(0.202)
Log total assets	4.468	6.705*	-1.916	0.638	17.988***	4.828
	(3.756)	(4.047)	(3.677)	(2.715)	(3.112)	(3.406)
Log total assets²	-0.215	-0.270	0.073	-0.054	-0.968***	-0.193
	(0.159)	(0.164)	(0.176)	(0.140)	(0.141)	(0.133)
Tier1 capital ratio	-0.383	-4.954	0.791	-0.238	-4.582	1.303
	(3.454)	(3.133)	(4.532)	(2.519)	(6.588)	(2.346)
NPL ratio	-0.749	-0.628	-5.744	-1.577	-8.099	2.005
	(2.444)	(4.220)	(4.133)	(2.046)	(4.995)	(2.152)
Cost-to-income ratio	0.637	0.654	-0.158	-2.235	1.119	0.724
	(0.932)	(0.664)	(1.376)	(1.646)	(1.775)	(0.694)
RoA	-21.266	15.728	11.281	-34.000	-17.636	1.484
	(27.847)	(21.307)	(32.578)	(22.373)	(46.460)	(19.382)
Liquidity ratio	-3.853*	-1.534	-5.549*	-1.968	-2.543	-3.619*
	(2.270)	(3.225)	(3.086)	(2.344)	(3.085)	(2.069)
Merger dummy	0.176	0.280	0.518	-0.090	0.034	0.139
	(0.246)	(0.189)	(0.366)	(0.242)	(0.478)	(0.215)
Constant	-19.389	-35.484	16.377	5.719	-76.335***	-25.402
	(21.569)	(23.275)	(19.582)	(13.847)	(17.431)	(20.291)
Observations	457	428	438	439	385	427
R^2	0.057	0.271	0.094	0.248	0.107	0.089
Number of banks	160	150	155	156	137	154

[10] Due to the level-log specification the coefficient on log(Total Assets) has to be divided by 100 to obtain the effect on the level of loan rates (Table 8) and deposit rates (Table 9).

In none of the specifications do we find a significant effect of the levy. The picture for deposit rates looks different. Here, we find a positive and significant effect on deposits of firms. Banks being affected more by the levy increase rates on newly received firm deposits as compared to the control group. If, in contrast, banks would aim at increasing their interest rates spreads, they would have to lower rather than increase deposit rates. According to our results though, banks aim at shifting their funding sources away from those funds affected by the levy towards funding sources not affected such as deposits.

Table 9: Baseline Regression Results: Deposit Rates

This table shows the regression results of the estimation specified in Equation (1). The estimations are based on the sample of banks that report to the MFI interest rate statistics and cover 2008–2011. The dependent variable is the interest rate paid for newly received deposits for different maturities and sectors: overnight, short-term: < 1 year; medium-term: ≥ 1 year. The effect of the bank levy ("Bank levy (0/1)") is the coefficient on the dummy "*Charged Bank * After2010*," which is equal to 1 in 2011 if the bank had contribution-relevant liabilities higher than €300 million. Total assets are expressed in million €. The independent variables comprise the CAMEL variables, as defined in Section 3.3, included with a lag. The merger dummy is equal to 1 if a merger took place in a given year and 0 otherwise. Time and bank fixed effects are included but not reported. The standard errors are robust to heteroskedasticity. *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) All maturities	(2) Overnight	(3) Short-term	(4) Medium-term	(5) All maturities households	(6) All maturities firms
Bank levy (0,1)	0.153	0.023	-0.039	0.012	0.093	0.533**
	(0.115)	(0.043)	(0.155)	(0.127)	(0.161)	(0.265)
Log total assets	-5.255***	-0.460	-2.004	-1.347	-3.063	-2.443
	(1.720)	(0.723)	(1.359)	(2.106)	(2.059)	(1.976)
Log total assets²	0.196***	0.028	0.064	0.068	0.101	0.074
	(0.074)	(0.033)	(0.057)	(0.106)	(0.092)	(0.084)
Tier1 capital ratio	0.145	1.062	-1.121	1.208	-0.239	-1.232
	(1.663)	(1.315)	(1.724)	(2.397)	(1.914)	(1.850)
NPL ratio	2.587*	7.574	0.144	0.386	2.067	-0.722
	(1.438)	(4.819)	(1.130)	(1.697)	(1.646)	(1.335)
Cost-to-income ratio	-1.107**	-0.467	-0.171	-0.871	-0.924	-0.187
	(0.540)	(0.329)	(0.409)	(0.762)	(0.616)	(0.602)
RoA	-15.050	12.767*	-19.555	-22.491	-12.678	-8.864
	(15.702)	(6.649)	(11.843)	(22.014)	(19.201)	(12.170)
Liquidity ratio	0.616	-0.972	1.406	0.076	1.520	2.247
	(1.619)	(0.683)	(2.258)	(1.684)	(1.788)	(1.826)
Merger dummy	-0.128	-0.114	-0.010	-0.138	-0.248*	-0.146
	(0.141)	(0.153)	(0.099)	(0.166)	(0.142)	(0.156)
Constant	33.360***	2.457	14.115*	9.550	21.516*	17.285
	(9.798)	(4.438)	(7.850)	(10.633)	(11.355)	(11.300)
Observations	444	443	414	418	434	404
R^2	0.126	0.380	0.405	0.185	0.059	0.250
Number of banks	156	152	143	153	152	148

With regard to the impact of the control variables, most CAMEL variables are insignificant, suggesting that differences across banks are absorbed largely by the bank fixed effects. If anything, more profitable banks lend more. The higher the share of non-performing loans in the portfolio and the less efficiently a bank is managed, which implies a higher cost-to-income ratio, the lower are loans. Regarding interest rates, larger banks charge higher loan rates and pay lower deposit rates. The effect is non-linear, and it reverses for larger banks.

In sum, the levy has negative effects on total loan supply and we find some evidence for an increase in deposit rates offered to firms. However, banks do not adjust their rates charged for new loans.

4.2 Impact of the Size of the Bank Levy

Results presented so far are based on data for all German banks reporting to the MFI statistics. Given that many banks are exempt from paying the bank levy and that these banks are more than proportionally reflected in the sample, we might underestimate the effect of the levy. Therefore, we now focus our analysis on the banks that are affected more by the levy. We ask whether, within the group of banks that pay the levy, those that are charged more behave differently from those that are charged less. We test whether differences in the responses of banks to the levy are linked to the absolute size of the payment. We compare differences in the adjustment across banks that meet different thresholds for contribution-relevant positions. We focus only on banks with contribution-relevant liabilities *higher* than €300 million. Otherwise, the identification is identical. The regression equation is now given by:

$$y_{it} = \alpha_i + \gamma_t + \delta * ChargedBank_{high} * After\ 2010 + \beta' x_{it-1} + \varepsilon_{it} \qquad (2)$$

Here though, our interest is in the coefficient δ of the interaction term *Charged Bank* $_{high}$ * *After 2010*, where *Charged Bank* $_{high}$ is an indicator variable that takes a value of 1 if the bank meets the contribution threshold above €10 billion or 0 if the bank's contribution-relevant liabilities are higher than €300 million but smaller than or equal to €10 billion. Alternatively, we could control directly for the size of the tax payment. However, as we lack full information on the relevant positions to be taxed, doing so might cause a measurement bias.

In Tables 10–12, we present the results of estimating Equation (2). The sample now includes only those banks with contribution-relevant liabilities greater than €300 million, based on December 2010 balance sheet data. Within this sample, we analyze whether the effect of the bank levy changes with the size of contribution-relevant liabilities. Finding a significant coefficient for the term *Charged Bank* $_{high}$ * *After 2010*, for example, would suggest that banks subject to higher tax rates react differently than banks with smaller contribution-relevant liabilities.

The effects of the levy on loan volumes are shown in Table 10.

Table 10: Regression Results: Size Effect of Bank Levy on Loan Volumes

This table shows the regression results of the estimation specified in Equation (2). The estimations are based on the sample of banks that report to the MFI interest rate statistics and cover 2008–2011. The sample is restricted to MFI banks that had more than €300 million of contribution-relevant liabilities. The dependent variable is either newly granted loans ("New Loans") or the volume of existing loans ("Loans"). "New Loans households (firms)" refers to new loans to households (to non-financial firms). The effect of the bank levy ("Bank levy$_{high}$ (0/1)") is the coefficient on the dummy "*Charged Bank $_{high}$ * After2010*," which is equal to 1 in 2011 if the bank had contribution-relevant liabilities higher than €10 billion and 0 if the bank's contribution-relevant liabilities were greater than €300 million but less than or equal to €10 billion. Total assets are expressed in million €. The independent variables comprise the CAMEL variables, as defined in Section 3.3, included with a lag. The merger dummy is equal to 1 if a merger took place in a given year and 0 otherwise. Time and bank fixed effects are included but not reported. The standard errors are robust to heteroskedasticity. *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) New Loans (log)	(2) Loans (log)	(3) Loans / Assets	(4) Loans (YoY change)	(5) New loans households (log)	(6) New loans firms (log)
Bank levy$_{high}$ (0,1)	0.042	-0.063***	-0.004	-0.013	-0.057	0.099
	(0.127)	(0.024)	(0.010)	(0.030)	(0.241)	(0.137)
Log total assets	0.139	-0.519	-0.323	-0.643	0.263	-0.061
	(1.806)	(0.821)	(0.210)	(0.981)	(2.924)	(2.167)
Log total assets²	0.034	0.048	0.016	0.019	0.033	0.053
	(0.086)	(0.042)	(0.010)	(0.048)	(0.143)	(0.107)
Tier 1 capital ratio	0.245	-1.032**	-0.757***	0.193	1.657	1.447
	(2.396)	(0.470)	(0.245)	(0.661)	(6.863)	(2.444)
NPL ratio	-0.458	-0.087	-0.115	-0.420*	-5.082**	0.083
	(0.711)	(0.339)	(0.168)	(0.239)	(2.339)	(0.789)
Cost-to-income ratio	-1.006*	-0.322**	-0.003	0.120	-1.488	-1.164*
	(0.590)	(0.129)	(0.078)	(0.219)	(1.289)	(0.628)
RoA	11.575	6.923**	1.495	4.098*	17.881	8.228
	(15.696)	(2.714)	(1.029)	(2.392)	(20.391)	(17.572)
Liquidity ratio	-1.514	0.010	0.499	-0.225	-1.259	0.223
	(1.515)	(0.270)	(0.304)	(0.396)	(2.392)	(1.304)
Merger dummy	0.157	0.099**	0.028	0.129***	0.592***	0.187
	(0.106)	(0.042)	(0.018)	(0.049)	(0.210)	(0.119)
Constant	10.157	16.534***	2.242**	4.198	6.499	10.105
	(9.638)	(3.965)	(1.129)	(5.018)	(15.199)	(11.123)
Observations	417	417	417	417	359	405
R^2	0.068	0.463	0.305	0.203	0.186	0.076
Number of banks	145	145	145	145	126	142

We find a negative and significant impact of the levy on total loan supply: Banks with contribution-relevant liabilities of *more* than €10 billion provide relatively fewer loans than banks with liabilities below this threshold. The coefficient estimate for log loans (-0.063)

indicates that loans increased, on average, by 6.1% less for banks subject to higher tax rates than for banks with low contribution-relevant liabilities. [11]

The effects of the volume of the actually paid levy on interest rates are shown in Tables 11 and 12. With regard to loan pricing, there is again no significant effect.

Table 11: Regression Results: Size Effect of Bank Levy on Loan Rates

This table shows the regression results of the estimation specified in Equation (2). The estimations are based on the sample of banks that report to the MFI interest rate statistics and cover 2008–2011. The sample is restricted to MFI banks that had more than €300 million of contribution-relevant liabilities. The dependent variable is the interest rate charged on newly granted loans for different maturities and sectors: short-term: < 1 year; medium-term: ≥ 1 year & < 5 years; long-term: ≥ 5 years & < 10 years. The effect of the bank levy ("Bank $levy_{high}$ (0/1)") is the coefficient on the dummy *"Charged Bank $_{high}$ * After2010*," which is equal to 1 in 2011 if the bank had contribution-relevant liabilities higher than €10 billion and 0 if its contribution-relevant liabilities were greater than €300 million but less than or equal to €10 billion. Total assets are expressed in million €. The independent variables comprise the CAMEL variables, as defined in Section 3.3, included with a lag. The merger dummy is equal to 1 if a merger took place in a given year and 0 otherwise. Time and bank fixed effects are included but not reported. The standard errors are robust to heteroskedasticity. *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) All maturities	(2) Short-term	(3) Medium-term	(4) Long-term	(5) All maturities, households	(6) All maturities, firms
Bank $levy_{high}$ (0,1)	0.030	-0.067	0.092	-0.159	-0.031	0.087
	(0.145)	(0.138)	(0.235)	(0.208)	(0.362)	(0.121)
Log total assets	4.458	8.601*	-5.757	-0.679	15.799***	5.475
	(4.718)	(4.357)	(4.288)	(3.215)	(3.312)	(4.018)
Log total assets²	-0.219	-0.346*	0.234	-0.006	-0.874***	-0.219
	(0.200)	(0.180)	(0.193)	(0.163)	(0.147)	(0.159)
Tier 1 capital ratio	-2.433	-5.626*	2.385	-0.799	-3.979	0.150
	(4.052)	(3.277)	(5.239)	(3.086)	(6.828)	(2.580)
NPL ratio	-0.887	-0.160	-7.041*	-1.403	-8.761*	1.828
	(2.582)	(4.246)	(3.930)	(2.092)	(4.999)	(2.287)
Cost-to-income ratio	0.764	0.877	0.217	-1.812	1.826	0.643
	(1.066)	(0.753)	(1.359)	(1.707)	(1.987)	(0.810)
RoA	-22.708	14.687	15.873	-25.893	-19.103	-0.298
	(29.625)	(22.982)	(34.050)	(23.992)	(49.293)	(20.149)
Liquidity ratio	-3.582	-2.664	-6.694**	-1.415	-2.714	-3.616*
	(2.456)	(3.254)	(3.381)	(2.598)	(3.209)	(2.024)
Merger dummy	0.176	0.319	0.467	-0.140	0.015	0.180
	(0.259)	(0.211)	(0.369)	(0.242)	(0.516)	(0.221)
Constant	-18.983	-46.792*	37.424	13.317	-65.167***	-29.143
	(26.987)	(25.048)	(23.643)	(16.340)	(19.141)	(23.711)
Observations	412	392	396	396	346	392
R^2	0.060	0.286	0.116	0.244	0.118	0.102
Number of banks	143	136	139	141	122	138

[11] Following Halvorsen and Palmquist (1980), the percentage effect is (exp(δ)-1)*100.

For deposit rates, we confirm that the effect on the structure of funding dominates. Banks being affected more by the levy increase rates on newly received deposits compared to the control group. This holds in particular for deposits obtained from households.

Table 12: Regression Results: Size Effect of Bank Levy on Deposit Rates

This table shows the regression results of the estimation specified in Equation (2). The estimations are based on the sample of banks that report to the MFI interest rate statistics and cover 2008–2011. The sample is restricted to MFI banks that had more than €300 million of contribution-relevant liabilities. The dependent variable is the interest rate paid for newly received deposits for different maturities and sectors: overnight, short-term: < 1 year; medium-term: ≥ 1 year. The effect of the bank levy ("Bank $levy_{high}$ (0/1)") is the coefficient on the dummy *"Charged Bank $_{high}$ * After2010*," which is equal to 1 in 2011 if the bank had contribution-relevant liabilities higher than €10 billion and 0 if its contribution-relevant liabilities were greater than €300 million but less than or equal to €10 billion. Total assets are expressed in million €. The independent variables comprise the CAMEL variables, as defined in Section 3.3, included with a lag. The merger dummy is equal to 1 if a merger took place in a given year and 0 otherwise. Time and bank fixed effects are included but not reported. The standard errors are robust to heteroskedasticity. *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) All maturities	(2) Overnight	(3) Short-term	(4) Medium-term	(5) All maturities, households	(6) All maturities, firms
Bank $levy_{high}$ (0,1)	0.193*	-0.071	-0.029	-0.425	0.251**	0.108
	(0.102)	(0.067)	(0.089)	(0.289)	(0.117)	(0.104)
Log total assets	-5.424***	-0.185	-3.524**	-3.546	-4.215**	-3.847**
	(1.947)	(0.918)	(1.450)	(2.332)	(1.970)	(1.926)
Log total assets²	0.202**	0.014	0.127**	0.160	0.149*	0.138*
	(0.081)	(0.037)	(0.060)	(0.114)	(0.085)	(0.078)
Tier 1 capital ratio	-1.141	0.625	-0.986	2.264	-2.188	-0.371
	(2.099)	(1.608)	(2.038)	(3.074)	(2.497)	(1.544)
NPL ratio	2.022	8.046	0.019	1.060	1.817	-1.833
	(1.543)	(4.991)	(1.205)	(1.789)	(1.741)	(1.399)
Cost-to-income ratio	-1.243**	-0.499	-0.223	-0.416	-1.296*	-0.206
	(0.561)	(0.361)	(0.411)	(0.909)	(0.709)	(0.503)
RoA	-15.503	12.075*	-17.769	-6.178	-13.524	-8.710
	(16.380)	(7.163)	(12.410)	(24.098)	(20.074)	(11.965)
Liquidity ratio	0.473	-1.099	1.975	-1.325	1.717	1.538
	(1.690)	(0.768)	(2.422)	(1.648)	(1.898)	(1.825)
Merger dummy	-0.105	-0.134	-0.030	-0.221	-0.255*	-0.114
	(0.142)	(0.163)	(0.095)	(0.171)	(0.132)	(0.160)
Constant	34.860***	1.112	23.106***	20.929*	28.637**	24.731**
	(11.232)	(5.757)	(8.393)	(11.988)	(11.313)	(11.285)
Observations	397	400	377	371	387	374
R^2	0.142	0.398	0.421	0.195	0.086	0.301
Number of banks	139	137	130	136	135	135

4.3 Robustness Tests

We check the robustness of our results to changes in the methodology and sample composition. A brief summary of the results can be found in Table 13 if the dependent variable refers to loans and Table 14 if the dependent variable is based on deposit rates.

For brevity, we do not report robustness tests for loan rates because they throughout confirm the insignificant result obtained above. All robustness tests start from the model specified in Equation (1) if not stated otherwise and panel a) repeats the results of the baseline model.

Sample period: In Panel (b), we reduce the sample period to include only the year before (2010) and after (2011) the introduction of the tax payment. In this specification, we do not include the control variables or fixed effects. Instead, we now introduce a dummy for whether a bank is treated or not and a dummy which equals 1 after the introduction of the tax and 0 otherwise. The results confirm a negative effect of the bank levy on banks' total loan supply (Column 2).

Region-year fixed effects: In our baseline model, we included year fixed effects capturing general macroeconomic conditions. To account for the fact that banks are exposed to different regional macroeconomic factors, we exploit that we know the region (*Bundesland*) in which a bank is located. Thus, in Panel (c), we take the baseline model and add region-year fixed effects. Controlling for time-varying effects specific to the region in which the bank is located, we again find a significant and negative effect of the bank levy on lending. Also, the significantly positive effect on deposit rates to non-financial firms remains robust.

Bank types: The response of banks' behavior might differ depending on the group of bank they belong to. Thus, in panel d), we include only commercial banks and, in panel e), we restrict the analysis to savings banks and credit unions including their central institutions. This has, in addition, the advantage that control and treated group become more homogeneous. The disadvantage is that the sample size decreases. For both types of banks, we can confirm our results, while the qualitative effect seems to be stronger for commercial banks.

Longer sample period: These results differ compared to a previous version of the paper in which the analysis was based on a longer sample period (2003-2011). We did not find significant results for the baseline model (Equation 1) as well as the results for deposit rates differed when including only banks above the €300 million threshold (Equation 2). This might be due to the more heterogeneous time window including both a crisis and non-crisis period. However, we also found a negative and significant effect on the total loan volume based on the model specified in Equation (2).

Table 13: Robustness: Loan Volumes

This table shows the robustness tests for the estimation specified in Equation (1). In a), we show results of the baseline model. In b), we run regressions for 2010-2011 excluding the bank-level controls but including a dummy indicating whether a bank is treated and a time dummy which is equal to 1 in 2011. In c), we include region-year fixed effects. In d) and e), we redo the regression focusing only on commercial or savings banks and credit unions. All specifications include bank-level controls except specification b).The estimations are based on the sample of banks that report to the MFI interest rate statistics and cover 2008–2011. The dependent variable is either newly granted loans ("New Loans") or the volume of existing loans ("Loans"). "New Loans households (firms)" refers to new loans to households (to non-financial firms). The effect of the bank levy ("Bank levy (0/1)") is the coefficient on the dummy "*Charged Bank * After2010*," equal to 1 in the year 2011 if the bank had contribution-relevant liabilities higher than €300 million. Total assets are expressed in million €. The independent variables comprise the CAMEL variables, as defined in Section 3.3, included with a lag. The merger dummy is equal to 1 if a merger took place in a given year and 0 otherwise. Time and bank fixed effects are included but not reported. The standard errors are robust to heteroskedasticity. *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) New loans (log)	(2) Loans (log)	(3) Loans / Assets	(4) Loans (YoY change)	(5) New loans households (log)	(6) New loans firms (log)
a) Baseline model						
Bank levy (0,1)	0.060	-0.061**	-0.011	-0.019	0.299	0.099
	(0.173)	(0.025)	(0.010)	(0.013)	(0.225)	(0.366)
Observations	464	464	464	464	402	449
R^2	0.067	0.426	0.275	0.194	0.191	0.061
Number of banks	162	162	162	162	141	159
b) 2010-2011 excl. controls						
Bank levy (0,1)	0.142	-0.045***	-0.009	-0.001	0.274	0.243
	(0.202)	(0.014)	(0.006)	(0.015)	(0.207)	(0.373)
Observations	330	330	330	330	276	320
R^2	0.138	0.168	0.035	0.026	0.053	0.182
Number of banks	165	165	165	165	142	161
c) Region-year fixed effects						
Bank levy (0,1)	0.112	-0.051**	-0.013	-0.036**	0.452*	0.117
	(0.198)	(0.023)	(0.010)	(0.016)	(0.249)	(0.355)
Observations	464	464	464	464	402	449
R^2	0.166	0.505	0.333	0.253	0.255	0.190
Number of banks	162	162	162	162	141	159
d) By bank group: Commercial banks						
Bank levy (0,1)	-0.547	-0.538***	-0.190**	0.203	1.136	-1.576**
	(0.730)	(0.156)	(0.075)	(0.231)	(2.144)	(0.686)
Observations	60	60	60	60	51	57
R^2	0.386	0.434	0.632	0.356	0.458	0.441
Number of banks	21	21	21	21	19	20
e) By bank group: Savings banks & credit unions						
Bank levy (0,1)	-0.139	-0.043***	-0.008	-0.021*	0.286	-0.073
	(0.116)	(0.016)	(0.007)	(0.012)	(0.229)	(0.390)
Observations	360	360	360	360	341	348
R^2	0.051	0.616	0.360	0.214	0.170	0.027
Number of banks	120	120	120	120	116	118

Table 14: Robustness: Deposit Rates

This table shows the robustness tests for the estimation specified in Equation (1). In a), we show results of the baseline model. In b), we run regressions for 2010-2011 excluding the bank-level controls but including a dummy indicating whether a bank is treated and a time dummy which is equal to 1 in 2011. In c), we include region-year fixed effects. In d) and e), we redo the regression focusing only on commercial or savings banks and credit unions. All specifications include bank-level controls except specification b).The estimations are based on the sample of banks that report to the MFI interest rate statistics and cover 2008–2011. The dependent variable is the interest rate paid for newly received deposits for different maturities and sectors: overnight, short-term: < 1 year; medium-term: ≥ 1 year. The effect of the bank levy ("Bank levy (0/1)") is the coefficient on the dummy "*Charged Bank * After2010*," which is equal to 1 in 2011 if the bank had contribution-relevant liabilities higher than €300 million. Total assets are expressed in million €. The independent variables comprise the CAMEL variables, as defined in Section 3.3, included with a lag. The merger dummy is equal to 1 if a merger took place in a given year and 0 otherwise. Time and bank fixed effects are included but not reported. The standard errors are robust to heteroskedasticity. *, **, *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) All maturities	(2) Overnight	(3) Short-term	(4) Medium-term	(5) All maturities, households	(6) All maturities, firms
a) Baseline model						
Bank levy (0,1)	0.153	0.023	-0.039	0.012	0.093	0.533**
	(0.115)	(0.043)	(0.155)	(0.127)	(0.161)	(0.265)
Observations	444	443	414	418	434	404
R^2	0.126	0.380	0.405	0.185	0.059	0.250
Number of banks	156	152	143	153	152	148
b) 2010-2011 excl. controls						
Bank levy (0,1)	0.102	0.013	-0.054	0.028	0.138	0.078
	(0.107)	(0.031)	(0.171)	(0.132)	(0.121)	(0.136)
Observations	315	309	285	296	308	286
R^2	0.056	0.090	0.099	0.014	0.041	0.078
Number of banks	159	155	145	154	155	149
c) Region-year fixed effects						
Bank levy (0,1)	0.085	0.030	-0.121	0.103	0.035	0.517*
	(0.100)	(0.050)	(0.153)	(0.132)	(0.169)	(0.277)
Observations	444	443	414	418	434	404
R^2	0.301	0.424	0.600	0.380	0.297	0.306
Number of banks	156	152	143	153	152	148
d) By bank group: Commercial banks						
Bank levy (0,1)	0.419	-0.891	0.622	0.752	0.394	1.642**
	(0.603)	(0.682)	(0.606)	(0.650)	(0.606)	(0.569)
Observations	55	60	55	53	55	49
R^2	0.323	0.589	0.396	0.211	0.416	0.267
Number of banks	20	21	20	19	20	18
e) By bank group: Savings banks & credit unions						
Bank levy (0,1)	0.154	-0.006	0.002	-0.003	0.114	0.521*
	(0.150)	(0.033)	(0.158)	(0.155)	(0.209)	(0.297)
Observations	356	357	349	337	354	325
R^2	0.102	0.459	0.427	0.221	0.062	0.307
Number of banks	119	119	118	119	119	114

5 Conclusion

This paper assesses effects of the German bank levy on bank lending and interest rates. The levy has been introduced in 2011. It aims at internalizing the systemic risk of banks and financing a bank restructuring fund. Larger banks with more risky positions have to pay higher levies. The paper proceeds in three steps.

First, we have explored the distribution of the tax burden on different types of banks. To do so, we have constructed levies paid by individual German banks on the basis of bank-level information provided by the *Deutsche Bundesbank*. The results show that the majority of German banks (77%) were exempt from paying the tax. The reason is that banks with contribution-relevant liabilities of less than €300 million are exempt from paying the tax. This applies to most of the small savings banks, credit unions, and commercial banks. The bulk of the tax payments comes from large commercial banks and central institutions of savings banks and credit unions. Due to the progressivity of the tax rate, larger banks have to pay more, but tax payments are capped at 20% of annual earnings. This aspect of regulation in connection with low earnings in the aftermath of the crisis might explain that the overall proceeds from the tax have been small, accounting for only 4.85% of the banking system's profits before taxes in 2011.

Second, we have analyzed the effects of the bank levy on bank behavior. We have focused on a subsample of banks for which we have information on total loans and on new loans as well as interest rates on new loans and on new deposits. In terms of the effects of the levy, results are mixed. We do not find evidence for changes in the provision of new loans. However, banks affected by the levy respond by increasing their total supply of loans less than non-affected banks and by increasing interest rates on new deposit more than banks which do not have to pay the levy. A similar result emerges if we compare banks with a high tax base to those with a low tax base. These results suggest that banks react to increased funding costs by the levy in two ways. First, they decrease their total stock of loans whereas the provision of new loans remains unaffected. Second, banks try to attract deposits which are not subject to the tax by increasing deposit rates.

Finally, the design of the levy implies that banks' costs of wholesale funding increase. Thus, banks might have incentives to adapt their business model towards more equity and retail funding. First evidence suggests that banks did not change their business model in any significant way. However, these structural changes might rather take place in the longer run. This provides interesting avenues for future research.

References

Albertazzi, U., and L. Gambacorta (2010). Bank Profitability and Taxation. *Journal of Banking & Finance* 34(11): 2801-2810.

Altunbas, Y., S. Manganelli, and D. Marques-Ibanez (2011). Bank Risk During the Financial Crisis: Do Business Models Matter? ECB Working Paper Series 1394, European Central Bank.

Arinaminpathy, N., S. Kapadia, and R. May (2012). Size and Complexity in Model Financial Systems. *PNAS* 109 (45): 18338-18343.

Chiorazzo, V., and C. Milani (2011). The Impact of Taxation on Bank Profits: Evidence from EU Banks. *Journal of Banking & Finance* 35: 3202–3212.

Demirgüç-Kunt, A., and H. Huizinga (1999). Determinants of Commercial Bank Interest Margins and Profitability: Some International Evidence. *World Bank Economic Review* 13(2): 379–408.

Demirgüç-Kunt, A., and H. Huizinga (2001). The Taxation of Domestic and Foreign Banking. *Journal of Public Economics* 79: 429–453.

De Nicolò, G., A. Gamba, and M. Lucchetta (2012). Capital Regulation, Liquidity Requirements and Taxation in a Dynamic Model of Banking. Discussion Papers 10/2012, Deutsche Bundesbank, Research Centre.

Deutsche Bundesbank (2004). The new MFI interest rate statistics—methodology for collecting the German data. Deutsche Bundesbank *Monthly Report* (January 2004). Frankfurt a. M.

Deutsche Bundesbank (2011). Extended MFI interest rate statistics: methodology and first results. Deutsche Bundesbank *Monthly Report* (June 2011). Frankfurt a. M.

Drehmann, M., and N. Tarashev (2011). Systemic Importance: Some Simple Indicators. BIS Quarterly Review, Bank for International Settlements, March.

Drehmann, M., and N. Tarashev (2013). Measuring the Systemic Importance of Interconnected Banks. *Journal of Financial Intermediation* 22(4): 586-607.

Gottlieb, G., A. Avanova, and G. Impavido (2012). Taxing Finance. *Finance and Development* 49(3): 44-47.

Haldane, A. (2012). On Being the Right Size. Speech given at the Institute of Economic Affairs' 22nd Annual Series, The 2012 Beesley Lectures at the Institute of Directors, Pall Mall, October 2012.

Halvorsen, R., and R. Palmquist (1980). The Interpretation of Dummy Variables in Semilogarithmic Equations. *The American Economic Review* 70(3): 474-475.

International Monetary Fund (IMF) (2010). Financial Sector Taxation: The IMF's Report to the G20 and Background Material. Washington DC: IMF.

Laeven, L., and F. Valencia (2012). Systemic Banking Crises Database: An Update. IMF Working Paper 12/163. Washington DC.

Perotti, E., and J. Suarez (2009). Liquidity Insurance for Systemic Crises. CEPR Policy Insight No. 31, February.

Perotti, E., and J. Suarez (2011). A Pigovian Approach to Liquidity Regulation. *International Journal of Central Banking* 7(4): 3-41.

Reinhart, C.M., and K.S. Rogoff (2011). From Financial Crash to Debt Crisis. *American Economic Review* 101: 1676-1706.

Reinhart, C.M., and K.S. Rogoff (2013). Banking Crises: An Equal Opportunity Menace. Journal of Banking & Finance 37(11): 4557-4573.

Schweikhard, F.H., and M. Wahrenburg (2013). The Internalization of Systemic Risk: An Analysis of Bank Levy Schemes. Presented at the EFA 2013 Meetings, Gothenburg.

Shin, H.S. (2010). Non-Core Liabilities Tax as a Tool for Prudential Regulation. Policy Memo: http://www.princeton.edu/~hsshin/www/NonCoreLiabilitiesTax.pdf.

Data Appendix

The empirical results in this paper are based on bank-level data obtained from the *Deutsche Bundesbank*. The data are confidential and can be used on the premises of the *Deutsche Bundesbank* only. We resort to information on banks' regulatory capital, bank lending, banks' balance sheets, and banks' profit and loss accounts. Variables and definitions are listed below.

Banking groups

MFI banks: Group of banks required to report in the context of the MFI interest rate statistics.

Central institutions: Central institutions of savings banks and credit unions.

Mortgage banks: Mortgage banks and building societies.

Information used to calculate the bank levy

Banks affected by the levy: The levy applies to all credit institutions with a banking license, as specified in the German Banking Act (*Kreditwesengesetz*). Bridge banks, defined as banks established by the FMSA to resolve banks in distress, and development banks (*Förderbanken*) such as the Reconstruction Loan Corporation (KfW) are excluded from the levy. Because the levy is computed on the basis of non-consolidated, single-entity accounts, domestic and foreign branches of German banks are subject to it. The levy also applies to any subsidiary of foreign banks located in Germany with a German banking license. Foreign subsidiaries of German banks are excluded from the regulation, unless they fall under the classification of the KWG and hold a German banking license. Branches of non-German banks are exempted from the regulation if they belong to credit institutions in the European Economic Area (KWG, section 53b). In contrast, branches and subsidiaries of non-German, non-EU banks pursuant to the KWG section 53c are charged. To avoid double taxation of foreign branches of German banks abroad, Germany signed bilateral agreements with individual countries (e.g., the United Kingdom). Bank levy payments made in Germany thus are deductible from similar payments made abroad.

Contribution-relevant liabilities: First tax base of the bank levy; net liabilities of a bank computed according to RStruktFV, to which the respective tax rates are applied to obtain the first component of the bank levy.

Derivatives: Second tax base of the bank levy; amount of derivatives held by a bank; for the calculation of the bank levy, the amount of OTC derivatives held by a bank and reported to the BIS is used as a proxy.

Dependent variables

Newly issued loans: New loans granted to households and/ or non-financial firms.

Loan stock: Loans to the private sector (households and firms) excluding interbank loans.

Loan rates: Volume-weighted interest rates charged on newly issued loans to the private sector (households and/ or non-financial firms).

Deposit rates: Volume-weighted interest rates paid for newly received deposits from the private sector (households and/ or non-financial firms).

Bank-level explanatory variables

Total assets: Sum of on-balance sheet items, in million € unless indicated otherwise.

Tier 1 capital ratio: Tier 1 capital over risk-weighted assets.

Non-performing loans (NPL) ratio: Non-performing loans over gross loan volume, where gross loan volume before 2009 is given by the gross loan volume, and after 2009, it is the sum of the net loan volume plus specific loan loss provisions plus general loan loss provisions plus untaxed general loan loss provisions plus direct write-offs. Non-performing loans before 2009 is the gross loan volume with specific loan loss provisions (excluding loans to financial institutions); after 2009, it is the sum of loans with latent risks.

Cost-to-income ratio: Degree by which operating expenses are covered by operating income, where costs are operating expenses, and income is operating income.

Return on assets (RoA): After-tax profit including extraordinary items plus taxes paid relative to total assets.

Liquidity ratio: Liquid assets over total assets held, where liquidity is cash plus central bank balances plus claims with banks repayable on demand plus securities eligible as collateral at central banks.

Merger dummy: Dummy variable is equal to 1 if a merger took place in a given year during the sample period and 0 otherwise.