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## Banks' equity stakes and lending: evidence from a tax reform

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# Non-technical summary

## Research Question

As part of the "Deutschland AG" (*Germany Inc.*), a system of minority stakes and cross-holdings, many German banks held equity stakes in German industrial companies. This paper studies how a bank's equity stake in a borrowing firm affects lending to that firm. In the academic literature, it has often been argued that equity stakes may be beneficial for lending because the control rights of the equity stake provide the lender with an advantage in monitoring the borrower and the cash flow rights align the incentives of debt and equity holders. However, prior cross-sectional studies are potentially biased because banks may be more likely to buy equity stakes in firms with which they have a close lending relationship (reverse causality).

## Contribution

In 2000, the German government decided to abolish the capital gains tax on the divestitures of equity stakes. Following this tax reform, the banks sold most of their equity stakes. We study how these divestitures affected lending to these firms. This approach allows us to study the causal effect of equity stakes on lending.

## Results and Policy Recommendations

We find that banks sell most of their equity stakes in industrial firms after the tax reform. However, we cannot find any evidence that banks reduced lending to these firms following the divestitures. Thus, the positive cross-sectional correlation between equity stakes and lending, which we also confirm in our sample, seems to be driven by endogeneity issues and cannot be interpreted causally. Rather, equity stakes held by banks seem to be immaterial to their lending. Our findings have important policy implications because they indicate that the benefits of equity stakes for lending may be overstated in the literature. This finding is relevant for bank-based economies such as Germany and Japan, but also applies to the United States, where banks are allowed to hold large equity stakes in their borrowers since the repeal of the Glass–Steagall Act. Furthermore, it is relevant for institutional investors that participate in lending syndicates which often hold both debt and equity of the same company

# Nichttechnische Zusammenfassung

## Fragestellung

Die sogenannte „Deutschland AG“ war dadurch gekennzeichnet, dass Banken große Aktienbestände an Industrieunternehmen hielten. In dieser Arbeit wird untersucht, wie dies die Kreditvergabe an diese Unternehmen beeinflusst. Vielfach wurde in der akademischen Literatur argumentiert, dass eine Kapitalbeteiligung für die Kreditvergabe von Vorteil sei, da sie Interessenkonflikte zwischen Kreditgebern und Eigentümern des Unternehmens verringert. Jedoch kann aus den bisher verfügbaren Querschnittsanalysen keine kausale Wirkung von Kapitalbeteiligungen auf die Kreditvergabe abgeleitet werden, denn ihre Ergebnisse werden dadurch verzerrt, dass die Kreditbeziehung einen Einfluss auf Kapitalbeteiligungen hat („umgekehrte Kausalität“).

## Beitrag

Der Deutsche Bundestag beschloss im Jahre 2000, den Verkauf von Kapitalbeteiligungen steuerfrei zu stellen, um die Auflösung der „Deutschland AG“ voran zu treiben, woraufhin Banken viele ihrer Kapitalbeteiligungen verkauften. Wir untersuchen, wie sich diese Verkäufe auf die Kreditvergabe an dieselben Unternehmen auswirken. Dieser Ansatz ermöglicht es uns, den kausalen Effekt von Kapitalbeteiligungen auf die Kreditbeziehung zu messen.

## Ergebnisse und Politikempfehlungen

Es ergibt sich, dass deutsche Banken nach der Steuerreform zahlreiche Beteiligungen an Unternehmen, die mit ihnen in einer Kreditbeziehung standen, veräußerten. Jedoch deuten die Ergebnisse nicht darauf hin, dass die Banken auch ihre Kreditvergabe an diese Unternehmen reduzierten. Daraus folgt, dass die in bisherigen Querschnittsanalysen gefundene positive Korrelation zwischen Beteiligungen und Kreditvergabe nicht kausal interpretiert werden darf. Stattdessen kann der Bestand an Unternehmensbeteiligungen als irrelevant für die Kreditbeziehung gelten. Als wichtige politische Implikation deuten unsere Ergebnisse darauf hin, dass die Vorteile von Beteiligungsbeziehungen zwischen der Finanz- und Realwirtschaft in der Literatur überschätzt werden. Dies ist vor allem für bankbasierte Finanzsysteme wie Deutschland und Japan relevant, aber auch für die USA, wo es Banken seit Aufhebung des *Glass-Steagall-Act* gestattet ist, große Eigenkapitalanteile an Unternehmen zu halten. Bedeutend sind die Ergebnisse zudem für institutionelle Investoren, die sich an Kreditsyndikaten beteiligen, welche oft sowohl Eigen- als auch Fremdkapitaltitel an Unternehmen halten.

BUNDESBANK DISCUSSION PAPER NO 06/2018

# Banks' Equity Stakes and Lending: Evidence from a Tax Reform

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**Abstract**

Several papers find a positive association between a bank's equity stake in a borrowing firm and lending to that firm. While such a positive cross-sectional correlation may be due to equity stakes benefiting lending, it may also be driven by endogeneity. To distinguish the two, we study a German tax reform that permitted banks to sell their equity stakes tax-free. After the reform, many banks sold their equity stakes, but did not reduce lending to the firms. Thus, our findings question whether prior evidence can be interpreted causally and suggest that banks' equity stakes may be less important for lending than previously thought.

**Keywords:** Relationship banking, Ownership, Monitoring

**JEL classification:** G21, G32

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# 1. Introduction

For most of the twentieth century, the Glass–Steagall Act enforced a division between commercial and investment banking in the United States. When it was repealed in 1999, U.S. commercial banks not only obtained the right to engage in underwriting and advisory activity but also the right to hold large equity stakes in firms they lend to (Kroszner (2000)).[1] While this option was new in the United States, banks in other countries such as Germany and Japan frequently held equity in their borrowers (Allen and Gale (1995)). Indeed, in the 1990s, some researchers praised bank equity ownership as an advantage of such bank-based economies (e.g., Prowse 1990), while others saw it as a risk to financial stability (e.g., John, John, and Saunders (1994), Boyd, Chang, and Smith (1998)). Nowadays, this discussion gains new importance as the United States reintroduce some of the Glass-Steagall provisions in form of the Volcker Rule, which limits banks' ability to engage in private equity investments.

We contribute to this debate by studying how a bank's equity stake in a borrowing firm affects lending to that firm. There are two reasons why equity stakes may provide an advantage in lending to a firm: First, the cash flow rights of an equity stake align the incentives of debt and equity holders and thus reduce the agency cost of debt (John, John, and Saunders (1994), Santos (1999), Mahrt-Smith (2006)). Second, the control rights of the equity stake may allow the lender to better monitor the borrower.

Prior papers (e.g. Ferreira and Matos (2012), Prowse (1990)) find a positive association between banks' equity stakes and lending, which they argue supports that equity stakes are beneficial for lending. However, such a positive cross-sectional correlation can also be driven by endogeneity issues because banks decide on their debt and equity holdings jointly.

To address such endogeneity issues, we use a German tax reform which triggered divestitures of equity stakes as identification. While we confirm prior papers in finding a positive cross-sectional correlation between banks' equity stake and lending, we do not find any causal evidence that equity stakes benefit lending: following the reform, banks sell their equity stakes, but they do not decrease lending to these firms. Thus, our findings question whether the prior evidence can be interpreted causally and suggest that banks' equity stakes may be less important for lending than previously thought.

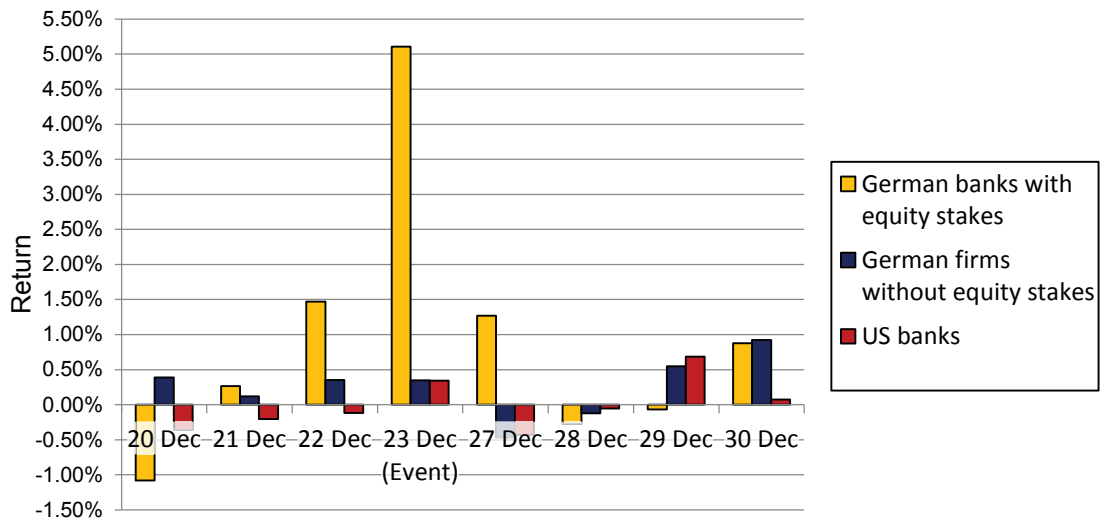
[1] The Gramm-Leach-Bliley Act of 1999 allows banks to engage in "merchant banking investments". Banks can obtain any percentage of equity in an industrial company and keep it for up to 15 years. The bank is not allowed to "routinely manage or operate" the company, but can exert some influence on the firm. Under the Glass-Steagall Act, such merchant banking investments were limited to 5% of voting equity (Kroszner, 2000).

We use the German capital gains tax reform in 2000 for identification. Before the reform, German banks held large minority stakes in German industrial companies. For example, Deutsche Bank held equity stakes in 24 industrial companies ranging from 0.25% to 30% of the firms' equity and adding up to a total market value of EUR 22.7 billion (45% of Deutsche Bank's own market capitalization). Many of these stakes had already been established in the 1950s and 1960s and thus had accumulated large unrealized capital gains over time. Consequently, banks maintained the equity stakes mainly to avoid capital gains taxation (Sautner and Villalonga (2010)). The German government decided to abolish the 50% capital gains tax in 2000, thus removing a major obstacle to the divestiture of banks' equity stakes (Edwards et al. (2004)). Banks' stock prices increased by 5% upon the announcement of the tax reform (see Figure 1), which suggests that (1) the reform was a surprise to the market, and (2) that the tax acted as a binding constraint on banks.

**Figure 1: Announcement returns of the tax reform**

In Panel A, we display the mean returns of German banks with equity stakes around the announcement of the tax reform on December 23rd, 1999. As control groups we report German firms without equity stakes and US banks (SIC codes 6000-6199). An equity stake is defined as a holding of another firm's equity of less than 50%, which is held either directly or through a chain of subsidiaries at the 75% threshold. In Panel B, we display the returns of the four largest publicly traded German banks. To put those returns into perspective, we also display the aggregated value of the equity stakes, the market capitalization of the bank before the tax reform and the market capitalization increase implied by the return computed as return multiplied by market capitalization. In the last column, we display the market capitalization increase as a function of the value of the equity stakes computed as market capitalization increase divided by the aggregate value of the equity stakes.

*Panel A: Stock returns around the announcement of the tax reform*



*Panel B: Announcement returns on the banks with the largest holdings*

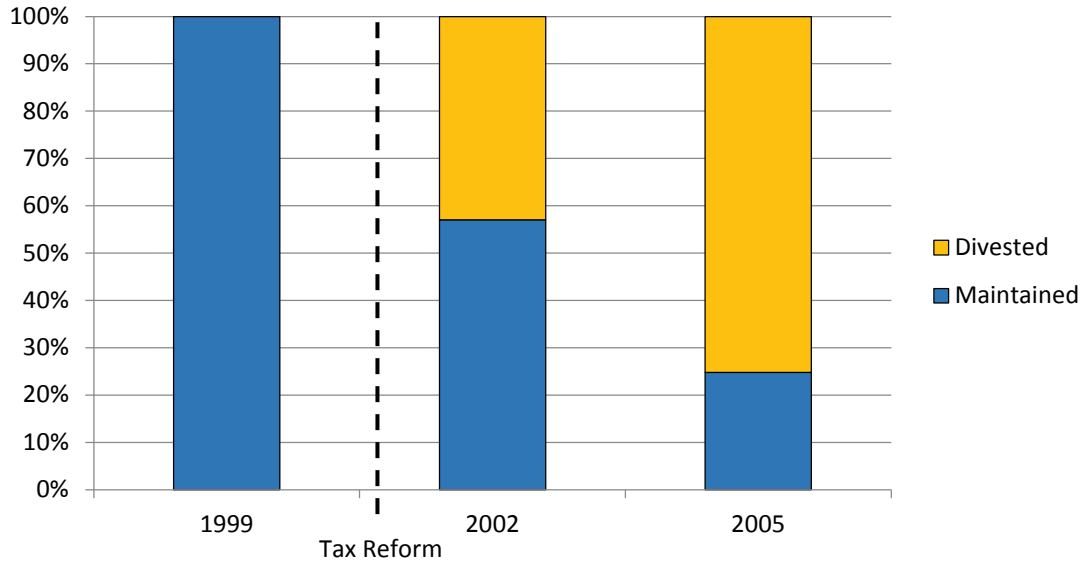
| Name | Value of Equity Stakes (EUR million) | Market Capitalization (EUR million) | Return on 23 December 1999 | Market Capitalization Increase (EUR million) | Market Capitalization Increase in % of Equity Stakes Value |
|---|---|---|---|---|---|
| Deutsche Bank AG | 18614 | 51513 | 13.6% | 7019 | 38% |
| Dresdner Bank AG | 15213 | 28110 | 10.9% | 3077 | 20% |
| Bayerische Hypo- und Vereinsbank AG | 6286 | 28577 | 7.6% | 2166 | 34% |
| Commerzbank AG | 2244 | 18716 | 4.7% | 882 | 39% |

As these equity stakes tied up much regulatory capital, one would expect banks to divest their stakes despite potential benefits these stakes might have for the lending relationships. Indeed, 75% of banks' equity stakes were divested in the six years following the tax reform (see Figure 2).

## Figure 2: Divestitures of equity stakes following the tax reform

This figure illustrates the divestitures of banks' equity stakes following the tax reform. An equity stake is defined as a bank holding less than 50% in an industrial company, either directly or through a chain of subsidiaries at the 75% threshold. We display whether an equity stake held by a bank in December 1999 (before the tax reform) has been divested or maintained by December 2002 and December 2005. We define a stake as divested if the firms is still covered in the respective database ("*Who owns whom*?" or Hoppenstedt) and the stake has been decreased by at least 50%. We also supplement our data with regulatory data from the German Central Bank on equity stakes of banks. For 14 of 135 equity stakes the coverage ends before the bank divests the equity stake. These are set to missing and are excluded from computing these percentages.

*Equity stakes by divestiture (%)*



In our main tests, we use loan-level data from the German Large Credit Register provided by the German Central Bank (Deutsche Bundesbank) to study how equity stakes by banks affected lending. We start by conducting the same cross-sectional analysis as prior studies (e.g. Ferreira and Matos (2012), Prowse (1990)) for the time period before the announcement of the tax reform. We find a positive correlation between equity stakes and lending for both the extensive and intensive margin. The existence of an equity link is correlated with a higher probability of a lending relationship (44.1% instead of 18.7%) and conditional on the existence of a lending relationship, the bank lends on average 2.6 times as much money to the firm if it holds its equity. These results are significant at the 1 percent level in all our specifications. While the positive cross-sectional correlation is in line with the prior papers, it does not imply that equity stakes are beneficial for lending. Rather it could be explained by reverse causality or omitted variable bias.

Therefore, we go on to study how banks change their lending to firms whose equity they divest following the tax reform. Because divestiture decisions are endogenous, we conduct an intention-to-treat analysis and condition our analysis only on the ownership of equity stakes prior to the tax reform rather than the actual divestiture decision. Specifically, we run a difference-in-difference regression where the treated group consists of bank-firm pairs with an equity stake in 1999. Such an intention-to-treat analysis is common in the literature (e.g. Angrist, 1990; Karlan and Zinman, 2010) and is the same as a reduced-form instrumental variable approach in which the divestiture of an equity stake is instrumented by the existence of an equity stake at the time of the tax reform. The same identification strategy is used in von Beschwitz (2017).

The idea of this analysis is that before the reform, the tax forced banks to keep inefficiently large equity stakes in firms. Once the tax is abolished, banks are free to sell their stakes down to the optimal level (which in many cases is no equity stake). If equity stakes were indeed beneficial for lending (as prior papers have argued), we would expect a reduction in lending to firms in which banks divest equity stakes for the exogenous reason of the tax reform. However, we do not find any evidence of this reduction in lending. Rather there seems to be no significant change in lending to previously equity linked firms following the tax reform. If anything, there is an (insignificant) increase in lending. This finding suggests that the evidence in the prior papers may be affected by endogeneity issues and thus be misleading.

Since the treatment occurs at the bank-firm-level, we can control for trends at the bank- and firm-level with bank-year and firm-year fixed effects, respectively. Intuitively, bank-year fixed effects imply that we examine the change in the bank's lending to the

firm in which it held equity relative to its lending to other firms, while firm-year fixed effects imply that we study how the company's borrowing from the (formerly) equity-linked bank changes relative to its borrowing from other banks. Thus, we control for any bank or firm specific effects, such as the additional capital that banks obtain from selling their equity stakes.

We show several additional analyses that confirm our results and address potential concerns with our methodology. For example, one concern may be that our results are distorted by including equity stakes that were not sold. Thus, in a second test, we rerun our difference-in-difference set-up, but only include equity stakes that were divested until 2005. The result remains unchanged.

Next, we directly study the change in lending around divestitures after the tax reform. While this analysis is affected by endogeneity concerns, such endogeneity would most likely bias the analysis towards finding a negative effect of divestitures on lending. For example, if a bank has negative information about the firm, it may choose to divest the equity stake and reduce lending. However, even using this specification, we find that banks (insignificantly) increased lending following the divestiture of an equity stake.

Next, we examine whether we can find a negative effect of the tax reform in the subset of bank-firm pairs where equity stakes are particularly likely to benefit lending. Specifically, we study the subset of cases where the bank also sits on the company's supervisory board and where the company is not publicly listed. We don't observe a negative effect of the tax reform on lending for either of these two subsets.

We conduct several robustness checks. For example, we add companies and banks without equity links to our control group or study different regression set-ups. Our results do not change. We also show that the number of votes banks obtain from proxy-voting the shares of their customers is miniscule compared to the votes obtained through equity stakes. Furthermore, we show that our sample is representative: Banks that hold equity stakes account for 59% of the assets of the German banking system and firms with banks as equity holders are similar to other German firms along a number of characteristics.

Overall, our findings show no indication that banks reduce lending to firms in which they divest equity stakes for exogenous reasons. This finding questions whether the cross-sectional evidence can be interpreted as showing that equity stakes benefit lending. Rather, it seems likely that equity stakes are immaterial for lending and the cross-sectional evidence provided in other studies is affected by endogeneity issues such as reverse causality and omitted variable bias. Reverse causality seems likely because several studies document that lenders can use their access to private information for

profitable investments in the borrower's equity (Massa and Rehman (2008), Ivashina and Sun (2011), Massoud et al. (2011)). Also omitted variable bias seems relevant, because good relationships with a company may cause a bank to invest in both, the company's debt and equity. An alternative interpretation is that an equity stake might facilitate the initiation of a lending relationship, but it may provide no further benefits afterward. Consistent with this view, Hellmann, Lindsey, and Puri (2008) show that banks are more likely to extend credit to companies in which they have previously held a venture capital investment. We can only speculate which mechanism causes the cross-sectional correlation, but our results suggest that the cross-sectional evidence does not imply a positive effect of equity stakes on lending for established lending relationships.

The finding that equity stakes may not benefit lending also has important policy implications. It suggests that regulations preventing banks from holding equity in their borrowers (such as under Glass–Steagall) do not adversely affect lending.

Our paper adds to a strand of literature studying the effect of equity stakes on lending. These studies generally document a positive association between banks' debt and equity investments in a firm, be it in Portugal (Antão, Ferreira, and Lacerda (2011)) or in Japan (Flath (1993), Prowse (1990), Sheard (1989)). Similarly, Ferreira and Matos (2012) find that banks are more likely to act as lead arrangers for syndicated loans to companies in which they hold an equity stake through their mutual fund or asset management divisions. Different to our paper, these studies are based on cross-sectional comparisons. Many of these papers try to address endogeneity with instrumental variables, such as whether the bank or the firm is publicly listed or how strong the restrictions on the mixing of banking and commerce are in a country. However, these instrumental variables can affect lending through other channels besides affecting the likelihood of the bank holding an equity stake. Therefore, it seems likely that the exclusion restriction of these instrumental variables is not fulfilled, making them invalid. Our difference in difference analysis is a superior method to address endogeneity because it provides plausibly exogenous variation to the ownership of equity stakes. Our findings question whether the cross-sectional results can be interpreted as showing that equity stakes benefit lending.

Our research is also related to papers that analyze the relationship between equity stakes and loan pricing. Santos and Wilson (2008) find that banks request lower interest rates from borrowers whose voting rights they control. Fang, Ivashina, and Lerner (2013) show that banks provide cheaper financing to companies in which their private equity arms invest. Jiang, Li, and Shao (2010) show that non-bank institutional investors charge lower interest rates on syndicated loans if they also hold equity in the borrower.

Contrary to these studies, Lim, Minton, and Weisbach (2012) find that leveraged loans of non-bank institutional investors have higher spreads when the lenders hold equity in the borrower. While our data do not allow us to study loan pricing or loan characteristics, our findings show the importance of controlling for endogeneity when studying equity investments of banks, which may explain the inconsistent results on loan pricing.

Other studies focus on the effect of bank ownership on the borrowing firm. For Japan, bank ownership is associated with better performance in financial distress (Hoshi, Kashyap, and Scharfstein (1990)) and better access to financing (Hoshi, Kashyap, and Scharfstein (1991)), but also with lower growth and profitability (Weinstein and Yafeh (1998)). For Germany, several studies find a positive effect of bank influence on firm performance (Gorton and Schmid (2000), Lehmann and Weigand (2000), Cable (1985)), while Dittmann, Maug, and Schneider (2010) find that bankers on the firm's supervisory board add little value. Bank equity ownership may be beneficial for two reasons: Banks may provide more financing or they may be efficient shareholders. Our results suggest that the first is less likely to be the case than was previously thought.

## 2. Institutional details

### 2.1 The German Tax Reduction Act of 2000

Our source of identification is Germany's abolition of its corporate capital gains tax in 2000. Before the reform, many German banks held equity stakes in German industrial companies. These equity stakes were part of a system of minority stakes and cross-holdings often called "Germany Inc." (Deutschland AG) (Höpner and Krempel (2006)). Many of these holdings had been acquired in the distant past and thus had book values significantly below their market value (Edwards et al. (2004)). For example, some of the holdings of Deutsche Bank in old industrial companies dated back to the companies' foundation before World War II. Other equity stakes of banks were acquired in the 1950s and 1960s, potentially to exercise control over industrial companies through board representation. In the 1990s, German banks increasingly moved towards investment banking and wanted to divest their equity holdings to free up capital (Beyer (2003), Vitols (2005)). However, the prevailing 50% corporate capital gains tax rate implied that banks would have been subject to a significant tax cost from divesting their equity holdings in German companies (Sautner and Villalonga (2010)).[2] This lock-in was lifted when the government introduced a tax exemption on the sale of equity stakes with the explicit intention to facilitate the sale of equity stakes (Hoepner, 2000).

[2] Capital gains were taxed at 40% corporate tax and trade tax that varies across regions, but was approximately 10%. For more details see Edwards et al. (2004).

The abolition of the capital gains tax was part of a wider tax reform, which included a reduction in individual and corporate tax rates as well as a change in dividends taxation. However, there is no reason to believe that the general tax changes specifically affected banks' lending to firms in which they hold equity.[3] The tax reform was first announced in December 1999 and the German parliament passed it in the summer of 2000 to become effective on January 1, 2001. The abolition of the capital gains tax did not enter into force until January 1, 2002. However, there were ways for companies to divest holdings before 2002 and still capture the better tax treatment. For example, Deutsche Bank sold a stake in Allianz on 6 June 2000 and stated in its investor relations release:

> "The economic disposal has been achieved by an innovative structure which allows Deutsche Bank to obtain the full benefits from the upcoming tax reform in Germany. The transaction will qualify as a disposal for the Deutsche Bank Group in its IAS accounts, giving rise to a capital gain in excess of EUR 2 billion, but without triggering a tax disposal in the current year."[4]

Furthermore, anticipating the tax reform, banks may have changed their lending to firms in which they plan to sell equity and thus the tax reform may already have had an effect before January 1st, 2002. Accordingly, we use the announcement of the tax reform in December 1999 as our event date.

### 2.2 The regulatory and supervisory environment

Our sample period ranges from 1998 to 2005. It therefore lies entirely before the implementation of the Basel II Accords in Germany in 2007[5]. Thus, according to Basel I rules, equity stakes and loans were part of risk-weighted assets, which banks had to back with 4% core capital and with 8% total core and additional capital. The risk weight for equity stakes was 100% and thus the same as that of uncollateralized corporate bonds. For tax and regulatory purposes, banks applied German GAAP accounting and thus valuing equity stakes at historical cost. Loans were generally valued at face value.

We conclude from this environment that, first, changes in the market value of the equity stakes did generally not affect the bank's book equity or risk-weighted assets. Second, the tax reform created an incentive for banks to divest their holdings because a sale of an equity stake increased their capital by the amount of the capital gains.

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[3] For a detailed description of the tax reform, see Keen (2002).

[4] "Deutsche Bank reduces Allianz stake to 4.1%" (DB Investor Relations Release) and "Deutsche plays clever in Allianz sale to avoid CGT" (article from http://www.efinancialnews.com).

[5] The Basel II Accords were published already in June 2004 and discussed before that. Therefore, German banks might have taken the expected change in regulation into account during our sample period.

Different to the United States, there are no lender liability laws in Germany. Thus, banks do not risk equitable subordination in the case of bankruptcy if they are represented on the firm's supervisory board or hold the firm's equity (Dittmann, Maug, and Schneider (2010)).

We provide additional information on the German banking system and German corporate governance in Appendix 2 to 4.

## 3. Data and Variables

### 3.1 Ownership data

Our data on equity holdings of German companies is from *Who owns Whom?* (Wer gehört zu wem?) provided by Picoware as of July 1999. This database contains ownership data for private and public companies. The data are based on public sources and self-reported information. In addition, we manually add holdings of banks reported in *Hoppenstedt Aktienführer 2001* (these holdings are as of December 1999). To focus on equity stakes rather than subsidiaries, we define an equity link as a holding by a bank in an industrial company of less than 50% equity. However, we do include equity holdings of a bank's subsidiary if the bank holds at least 75% of the subsidiary's equity.[6] We exclude holdings in other banks, private equity companies and vehicles of project finance using the industry information provided in *Who owns Whom?* as well as manual checks. We exclude these holdings because they are more likely part of the normal operations of the bank and thus are much less likely to be divested after the tax reform. After these filters, our sample includes 135 equity stakes that 26 banks held in 117 companies.

We also determine the year in which an equity stake is divested. This exercise is not trivial given that both *Who owns Whom?* and *Hoppenstedt Aktienführer* provide only yearly cross-sections rather than a panel dataset. We choose a conservative measure of divestiture, which only counts an equity stake as divested if a company is still covered in the data and the equity stake is listed as belonging to another owner[7]. We also ensure through manual checks that the new owner is indeed a different company and that the equity stake has not just moved into a different holding vehicle of the same bank. If a company disappears from the data before a divestiture, we set the time of divestiture to missing.

[6] We also include the equity holdings of lower levels of subsidiaries (i.e. subsidiaries of subsidiaries) as long as any link consists of at least 75%. The subsidiary can be a non-financial company. Results are also robust to using a 50% cut-off instead.

[7] We treat an equity stake as divested if at least half of the equity has been sold.

### 3.2 Loan-level data

Our loan-level data comes from the *German Large Credit Register* (Millionenkreditevidenz) provided by the German Central Bank and covers the time period from 1998 to 2005. German banks must report their debt exposures to companies and individuals at the end of each quarter if the exposure exceeds EUR 1.5 million during the quarter. For ease of interpretation, we refer to this quarterly exposure as a loan (following Khwaja and Mian (2008)). The credit exposure is further broken down into on-balance sheet items such as loans and bonds, as well as off-balance sheet exposure through credit derivatives, guarantees and undrawn credit lines. We focus on the total credit risk a bank faces towards a borrower.

We use four measures of loan size in the paper: *Loan Size (log)* is the natural logarithm of the size of the loan, while *Loan Size (EUR million)* is the unstandardized loan size winsorized at the 1% and 99% threshold. *Bank Share* is the share of a borrower's total credit that is provided by a bank. *Borrower Percentile* measures the importance of a borrower to a bank. It is a percentile based on the size of a borrower's loan relative to other borrowers of the bank. Detailed definitions of all variables are reported in Appendix 1.

The *German Large Credit Register provides* the most detailed data on the lending of German banks and has been used in other studies, such as Haselmann, Schoenherr, and Vig (2017). However, it does not include loan terms, forcing us to focus on the size of the loans.

### 3.3 Bank-level data

We conduct our main analysis on the 26 banks that hold equity stakes in industrial companies. These large banks account for 59% of the German banking system by assets. An extended sample used in robustness checks includes other banks that are covered by *Who owns Whom?* and have more than EUR 1 billion in total loans outstanding from 1998 to 1999 according to the *German Large Credit Register*. For these 89 banks, we obtain balance sheet data as of December 1999 from the *Regulatory Credit Information System* (Bankaufsichtliches Kredit-Informationssystem, BAKIS) of the German Central Bank. Extending the sample does not materially change our results.

### 3.4 Firm-level data

We match the firms in the *German Large Credit Register* to the firms which are covered in *Who owns Whom?*. For publicly listed firms, balance sheet data of the last fiscal year ending before December 1999 comes from *Worldscope* and stock market data from *Datastream* and *Compustat Global*. For private companies, we obtain balance sheet data

from the *Jalys/USTAN* database, which was constructed for the rediscount business of the German Central Bank. We match *Jalys/USTAN* to the *German Large Credit Register* using the links employed in Haselmann, Schoenherr, and Vig (2017). *Jalys/USTAN* is "the best and most comprehensive firm data set in Germany" for our time period (Stöss (2001)). Still some companies are not covered in every year. If a company is not covered in 1999, we instead use the last data point available in the dataset going back to 1995. We manually collect information on the composition of supervisory boards in 1999 from annual reports.

### 3.5 Summary statistics

We include in our main analyses only banks and firms with equity links in 1999, which we will refer to as the *Inside Sample*. Table 1 reports summary statistics for the *Inside Sample* as of 1999. The firms in our sample are fairly large with average assets of EUR 9,129 million (median EUR 304 million) and they receive on average loans from 12.8 (median 7) banks. The high number of banking relationships allows us to use firm-time effects in our difference-in-difference set up. Half of the sample consists of publicly listed companies.

Also the banks in our sample are large with mean assets of EUR 107 billion (median EUR 53 billion). On average, they hold equity stakes in 5.2 companies (median 1.5), making up 23% of the bank's equity on average (median 3.8%). This means that equity stakes are large enough that the associated cash-flow rights align the incentives of the bank with those of equity holders. Of our 26 banks, 11 banks belong to the commercial sector, 11 banks belong to the public sector (savings banks and their central institutions) and 4 banks belong to the cooperative sector.

If there is an equity link, a bank holds 14.6% of the firm's equity on average (median 10.5%). For 66% of the equity links, the bank also provides a loan to the company. In this case, the market value of equity is typically twice as large as the loan given that the debt constitutes on average 36% (median 32%) of total financing.[8] In 75% of the cases where the bank holds equity in the company, it is also represented on the company's supervisory board.

[8] If the firm is privately listed, we estimate the market capitalization using a multiple of its book equity, where this multiple is the median of the book to equity ratio of publicly listed companies.

## Table 1: Summary statistics

This table displays summary statistics as of December 1999. Panel A covers variables on the firm level for all firms in which a bank holds an equity stake. Panel B reports the summary statistics on the bank level for the 26 banks which hold equity in an industrial company. *Number of Equity* stakes is the number of industrial companies in which the bank holds equity. *Value of Equity Stakes* is the estimated market value of these stakes, while *Equity Stakes / Equity* is this value divided by the bank's equity. Panel C reports the summary statistics on the equity stake level. The size of the stake is given in EUR million and as a percentage of the company's equity. *Existence of a Loan* is a dummy variable indicating whether the bank holding the equity gives a loan to the firm. *Debt Share of Bank Funding* gives the loan value from the bank to the company divided by the total funding (debt + equity) taking into account only the 89 equity stakes with a loan. *Board Link 1999* is an indicator variable equal to one if a representative of the bank sits on the firm's supervisory board. Panel D reports the summary statistics on the loan level. Following Khwaja and Mian (2008), we refer to a bank-firm pair as a loan, i.e. multiple loans are aggregated. All other variables are defined in Appendix 1.

*Panel A: Firms*

| Variable | Mean | 25th Percentile | Median | 75th Percentile | Standard Deviation |
|---|---|---|---|---|---|
| Assets (EUR million) | 9128.8 | 41.3 | 303.7 | 1697.7 | 41375.0 |
| Firm Leverage (%) | 22.1 | 6.68 | 21.0 | 35.2 | 16.1 |
| Firm Tangibility of Assets (%) | 33.6 | 21.9 | 35.1 | 43.4 | 15.9 |
| Number of Bank Relationships | 12.8 | 2 | 7 | 14 | 16.9 |
| Publicly Listed | 0.50 | 0 | 0 | 1 | 0.50 |
| Return on Assets (%) | 5.53 | 3.05 | 5.85 | 7.91 | 6.99 |
| Observations | 117 | | | | |

*Panel B: Banks*

| Variable | Mean | 25th Percentile | Median | 75th Percentile | Standard Deviation |
|---|---|---|---|---|---|
| Assets (EUR billion) | 107.0 | 12.4 | 53.3 | 207.6 | 128.1 |
| Equity (EUR million) | 3336.8 | 550.4 | 1523.7 | 4820.5 | 4443.2 |
| Number of Loans | 5986.3 | 1271 | 3135 | 7187 | 7110.5 |
| Number of Equity Stakes | 5.19 | 1 | 1.50 | 9 | 6.25 |
| Value of Equity Stakes (EUR million) | 2382.3 | 5.52 | 36.4 | 386.8 | 6393.1 |
| Equity Stakes / Equity (%) | 22.8 | 0.76 | 3.75 | 18.3 | 45.6 |
| Lending Focus of Bank (%) | 43.4 | 33.7 | 43.4 | 54.4 | 15.5 |
| Return on Equity (%) | 5.44 | 3.39 | 4.75 | 7.60 | 3.65 |
| Observations | 26 | | | | |

*Panel C: Equity stakes*

| Variable | Mean | 25th Percentile | Median | 75th Percentile | Standard Deviation |
|---|---|---|---|---|---|
| Size of Equity Stake (%) | 14.6 | 5.52 | 10.5 | 21.6 | 12.0 |
| Size of Equity Stake (EUR million) | 458.8 | 3.31 | 17.3 | 97.6 | 1549.2 |
| Existence of a Loan | 0.66 | 0 | 1 | 1 | 0.48 |
| Debt Share of Bank Funding (in case of loan, %) | 35.9 | 6.06 | 32.2 | 58.1 | 29.9 |
| Board Link 1999 | 0.75 | 0.5 | 1 | 1 | 0.435 |
| Observations | 135 | | | | |

*Panel D: Loans*

| Variable | Mean | 25th Percentile | Median | 75th Percentile | Standard Deviation |
|---|---|---|---|---|---|
| Loan Amount (EUR million) | 35.3 | 2.86 | 10.1 | 30.5 | 83.5 |
| Bank Share (%) | 14.0 | 1.79 | 6.36 | 15.8 | 21.1 |
| Observations | 492 | | | | |

# 4. Results

## 4.1 Announcement of the tax reform: Event study

The abolition of the capital gains tax was part of a wider tax reform. While the general tax reform was announced on December 21, 1999, the plan to abolish the corporate capital gains tax was not confirmed until December 23, 1999. This enables us to examine the market reaction to the capital gains tax announcement separately (following Edwards et al. (2004)). In Panel A of Figure 1, we plot the average stock returns for banks with equity stakes around the announcement. Because almost all publicly listed German banks had equity stakes, we use German industrial companies and US banks as control groups to proxy for country and industry specific shocks. During a quiet stock market environment in the last week before Christmas, the stock prices of banks with equity stakes shot up by 5.1%, while the return for both control groups was only 0.3%. This finding is consistent with Edwards et al. (2004) and von Beschwitz (2017).

In Panel B, we display the returns on the announcement day for the four largest German banks, which also held the most equity stakes. To better understand these returns, we compare them to the aggregate value of the banks' equity stakes. Deutsche Bank, whose equity stakes had the highest aggregate value (EUR 18.6 billion), experienced a stock price increase of 13.6%, while Commerzbank, whose equity stakes had the lowest value (EUR 2.2 billion), experience a stock price increase of only 4.7%. This pattern suggests that the holding of equity stakes determined the market reaction. The average increase in market capitalization on the announcement day divided by the aggregate value of equity stakes was 33%. Given that the tax rate before the reform was 50%, the capital gains made up at least 66% of the value of the equity stakes and the surprise element of the tax reform was at least 66%.[9] In addition to the event study, newspaper articles suggest that the tax reform was a surprise to the market. For example, *Handelsblatt*, a German business newspaper, headlined "Eichel [the German minister of finance] surprises stock market with a Christmas present".[10] The fact that the reform was a surprise alleviates worries that equity stakes or lending decisions before 1999 were endogenous to the anticipation of the tax reform.

[9] The value increase of the equity stakes on the announcement day should depend on the amount of capital gains and on the change in probability of the passage of the tax reform. It can be approximately computed as: $Value\ Increase = Change\ in\ Probability\ of\ Tax\ Reform * Capital\ Gains * 0.50 = 0.33$ where 50% is the capital gains tax rate. This calculation implies that both *Change in Probability of Tax Reform* and *Capital Gains* were at least 66%.

[10] "Eichel überrascht die Börse mit einem Weihnachtsgeschenk", Handelsblatt, December 24, 1999.

### 4.2 Divestitures of equity stakes following the tax reform

Several prior studies find that most of the bank equity stakes were divested following the tax reform (Kengelbach and Roos (2006), Höpner and Krempel (2006)). In Figure 2, we confirm this result for our dataset. We show that 75% of banks' equity stakes in industrial firms were divested at least by half until 2005.

This result is not surprising given that banks had strong incentives to divest their equity stakes: First, banks realize large accounting gains by selling the holdings, which improves their capital position and leads to potential income and reputation gains for the bank's management. Second, divesting a holding leads to a cash proceed, which improves the liquidity position of the bank. Third, there was a general election in Germany in September 2002, and the political opposition had announced a plan to reintroduce capital gains taxation. The opposition narrowly lost the election and the corporate capital gains tax has not returned since. However, in 2002 the opposition was ahead in the polls potentially causing some banks to sell their holdings to front-run a return of the tax (Pauly and Schäfer (2002)).

### 4.3 Cross-sectional correlation between equity stakes and lending

Several prior papers find a positive correlation between banks' equity stakes and lending, for example in Japan and Portugal ((Antão, Ferreira and Lacerda (2011), Flath (1993), Prowse (1990), Sheard (1989)). In this section, we study whether the same cross-sectional correlation can be found in our data for Germany. We report our results in Table 2. In Panel A, we use a dataset with all possible bank-firm combinations, following Ferreira and Matos (2012) and Hellmann, Lindsey and Puri (2008). The dependent variable *Lending Relationship* is a dummy variable equal to one if the company received a loan from the bank in December 1999. The explanatory variable of interest is *Equity Link in 1999*. We control for geographic proximity using dummy variables equal to one if bank and firm are located in the same city or the same region. We use size, leverage and tangibility of assets as firm-specific controls. In regressions 2 to 4, we replace them with firm fixed effects. Since our dependent variables are binary, we use a logit specification, which we replace with a linear probability model (OLS) in the specifications with firm fixed effects due to the incidental parameter problem.[11] We double-cluster standard errors at the bank and firm level. We find that an equity link is correlated with a higher probability of a lending relationship, significant at the 1 percent

[11] Since our sample includes many firms, but only few banks, a simple non-linear probability model cannot be consistently estimated due to an incidental parameters problem (Chamberlain (1980); Puri, Rocholl and Steffen (2011), Greene (2004), Neyman and Scott (1948)). Therefore, following Puri, Rocholl and Steffen (2011) and Khwaja and Mian (2008), we employ a linear probability model estimated with OLS.

level in all our specifications. Based on the results of the logit regression, we predict a probability of having a lending relationship of 44.1% for bank-firm pairs with an equity stake, while it is only 18.7% for bank-firm pairs without an equity stake.

## Table 2: Comparison to other studies: Cross-sectional correlation

This table displays cross-sectional regressions as of December 1999, examining whether equity links are correlated with the existence and the size of a lending relationship. The analysis includes only banks and firms with equity stakes. In Panel A, the observational unit is a bank-firm pair. The dependent variable is a dummy variable equal to one if the bank provides a loan to the firm in December 1999. In Regressions 1, we estimate a logit model. In Regressions 2 to 4 we estimate a linear probability model, i.e. OLS. In Panel B, the observational unit is a loan (i.e. a bank-firm pair in which the bank provides credit to the firm). The dependent variables are *Loan Size (log)*, *Loan Size (EUR million), Bank Share, and Borrower Percentile*. The explanatory variable of interest is a dummy variable equal to one if the bank holds an equity stake in the company. All standard errors are double-clustered at the bank and the firm level. We report t-statistics below the coefficients in parenthesis. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

*Panel A: Lending Relationship*

| | Lending Relationship | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Equity Link 1999 | 1.944*** | 0.543*** | 0.352*** | 0.248*** |
| | (6.01) | (11.11) | (8.27) | (3.54) |
| Same City | 1.534** | 0.125* | 0.181*** | 0.134*** |
| | (2.26) | (1.71) | (2.95) | (2.77) |
| Same Region | 0.516 | 0.104 | 0.068 | 0.104 |
| | (0.70) | (1.35) | (1.02) | (1.56) |
| Board Link 1999 | | | | 0.113*** |
| | | | | (2.78) |
| Firm Size (log) | 0.431*** | | | |
| | (6.57) | | | |
| Firm Leverage | 2.820*** | | | |
| | (3.46) | | | |
| Firm Tangibility of Assets | 0.421 | | | |
| | (0.47) | | | |
| Observations | 2250 | 2756 | 2756 | 1976 |
| Adjusted $R^2$ | 0.38 | 0.25 | 0.40 | 0.43 |
| Regression Method | Logit | OLS | OLS | OLS |
| Firm Fixed Effects | No | Yes | Yes | Yes |
| Bank Fixed Effects | Yes | No | Yes | Yes |

Economic effect based on regression 1: 18.7% (no hold) 44.1% (hold) at means: 7.6% (no hold) 38.1% (hold)

*Panel B: Size of Lending Relationship*

| | Loan Size (log) | | Loan Size (EUR million) | | Bank Share | | Borrower Percentile | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Equity Link 1999 | 1.156*** | 0.961*** | 28.733*** | 21.876*** | 0.093*** | 0.089*** | 0.149*** | 0.110*** |
| | (3.66) | (3.23) | (2.88) | (2.86) | (2.83) | (2.85) | (3.74) | (2.70) |
| Same City | 0.056 | 0.531 | -12.158 | 0.050 | -0.015 | -0.007 | 0.023 | 0.078 |
| | (0.12) | (0.82) | (-0.92) | (0.00) | (-0.30) | (-0.12) | (0.36) | (1.05) |
| Same Region | 0.078 | -0.419 | 14.129 | 0.155 | 0.003 | -0.001 | -0.038 | -0.075 |
| | (0.09) | (-0.41) | (0.56) | (0.01) | (0.04) | (-0.01) | (-0.36) | (-0.64) |
| Observations | 468 | 468 | 468 | 468 | 468 | 468 | 468 | 468 |
| Adjusted $R^2$ | 0.24 | 0.32 | 0.21 | 0.25 | 0.71 | 0.72 | 0.19 | 0.24 |
| Firm Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Bank Fixed Effects | No | Yes | No | Yes | No | Yes | No | Yes |

Next, we want to examine whether an equity link is also associated with larger loans conditional on the existence of a lending relationship. We run OLS regressions where each observation is a bank-firm pair for which average lending in December 1999 is positive. The results are presented in Panel B. We find that in the cases where a bank holds the firm's equity, it lends 2.6 times as much or EUR 21.9 million more.[12] A bank that holds an equity stake in the company on average provides 8.9 percentage points more of the company's debt and the company ranks 11 percentage points higher amongst the banks borrowers. All these effects are significant at least at the 1% level.

These results indicate that there is the same positive cross-sectional correlation between equity stakes and lending volume in Germany as has been shown in previous studies for other countries. This suggests that the findings of our study may be extended to other countries as well. However, it is important to note that the positive cross-sectional correlation does not imply that equity stakes are beneficial for lending as we discuss in the next section.

### 4.4 How our analysis addresses endogeneity

The positive cross-sectional correlation between equity stakes and lending does not necessarily show that equity stakes benefit lending but could also be explained by omitted variable bias or reverse causality. In this section, we explain how our identification strategy addresses this issue.

Assume the bank chooses the amount of debt ($D$) and equity ($E$) invested in the firm jointly to maximize its profits ($\Pi$):

$$(D^*, E^*) = \underset{D,E}{\arg\max}\ \Pi\left(D,\ E\right) \tag{1}$$

$D^*$ and $E^*$ are the optimal levels of debt and equity that maximize profit for the bank (if it is unconstrained). If equity stakes are beneficial for lending, then debt and equity are complements, i.e. adding an extra unit of debt raises profits more if the bank owns more equity in the firm:

$$\frac{\partial^2 \Pi}{\partial \mathrm{D}\, \partial \mathrm{E}} > 0 \tag{2}$$

However, omitted variables, such as whether the bank has a good relationship with the firm, can lead to a correlation between $D$ and $E$ even if Equation 2 is not fulfilled. We can address this issue by using the tax reform as a natural experiment. Before the tax reform, banks were essentially forced to hold on to their equity stakes due to the high

[12] A difference in log loans of 0.96 corresponds to a difference in loans of $e^{0.96} - 1 = 160\%$.

capital gains tax.[13] This means that they were not at the unconstrained optimum $(D^*, E^*)$, but at a constrained optimum $(D^{**}, \bar{E})$, where the bank chooses the optimal lending $D^{**}$ conditional on a suboptimal large equity stake, $\bar{E}$:

$$\mathrm{D}^{**} = \arg\max_{\mathrm{D}} \ \Pi\,(\mathrm{D}|\bar{\mathrm{E}}) \tag{3}$$

Where

$$\bar{\mathrm{E}} > \mathrm{E}^* \tag{4}$$

After the tax reform, the constraint is lifted and the bank moves from the constrained optimum $(D^{**}, \bar{E})$ to the unconstrained optimum $(D^*, E^*)$. As we have shown above, banks indeed divested most of their equity stakes following the tax reform, suggesting that Inequality 4 holds. In fact, it seems that in most cases the optimal level of equity is zero ($E^* = 0$), as most of the stakes were fully divested. This is not surprising given the large regulatory capital cost of holding equity as a bank.

Given that the change in the level of equity from $\bar{E}$ to $E^*$ is exogenously caused by the tax reform, any change in $D$ must be due to the effect of $E$ on $D$.[14] Thus, if equity stakes are indeed beneficial for lending, i.e. if Equation 2 is true, we obtain that:

$$\mathrm{D}^* < \mathrm{D}^{**} \tag{5}$$

This means that we should see a decrease in lending to formerly equity-linked firms after the tax reform if equity stakes benefit lending. Instead, as we lay out in the next sections, we observe that the amount of lending to formerly equity-linked firms does not change (relative to firms without an equity link), suggesting that the cross-sectional correlation is due to endogeneity issues.

### 4.5 Impact of the tax reform on lending: Graphical evidence

As discussed above, we would expect a decrease in lending to (formerly) equity-linked firms after the tax reform if equity stakes benefit lending. Thus, we compare how lending changes after the tax reform to firms in which the bank held an equity stake in 1999. Since the treatment takes place at the bank-firm level, we do not need other firms or banks as a control group. Rather, we include only banks and firms with at least one equity link in 1999 in our sample (*Inside Sample*) and use their lending relationships

[13] We implicitly assume here that the original reason to purchase the equity stake has disappeared over time, which seems a reasonable assumption given that banks owned many of their stakes for several decades (see Section 2.1).

[14] One important assumption here is that the profit function Π does not change after the tax reform. Empirically, we control for any change in the profit function by including bank-year fixed effects in our regression. This means we examine the change in the bank's lending to the firm in which it held equity *relative to its lending to other firms*. As long changes in the profit function affect lending to all firms in the same way, they do not influence our results.

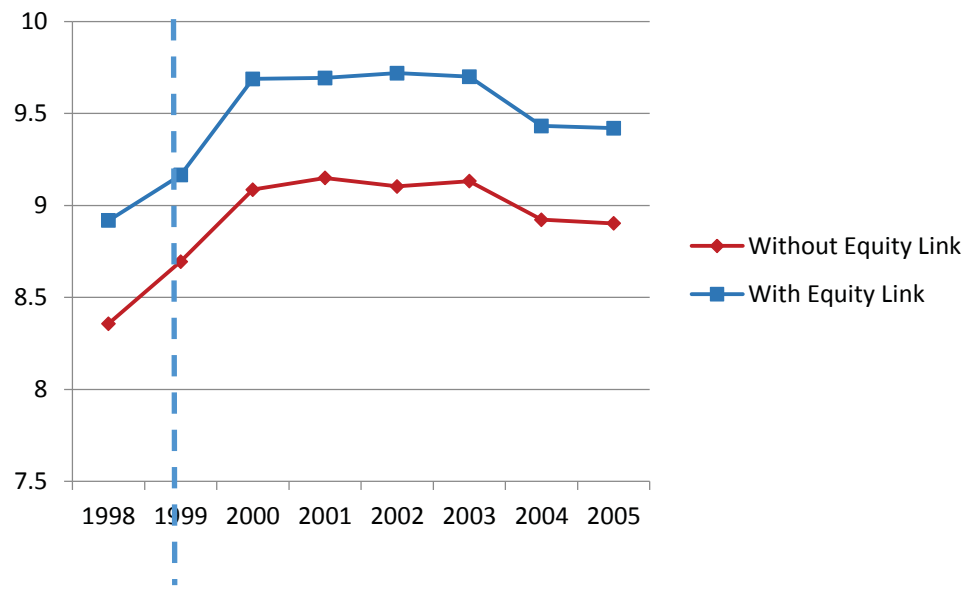
without an equity link as the control group. Using this Inside Sample has the advantage that our results cannot be driven by different time trends between treated and control firms or banks. To focus only on existing lending relationships, we only include bank-firm pairs for which the average lending before the tax reform (1998 to 1999) was positive.

We start with a simple graphical analysis in Figure 3 where we compute the average log loan size each year for bank-firm pairs with and without an equity link. If equity stakes benefit lending, we would expect the lending to firms with equity links to decrease after the tax reform when equity stakes are divested and the benefits from the equity stakes decrease. We do not find any evidence that lending to firms with equity links decreases relative to firms without equity links. Rather, the two lines are parallel both before and after the tax reform.

**Figure 3: Effect of the tax reform on lending**

This figure reports the average log loan size for bank-firm pairs with and without equity stakes. The analysis includes only banks and firms with equity stakes. The vertical line indicates the announcement of the tax reform in December 1999.

*Loan Size (log)*




## 4.6 Impact of the tax reform on lending: Difference-in-difference

Next, we conduct a more rigorous difference-in-difference analysis to study how the sale of equity holdings following the tax reform affected lending. We use the following set up that controls for bank and firm specific trends:

$$Loan\ Size_{b,f,q} = \alpha_q + \alpha_{b,f} + \alpha_{b,y} + \alpha_{f,y} + \beta * Equity\ Stake\ 1999_{b,f} * Post\ Reform_q + \gamma * Ctrl_{b,f} * Post\ Reform_q + \varepsilon_{b,f,q} \quad (6)$$

where *f* denotes the firm, b the bank, $q$ the quarter, y the year and *pr* the post tax reform period. *Equity Stake 1999* is a dummy variable equal to one if the bank holds an equity stake in the firm in 1999 and *Post Reform* is a dummy variable equal to one from 2000 to 2005 (after the announcement of the tax reform). The explanatory variable of interest is the interaction between *Equity Stake 1999* and *Post Reform* (we do not include the main effects of this interaction because they are multicollinear with the fixed effects). This specification measures how the loan size of bank-firm pairs with equity links in 1999 changes relative to bank-firm pairs without links in 1999 following the tax reform. This is an intention-to-treat analysis, where we only condition our analysis on the existence of an equity stake in 1999 rather than the endogenous decision to divest it. This is essentially a reduced form instrumental variable approach, in which the sale of an equity stake is instrumented with the existence of an equity stake prior to the tax reform.

We include quarter fixed effects (denoted $\alpha_q$) to control for changes in the economic environment and bank-firm fixed effects (denoted $\alpha_{b,f}$) to control for any time-invariant heterogeneity at the bank-firm-level. In addition, there may be time-varying effects on the firm or bank-level such as changes in credit demand or credit supply, which are potentially correlated with having an equity link. For example, banks may have used the additional capital from divesting their equity stakes to increase overall lending. We account for these issues by including bank and firm fixed effects interacted with yearly dummy variables (denoted $\alpha_{b,y}$ and $\alpha_{f,y}$). Intuitively, bank-year fixed effects imply that we examine the change in the bank's lending to the firm in which it held equity relative to its lending to other firms, while firm-year fixed effects imply that we study how the company's borrowing from the (formerly) equity-linked bank changes relative to its borrowing from other banks. With this regression set up, the only omitted variables that can distort our results are relationship-specific variables which are correlated with equity links and have a time-varying effect. Thus, we include *Same Region* and *Same City* indicators interacted with *Post Reform* to control for the time-varying effect of geographic proximity.

We display our results in Panel A of Table 3. We use the main specification described above and a specification in which bank-year and firm-year fixed effects are replaced with firm–*Post Reform* fixed effects. We use all four of our loan size measures as dependent variables. For none of our dependent variables the tax reform decreases lending for bank-firm pairs with an equity link in 1999. In fact, all coefficients are (insignificantly) positive. This finding does not suggest that equity stakes benefit lending. Rather, equity stakes seem to be immaterial to lending and the positive cross-sectional correlation is likely explained by endogeneity issues.

## Table 3: Impact of the tax reform on lending: Difference-in-difference

This table presents difference-in-difference regressions examining the effect of the tax reform on lending. The observational unit in this regression is the bank-firm-quarter and the time period spans from 1998 to 2005. A bank-firm pair is only included if there is a lending relationship before the tax reform (average lending from 1998 to 1999 is positive). The dependent variables are *Loan Size (log)*, *Loan Size (EUR million), Bank Share, and Borrower Percentile*. Variables are defined in Appendix 1. In all regressions, we include fixed effects for the bank-firm pair and quarter. In Regressions 1, 3, 5 and 7 we add firm–post reform fixed effects. In regressions 2, 4, 6 and 8 we add bank-year and firm-year fixed effects. In Panel A, the main explanatory variable of interest is the interaction between *Equity Link 1999* and *Post Reform*. The main effects *Equity Link 1999* and *Post Reform* are not included because they are multicollinear with the fixed effects. In Panel B, we exclude all bank-firm relationships with equity stakes that were not sold or for which divestiture information is missing. All standard errors are double-clustered at the bank and the firm level. We report t-statistics below the coefficients in parenthesis. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

*Panel A: All Equity Stakes*

| | Loan Size (log) | | Loan Size (EUR million) | | Bank Share | | Borrower Percentile | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Equity Link 1999 * Post Reform | 0.128 | 0.123 | 14.858*** | 15.803*** | 0.020 | 0.020 | 0.002 | 0.008 |
| | (0.93) | (0.87) | (3.61) | (3.90) | (1.10) | (1.04) | (0.07) | (0.27) |
| Same City * Post Reform | -0.375 | -0.382 | -13.347 | -10.312 | -0.050 | -0.057 | -0.063 | -0.058 |
| | (-0.48) | (-0.41) | (-1.13) | (-0.65) | (-1.19) | (-1.30) | (-1.22) | (-0.82) |
| Same Region * Post Reform | -0.232 | -0.237 | 8.430 | 2.052 | 0.038 | 0.045 | 0.015 | 0.000 |
| | (-0.30) | (-0.26) | (0.51) | (0.11) | (0.89) | (1.01) | (0.29) | (0.00) |
| Observations | 13327 | 13327 | 18554 | 18554 | 18554 | 18554 | 18554 | 18554 |
| Adjusted $R^2$ | 0.66 | 0.71 | 0.65 | 0.68 | 0.70 | 0.74 | 0.66 | 0.72 |
| Bank-Firm and Quarter F.E. | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm–Post Reform Fixed Effects | Yes | No | Yes | No | Yes | No | Yes | No |
| Firm-year and bank-year F.E. | No | Yes | No | Yes | No | Yes | No | Yes |

*Panel B: Only Divested Equity Stakes*

| | Loan Size (log) | | Loan Size (EUR million) | | Bank Share | | Borrower Percentile | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Divested Equity Link * Post Reform | 0.136 | 0.210 | 14.733*** | 15.434*** | 0.016 | 0.025 | 0.000 | 0.018 |
| | (0.81) | (1.34) | (2.87) | (2.88) | (0.77) | (1.12) | (0.01) | (0.62) |
| Same City * Post Reform | -0.288 | -0.384 | -14.087 | -11.015 | -0.053 | -0.064 | -0.066 | -0.063 |
| | (-0.36) | (-0.39) | (-1.15) | (-0.68) | (-1.22) | (-1.39) | (-1.23) | (-0.84) |
| Same Region * Post Reform | -0.303 | -0.221 | 4.400 | -2.868 | 0.030 | 0.037 | 0.025 | 0.006 |
| | (-0.37) | (-0.24) | (0.24) | (-0.14) | (0.70) | (0.83) | (0.48) | (0.08) |
| Observations | 12532 | 12532 | 17640 | 17640 | 17640 | 17640 | 17640 | 17640 |
| Adjusted $R^2$ | 0.66 | 0.70 | 0.64 | 0.67 | 0.67 | 0.72 | 0.66 | 0.71 |
| Bank-Firm and Quarter F.E. | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm–Post Reform Fixed Effects | Yes | No | Yes | No | Yes | No | Yes | No |
| Firm-year and bank-year F.E. | No | Yes | No | Yes | No | Yes | No | Yes |

As discussed above, we conduct an intention-to-treat analysis, where our treated group also includes equity stakes that were not divested after the tax reform. We do this because the decision to divest an equity stake is endogenous. However, given that we would not expect any effect on lending if equity stakes are not sold, this set-up biases our results towards zero. This could potentially explain why we do not observe a negative effect on lending. To address this concern, we run our analysis again, but remove from our sample all bank-firm pairs with equity stakes that were not divested after the tax reform (or whose divestiture information is missing). The results are presented in Panel B. They are very close to the results in Panel A and all coefficients remain positive.

### 4.7 Change in lending after divestitures

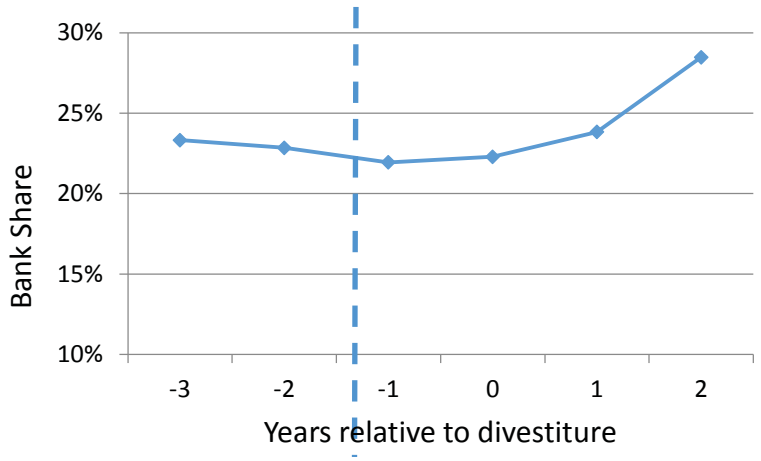
Next, we study how lending changes after actual divestitures. This analysis is affected by endogeneity concerns. For example, if a bank has negative information about the firm, it may choose to divest the equity stake and reduce lending. However, such endogeneity would bias the analysis towards finding a negative effect of divestitures on lending. Thus, if we do not find a negative effect in this endogeneous analysis, it suggests that the causal effect is also not negative.

We start with a simple graphical analysis. We plot *Bank Share*, i.e. the average share of the firm's total borrowing provided by the bank around the divestiture time. We focus on *Bank Share*, because it controls for general demand effects. The results are presented in Figure 4. We do not observe a reduction in lending after the divestiture. To the contrary, while lending slightly decreases before the divestiture, it increases somewhat after the divestiture.

**Figure 4: Lending around divestitures**

This figure reports the average *Bank Share* for bank-firm pairs with equity links around the time of the divestiture of the equity link. *Bank Share* is defined as the percentage of the firms' borrowing that the linked bank provides. The years are measured relative to the time of divestiture. Year zero is the year in which the equity stake was divested.

*Bank Share for bank-firm pairs with equity link*




Next we study the effect of divestitures in a regression setting. We use a setting similar to the difference-in-difference analysis in Table 3, but we replace the interaction of *Equity Link 1999 * Post Reform* with *Equity Link is Divested*, which is a dummy variable equal to one after the equity stake is divested and zero before. For bank-firm pairs without an equity stake, this variable is always zero. Therefore, it captures how lending changes after the divestiture relative to bank-firm pairs without an equity stake.

The results are presented in Table 4 and are very similar to the results in Table 3. Once again, all coefficients are very close to zero and most of them are (insignificantly) positive. This finding suggests that there is no decrease in lending after the divestiture of equity stakes. Given that endogeneity effects should bias the results to be more negative, these findings suggest that there is no negative causal effect of divestitures on lending, suggesting that equity stakes do not benefit lending and that the cross-sectional correlation is driven by endogeneity issues.

### Table 4: Impact of divestitures on lending

This table presents difference-in-difference regressions examining the effect of divestitures on lending. The observational unit in this regression is the bank-firm-quarter and the time period spans from 1998 to 2005. A bank-firm pair is only included if there is a lending relationship before the tax reform (average lending from 1998 to 1999 is positive). The dependent variables are *Loan Size (log)*, *Loan Size (EUR million), Bank Share, and Borrower Percentile*. Variables are defined in Appendix 1. In all regressions, we include fixed effects for the bank-firm pair and quarter. In Regressions 1, 3, 5 and 7 we add firm–post reform fixed effects. In regressions 2, 4, 6 and 8 we add bank-year and firm-year fixed effects. In Panel A, the main explanatory variable of interest is the interaction between *Equity Link 1999* and *Post Reform*. The main explanatory variable is *Equity Link is Divested*, which is equal to 1 after an equity has been divested and 0 before it is divested or if there is no equity link. All standard errors are double-clustered at the bank and the firm level. We report t-statistics below the coefficients in parenthesis. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

| | Loan Size (log) | | Loan Size (EUR million) | | Bank Share | | Borrower Percentile | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Equity Link is Divested | -0.002 | 0.064 | 4.238 | 3.405 | 0.004 | 0.015 | -0.001 | 0.014 |
| | (-0.01) | (0.45) | (0.59) | (0.47) | (0.17) | (0.82) | (-0.03) | (0.45) |
| Same City * Post Reform | -0.282 | -0.362 | -12.994 | -8.734 | -0.049 | -0.055 | -0.060 | -0.057 |
| | (-0.37) | (-0.39) | (-1.12) | (-0.54) | (-1.15) | (-1.23) | (-1.15) | (-0.79) |
| Same Region * Post Reform | -0.311 | -0.241 | 11.258 | 4.454 | 0.040 | 0.048 | 0.012 | -0.001 |
| | (-0.40) | (-0.27) | (0.73) | (0.24) | (0.90) | (1.04) | (0.24) | (-0.01) |
| Observations | 13119 | 13119 | 18316 | 18316 | 18316 | 18316 | 18316 | 18316 |
| Adjusted $R^2$ | 0.67 | 0.71 | 0.66 | 0.68 | 0.69 | 0.74 | 0.67 | 0.71 |
| Bank-Firm and Quarter F.E. | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm–Post Reform Fixed Effects | Yes | No | Yes | No | Yes | No | Yes | No |
| Firm-year and bank-year F.E. | No | Yes | No | Yes | No | Yes | No | Yes |

## 4.8 Sample splits

As described above, we do not find any negative effect of exogenous divestitures of equity stakes on lending when focusing on our whole sample. However, there may be a negative effect in certain subsamples in which bank equity ownership is especially beneficial. We consider two such subsamples: First, the proposed monitoring benefits of equity ownership may be higher if the equity stake allows the bank to be represented on the company's board. The bank would likely lose this board seat after divesting the equity stake, making the divestiture more important. Second, bank monitoring through equity stakes may be more important in private firms, because they are more opaque and less monitored by the general public. There is a second reason, why bank equity stakes may be more beneficial in private firms: If a bank has a close lending relationship with a firm, it may get inside information that gives it monopoly power. If the firm turns

to other banks, they will perceive this as a negative signal (Sharpe (1990), Rajan (1992), von Thadden (1995)). A paper by Mahrt-Smith (2006) argues that bank equity ownership in the firm can help prevent such a hold-up problem. Given that private firms are more opaque, they are more likely to be subject to such a hold-up problem. Therefore, we now split our sample by board links and whether the firm is publicly listed.

We present the results in Table 5. In Panel A, we report difference-in-difference regressions, where we split the treated group by whether a representative of the bank sits on the firm's supervisory board in 1999 (we will refer to this as a board link). More specifically, we define two dummy variables: *Equity Link with Board Link 1999* is equal to one if the bank holds an equity stake in the firm in 1999 and there is a board link, while *Equity Link without Board Link 1999* equals one if there is an equity link, but no board link in 1999. If a bank-firm pair does not have an equity link in 1999, both variables are set to zero. By including both of these variables (interacted with *Post Reform*) in the regression, we estimate the effect of equity stakes with and without board links both compared to bank-firm pairs without equity links. This set up is comparable to a sample split, but has the advantage of using a larger sample to compute coefficients of fixed effects and control variables. We do not find a negative effect of the tax reform on lending in either subgroup. Almost all coefficients are positive and the ones that are negative have t-statistics very close to zero. In fact, for some measures of loan size we even find a positive significant effect. This finding suggests that equity stakes do not benefit lending even when they allow the bank to obtain representation of the firm's supervisory board.

Next, in Panel B, we conduct a similar analysis where we split the treated group by whether the firm is publicly listed. Once again, almost all coefficients remain (insignificantly) positive and in those two cases where coefficients are negative, the t-statistics are very close to zero. This finding suggests that equity stakes do not benefit lending even when the firm is not publicly listed. More generally, these findings show that we do not find an effect of equity stakes on lending in those cases where equity stakes are most likely to benefit lending.

## Table 5: Sample splits

This table presents difference-in-difference regressions examining the effect of the tax reform on lending. The observational unit in this regression is the bank-firm-quarter and the time period spans from 1998 to 2005. A bank-firm pair is only included if there is a lending relationship before the tax reform (average lending from 1998 to 1999 is positive). The dependent variables are *Loan Size (log)*, *Loan Size (EUR million), Bank Share, and Borrower Percentile*. Variables are defined in Appendix 1. In all regressions, we include fixed effects for the bank-firm pair and quarter. In Regressions 1, 3, 5 and 7 we add firm–post reform fixed effects. In regressions 2, 4, 6 and 8 we add bank-year and firm-year fixed effects. In Panel A, we split firms with equity links in 1999 into those that also had a board link to the bank and those that did not. In Panel B, we split firms with equity links in 1999 into two groups depending on whether the firm is publicly listed. The main effects of the interactions are not included because they are multicollinear with the fixed effects. All standard errors are double-clustered at the bank and the firm level. We report t-statistics below the coefficients in parenthesis. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

*Panel A: Split by board link*

| | Loan Size (log) | | Loan Size (EUR million) | | Bank Share | | Borrower Percentile | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Equity Link with Board Link 1999 * Post Reform | 0.114 | 0.109 | 14.651** | 14.946** | -0.006 | -0.002 | 0.001 | 0.006 |
| | (0.60) | (0.55) | (2.31) | (2.04) | (-0.26) | (-0.06) | (0.04) | (0.16) |
| Equity Link without Board Link 1999 * Post Reform | 0.158 | 0.154 | 15.262* | 17.474** | 0.070** | 0.063*** | 0.002 | 0.011 |
| | (0.97) | (0.85) | (1.69) | (1.97) | (2.53) | (2.67) | (0.06) | (0.30) |
| Same City * Post Reform | -0.378 | -0.385 | -13.370 | -10.380 | -0.053 | -0.058 | -0.063 | -0.058 |
| | (-0.49) | (-0.41) | (-1.13) | (-0.66) | (-1.28) | (-1.35) | (-1.21) | (-0.82) |
| Same Region * Post Reform | -0.229 | -0.234 | 8.451 | 2.096 | 0.040 | 0.046 | 0.015 | 0.000 |
| | (-0.29) | (-0.26) | (0.52) | (0.11) | (0.97) | (1.05) | (0.29) | (0.00) |
| Observations | 13327 | 13327 | 18554 | 18554 | 18554 | 18554 | 18554 | 18554 |
| Adjusted $R^2$ | 0.67 | 0.71 | 0.66 | 0.68 | 0.70 | 0.74 | 0.67 | 0.72 |
| Bank-Firm and Quarter F.E. | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm–Post Reform Fixed Effects | Yes | No | Yes | No | Yes | No | Yes | No |
| Firm-year and bank-year F.E. | No | Yes | No | Yes | No | Yes | No | Yes |

*Panel B: Split into public and private firms*

| | Loan Size (log) | | Loan Size (EUR million) | | Bank Share | | Borrower Percentile | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Public Equity Link 1999 * Post Reform | 0.096 | 0.101 | 17.219*** | 18.423*** | 0.019* | 0.028** | 0.007 | 0.022 |
| | (0.66) | (0.65) | (2.87) | (2.90) | (1.70) | (2.09) | (0.28) | (0.73) |
| Private Equity Link 1999 * Post Reform | 0.233 | 0.199 | 8.928 | 9.569 | 0.021 | 0.002 | -0.012 | -0.025 |
| | (0.56) | (0.48) | (1.11) | (1.07) | (0.37) | (0.04) | (-0.19) | (-0.39) |
| Same City * Post Reform | -0.370 | -0.379 | -13.671 | -10.676 | -0.050 | -0.058 | -0.064 | -0.060 |
| | (-0.48) | (-0.41) | (-1.16) | (-0.67) | (-1.20) | (-1.32) | (-1.23) | (-0.84) |
| Same Region * Post Reform | -0.234 | -0.236 | 8.499 | 2.014 | 0.038 | 0.045 | 0.015 | 0.000 |
| | (-0.30) | (-0.26) | (0.52) | (0.11) | (0.89) | (1.00) | (0.30) | (0.00) |
| Observations | 13327 | 13327 | 18554 | 18554 | 18554 | 18554 | 18554 | 18554 |
| Adjusted $R^2$ | 0.67 | 0.71 | 0.66 | 0.68 | 0.70 | 0.74 | 0.67 | 0.72 |
| Bank-Firm and Quarter F.E. | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm–Post Reform Fixed Effects | Yes | No | Yes | No | Yes | No | Yes | No |
| Firm-year and bank-year F.E. | No | Yes | No | Yes | No | Yes | No | Yes |

### 4.9 External validity

While using a natural experiment has the important advantage of addressing endogeneity, it always comes at the cost of being limited to a specific sample and time period. Thus, it is important to determine whether the results can be generalized to other settings. This question cannot be formally tested, but we examine in this section whether external validity seems likely.

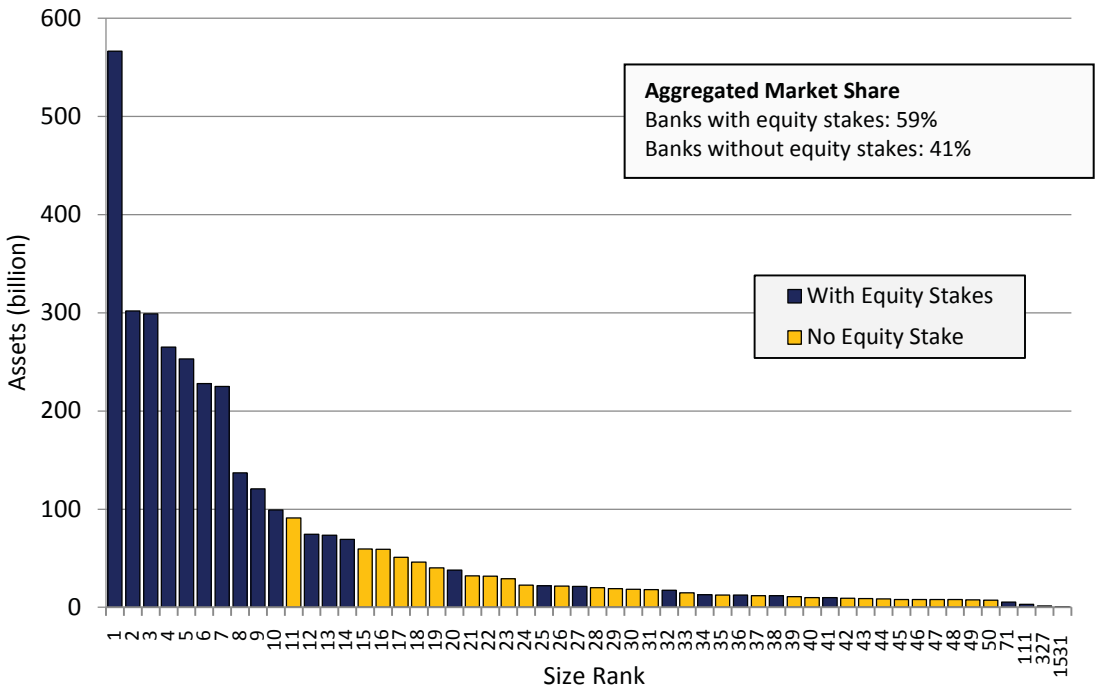
The equity stakes in our sample are relatively large with an average size of 14.6 % in terms of the firm's equity (see Table 1). Given that we do not find any effect of the divestitures of these large equity stakes, it seems unlikely that smaller equity stakes should benefit lending. Thus, it is likely that our findings transfer to other countries where banks hold smaller equity stakes. This is further supported by the fact that we find the same cross-sectional correlation as studies in Portugal and Japan (see section 4.3).

Next, to assess how banks owning equity stakes compare to the entire population of German banks, we plot the 50 largest German banks by assets in Figure 5. Of the 26 banks with equity stakes, 22 are amongst the largest 50. In general, the 26 banks with equity stakes in 1999 account for 59% of the total assets of the German banking system. Thus, they are representative of the German banking system as a whole.

**Figure 5: Size of banks with equity stakes**

This figure illustrates the size of the banks that own equity stakes (*Inside Sample*) compared to other German banks (excluding special banks such as mortgage banks). *Bank Size* is defined as total assets in 1999 taken from the Bankscope database. We plot the 50 largest banks according to this measure as well as the four banks that own equity stakes and are not amongst the largest 50 banks.

*Top 50 banks by size (assets)*



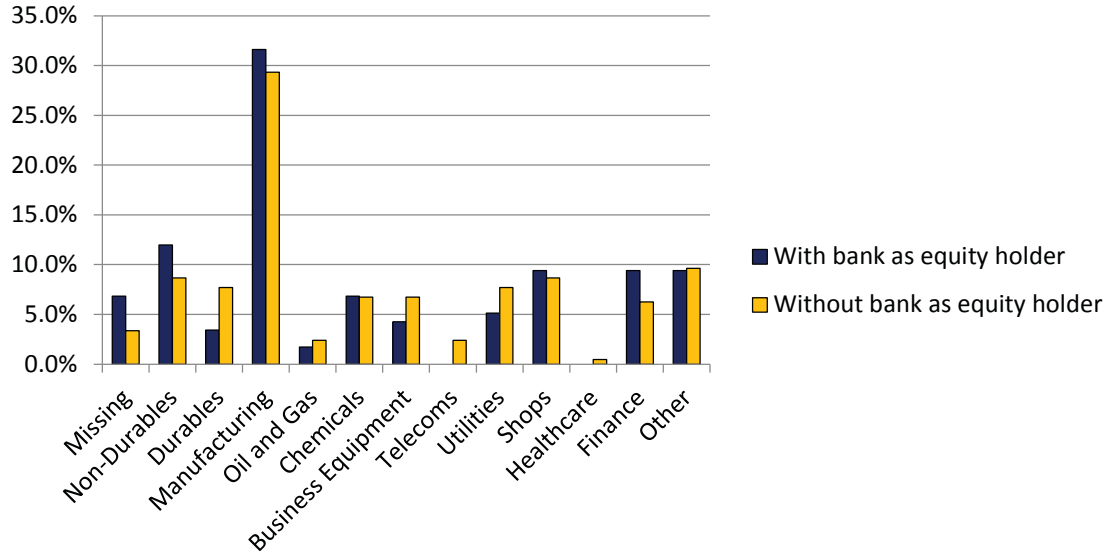
In Figure 6, we compare firms with equity links to a control group matched by assets and the criterion whether the firm is publicly listed. We find that there is no significant difference between the two groups for several control variables and in terms of industry composition. Thus, our firms are representative of German firms in general.

To summarize, the features of our data make it likely that our findings are general and not specific to our sample. Nonetheless, external validity can only be verified using different samples, which calls for further research in this area.

### Figure 6: Comparison of firms with and without equity links

This figure compares firms with banks as equity holders to a control sample matched by assets and whether the company is publicly traded. We match each company having a bank as equity holder to the next smaller and next larger company by assets within the group of public or private companies respectively (due to two firms with equity links being next to each other, the control sample is not exactly twice as large). In Panel A, we compare the firms based on 12 Fama-French industry groups. In Panel B, we report the means and medians for firm-specific control variables in 1999. *Firm Leverage* is defined as book value of debt divided by total assets. *Firm Tangibility of Assets* is defined as cash and equivalents plus net PPE divided by total assets. *Number of Bank Relationships* is the number of banks from which the company receives a loan. *Return on Assets* is EBIT divided by total assets. *Profit Margin* is net income divided by sales. *Asset Turnover* is sales divided by assets. We also report a Student t-test for the difference in means and a Wilcoxon rank-sum test for the difference in medians. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

*Panel A: 12 Fama-French industry groups*




*Panel B: Summary Statistics*

| | Mean | | | Median | | |
|---|---|---|---|---|---|---|
| | No bank as equity holder | Bank as equity holder | T-test of difference | No bank as equity holder | Bank as equity holder | Z-test of difference |
| Firm Leverage | 19.9 | 22.1 | -0.96 | 15.2 | 21.0 | -1.52 |
| Firm Tangibility of Assets (%) | 37.3 | 33.6 | 1.41 | 36.8 | 35.1 | 1.25 |
| Number of Bank Relationships | 14.1 | 12.8 | 0.20 | 5 | 7 | 0.15 |
| Return on Assets (%) | 5.71 | 5.53 | 0.13 | 5.37 | 5.85 | -0.14 |
| Profit Margin (%) | 7.08 | 6.85 | 0.093 | 5.30 | 4.72 | 0.29 |
| Asset Turnover (per year) | 1.35 | 1.31 | 0.27 | 1.11 | 1.17 | -0.50 |
| Observations | 207 | 117 | | 207 | 117 | |

# 5. Robustness checks

## 5.1 Less fixed effects

Given that the main result of our paper is that there is no significant effect, one can be concerned that we do not find statistically significant results, because our tests do not have enough power. The power of our test will be reduced by the large number of fixed effects we employ to control for supply and demand effects. Thus, in the robustness check in Table 6, we show results using two specifications with less fixed effects. In the first specification, we drop the firm-year and bank-year fixed effects as well as the controls for geographical proximity. This barely changes our results at all. In the second specification, we add again the controls for geographical proximity and include bank-Post Reform fixed effects (but exclude firm-time fixed effects). This change does also not alter our results much, suggesting that they are not driven by the specific set of fixed effects we use.

### Table 6: Robustness check: Fewer Fixed Effects

This table presents a robustness check to Table 3 with less fixed effects. The observational unit in this regression is the bank-firm-quarter and the time period spans from 1998 to 2005. A bank-firm pair is only included if there is a lending relationship before the tax reform (average lending from 1998 to 1999 is positive). The dependent variables are *Loan Size (log)*, *Loan Size (EUR million), Bank Share, and Borrower Percentile*. Variables are defined in Appendix 1. In all regressions, we include fixed effects for the bank-firm pair and quarter. In regressions 2, 4, 6 and 8 we add bank-Post Reform fixed effects. In Panel A, the main explanatory variable of interest is the interaction between *Equity Link 1999* and *Post Reform*. The main effects *Equity Link 1999* and *Post Reform* are not included because they are multicollinear with the fixed effects. In Panel B, we exclude all bank-firm relationships with equity stakes that were not sold or for which divestiture information is missing. All standard errors are double-clustered at the bank and the firm level. We report t-statistics below the coefficients in parenthesis. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

*Panel A: All Equity Stakes*

| | Loan Size (log) | | Loan Size (EUR million) | | Bank Share | | Borrower Percentile | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Equity Link 1999 * Post Reform | 0.158 | 0.230 | 11.173*** | 12.727*** | 0.021 | 0.023 | -0.000 | 0.004 |
| | (0.90) | (1.26) | (3.83) | (3.33) | (1.09) | (1.10) | (-0.01) | (0.12) |
| Same City * Post Reform | | -0.388 | | -22.328 | | -0.039 | | -0.189* |
| | | (-0.40) | | (-1.61) | | (-1.54) | | (-1.65) |
| Same Region * Post Reform | | 0.310 | | 18.692 | | 0.033** | | 0.206* |
| | | (0.30) | | (1.27) | | (2.03) | | (1.68) |
| Observations | 13327 | 13327 | 18554 | 18554 | 18554 | 18554 | 18554 | 18554 |
| Adjusted $R^2$ | 0.63 | 0.63 | 0.63 | 0.64 | 0.68 | 0.68 | 0.64 | 0.64 |
| Bank-Firm and Quarter F.E. | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Bank–Post Reform Fixed Effects | No | Yes | No | Yes | No | Yes | No | Yes |

*Panel B: Only Divested Equity Stakes*

| | Loan Size (log) | | Loan Size (EUR million) | | Bank Share | | Borrower Percentile | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Divested Equity Link * Post Reform | 0.186 | 0.230 | 11.445** | 12.919** | 0.010 | 0.018 | 0.019 | 0.023 |
| | (0.96) | (1.06) | (2.20) | (2.42) | (0.48) | (0.77) | (0.75) | (0.79) |
| Same City * Post Reform | | -1.027 | | -22.840 | | -0.052** | | -0.219* |
| | | (-1.17) | | (-1.51) | | (-2.27) | | (-1.82) |
| Same Region * Post Reform | | 1.034 | | 15.268 | | 0.030* | | 0.250** |
| | | (1.21) | | (0.85) | | (1.81) | | (1.99) |
| Observations | 12532 | 12532 | 17640 | 17640 | 17640 | 17640 | 17640 | 17640 |
| Adjusted $R^2$ | 0.63 | 0.63 | 0.62 | 0.63 | 0.65 | 0.65 | 0.63 | 0.63 |
| Bank-Firm and Quarter F.E. | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Bank–Post Reform Fixed Effects | No | Yes | No | Yes | No | Yes | No | Yes |

## 5.2 Different control groups

In our main test, we only include the *Inside Sample* of banks and firms with equity links. Using this Inside Sample has the advantage that our results cannot be driven by different time trends between treated and control firms or banks. The disadvantage is that bank-firm pairs in the control sample may be indirectly affected by the tax reform because the firm (bank) always has an equity link to another bank (firm). Therefore, we show in this section that our results are robust to conducting the same analysis on a larger sample. In this sample, we include all 89 banks that are covered in *Who owns Whom?* and have more than EUR 1 billion in total loans outstanding from 1998 to 1999 according to the *German Large Credit Register*, as well as all firms covered in *Who owns whom?* with assets above EUR 5 million. As the sample is larger, we report regressions using *Difference in Loan Size* as the dependent variable (following the methodology of Khwaja and Mian (2008)).[15]. We report the results of this specification in Table 7. In Panel A, we repeat our analysis on the *Inside Sample* to show robustness to the alternative methodology. As expected given the similarity of the two approaches, the results are very similar. In Panel B, we report results for the full sample of all banks and firms. Once again, all coefficients remain positive and the positive effect for *Borrower Percentile* even becomes significant. Finally, in Panel C, we use only firms that do not have equity links with any bank as the control group. This set up has the advantage that the control firms are not affected by the tax reform. However, this comes at the cost of not being able to control for firm-specific trends because the control group consists of different firms than the treated group. Thus, we report regressions where we replace the firm fixed effects with firm controls. Once again all coefficients are positive and some are even statistically significant.

[15] Due to the larger sample, it is computationally infeasible to run a full-fledged panel model as in Table 2 and Table 3. Due to data confidentiality reasons, we have to run all analyses on the computers of the German central bank, which have low computing power.

## Table 7: Robustness check: Different control groups and regression set up

This table presents regressions examining the effect of the tax reform on lending using different control groups. The dependent variables are differences averages between the pre and post-tax reform period (following Khwaja and Mian (2008)). The pre-reform period contains the average over the quarters in 1998 and 1999, while the post-reform period contains the average over all quarters from 2000 to 2005. The regression includes only bank-firm pairs for which pre-tax reform lending is positive. In Panel A, the sample consists only of firms and banks that have an equity link (as in Tables 3). In Panel B, the sample consists of all banks and companies in our wider sample, i.e. banks that are covered in *Who owns whom?* and have aggregate average lending of more than EUR 1 billion before the tax reform (1998 to 1999) as well as firms that are covered in *Who owns whom?* and have assets above 5 million EUR. In Panel C, we exclude non-linked loans of companies with equity links. In Panel A and Panel B, we report specifications with bank fixed effects as well as specifications with bank and firm fixed effects. In Panel C, we replace firm fixed effects with firm controls (because firm fixed effects cannot be estimated). In all regressions, we include three sets of loan size quartile fixed effects based on *Loan Size*, *Bank Share* and *Borrower Percentile* before the tax reform (average from 1998 to 1999). All standard errors are double-clustered at the bank and the firm level. We report t-statistics below the coefficients in parenthesis. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

*Panel A: Banks and firms with equity stakes*

| | Difference in Loan Size (log) | | Difference in Loan Size (EUR million) | | Difference in Bank Share | | Difference in Borrower Percentile | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Equity Link 1999 | 0.213 | 0.153 | 23.683*** | 23.797*** | 0.027 | 0.027 | 0.020 | 0.030 |
| | (1.17) | (0.91) | (3.24) | (3.74) | (1.41) | (1.30) | (1.29) | (1.32) |
| Same City | -0.550 | -0.883 | -6.596 | -4.115 | -0.072 | -0.078 | -0.071 | -0.070 |
| | (-0.84) | (-1.29) | (-0.77) | (-0.33) | (-1.33) | (-1.35) | (-1.37) | (-0.94) |
| Same Region | -0.311 | 0.006 | 8.853 | 3.867 | 0.061 | 0.068 | 0.019 | 0.014 |
| | (-0.39) | (0.01) | (0.64) | (0.25) | (1.18) | (1.20) | (0.40) | (0.20) |
| Observations | 541 | 541 | 608 | 608 | 608 | 608 | 608 | 608 |
| Adjusted $R^2$ | 0.12 | 0.13 | 0.16 | 0.16 | 0.06 | 0.08 | 0.18 | 0.22 |
| Firm Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Bank Fixed Effects | No | Yes | No | Yes | No | Yes | No | Yes |

*Panel B: All banks and firms*

| | Difference in Loan Size (log) | | Difference in Loan Size (EUR million) | | Difference in Bank Share | | Difference in Borrower Percentile | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Equity Link 1999 | 0.135 | 0.151 | 6.608*** | 6.365*** | 0.028 | 0.022 | 0.042** | 0.035* |
| | (0.78) | (0.88) | (4.06) | (4.02) | (1.43) | (1.08) | (2.34) | (1.89) |
| Same City | -0.192** | -0.238** | -0.023 | -0.365 | 0.010 | 0.002 | -0.003 | -0.005 |
| | (-1.99) | (-1.98) | (-0.05) | (-0.65) | (0.84) | (0.22) | (-0.46) | (-0.68) |
| Same Region | 0.195* | 0.209* | 0.926 | 1.495** | 0.001 | 0.010 | -0.002 | 0.006 |
| | (1.87) | (1.70) | (1.58) | (2.05) | (0.07) | (0.72) | (-0.34) | (0.56) |
| Observations | 9027 | 9027 | 11024 | 11024 | 11024 | 11024 | 11024 | 11024 |
| Adjusted $R^2$ | 0.11 | 0.12 | -0.02 | 0.02 | 0.17 | 0.20 | 0.02 | 0.05 |
| Firm Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Bank Fixed Effects | No | Yes | No | Yes | No | Yes | No | Yes |

*Panel C: Only different firms*

| | Difference in Loan Size (log) | | Difference in Loan Size (EUR million) | | Difference in Bank Share | | Difference in Borrower Percentile | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Equity Link 1999 | 0.456*** | 0.482*** | 7.455*** | 7.442*** | 0.014 | 0.012 | 0.025 | 0.022 |
| | (3.10) | (3.17) | (4.74) | (4.79) | (0.83) | (0.66) | (1.49) | (1.30) |
| Same City | -0.048 | -0.031 | -0.362 | -0.533 | 0.013* | 0.012* | -0.007 | -0.010 |
| | (-0.73) | (-0.36) | (-0.84) | (-1.17) | (1.82) | (1.65) | (-1.22) | (-1.56) |
| Same Region | 0.156** | 0.051 | 0.690 | 0.817 | 0.003 | 0.003 | 0.003 | 0.015 |
| | (2.34) | (0.62) | (1.31) | (1.49) | (0.24) | (0.23) | (0.64) | (1.28) |
| Firm Size (log) | 0.007 | 0.012 | -0.005 | 0.040 | 0.009*** | 0.010*** | -0.005** | -0.005** |
| | (0.57) | (1.01) | (-0.04) | (0.34) | (4.22) | (4.96) | (-2.45) | (-2.43) |
| Firm Leverage | -0.060 | -0.081 | -0.590 | -0.772 | 0.033*** | 0.030*** | -0.001 | 0.000 |
| | (-0.57) | (-0.79) | (-0.95) | (-1.31) | (3.66) | (4.07) | (-0.11) | (0.01) |
| Firm Tangibility of Assets | 0.263*** | 0.232*** | 1.334** | 1.076* | -0.017* | -0.021** | -0.004 | -0.005 |
| | (3.45) | (2.90) | (2.07) | (1.96) | (-1.79) | (-2.33) | (-0.53) | (-0.77) |
| Observations | 9380 | 9380 | 11101 | 11101 | 11101 | 11101 | 11101 | 11101 |
| Adjusted $R^2$ | 0.00 | 0.01 | 0.01 | 0.04 | 0.01 | 0.04 | 0.02 | 0.04 |
| Bank Fixed Effects | No | Yes | No | Yes | No | Yes | No | Yes |

## 5.3 Equity repurchases following the tax reform

Our results could be influenced by banks extending credit to firms in order to enable these firms to buy back the equity stake from the bank. In this section, we study whether our results are driven by this phenomenon. Specifically, we examine whether firms with an equity link exhibit an increase in the number of stock repurchases following the tax reform. We report the results in Table 8. The dependent variable in this regression is a dummy variable equal to one if the firm undertakes a buyback in a year measured as an increase in the number of treasury shares held by the firm. In Regression 1, we estimate a logit model only after the tax reform, which shows that there is no effect of equity stakes on repurchases cross-sectionally. In Regressions 2 to 4, we apply a difference-in-difference set up using a linear probability model in the sample from 1998 to 2005. None of the specifications shows an increase of repurchases for firms with equity links. The coefficients are never significant and in two cases they are, in fact, negative. This finding suggests that the banks did not sell their equity stakes to the specific firms.

### Table 8: Equity repurchases following the tax reform

This table presents regressions examining the effect of the tax reform on the number of equity repurchases depending on whether the firm has a bank as an equity holder. The dependent variable in this regression is a dummy variable equal to one if there was an increase in the number of treasury shares in a year and equal to zero if the change was zero (and neither value was missing). We base this variable first on the number of treasury shares from USTAN/Jalys. If it cannot be determined (because either value is missing), we use data from Compustat Global instead. In Regressions 1, we estimate a logit model only after the tax reform. In Regressions 2 to 4, we estimate a difference-in-difference set up using a linear probability model, i.e. OLS. In Regression 4, we add 12 Fama-French Industry fixed effects interacted with *Post Reform*. All standard errors are clustered at the firm level. The main effects of the interacttions are not included because they are multicollinear with the fixed effects. We report t-statistics below the coefficients in parenthesis. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

| | Repurchase Dummy | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Equity Link 1999 | 0.019 | | | |
| | (0.05) | | | |
| Equity Link 1999 * Post Reform | | 0.001 | -0.008 | -0.012 |
| | | (0.03) | (-0.25) | (-0.39) |
| Firm Size (log) | 0.121* | | | |
| | (1.85) | | | |
| Firm Leverage | -0.151 | | | |
| | (-0.16) | | | |
| Firm Tangibility of Assets | -1.722* | | | |
| | (-1.91) | | | |
| Firm Size (log) * Post Reform | | | 0.000 | 0.000 |
| | | | (0.05) | (0.02) |
| Firm leverage * Post Reform | | | 0.009 | 0.033 |
| | | | (0.14) | (0.47) |
| Firm Tangibility of Assets * Post Reform | | | -0.172** | -0.110 |
| | | | (-2.37) | (-1.41) |
| Observations | 1047 | 1486 | 1473 | 1473 |
| Adjusted $R^2$ | 0.03 | 0.20 | 0.20 | 0.20 |
| Sample Period | After Tax Reform | Full Sample | Full Sample | Full Sample |
| Regression Method | Logit | OLS | OLS | OLS |
| Firm Fixed Effects | No | Yes | Yes | Yes |
| Year Fixed Effects | No | Yes | Yes | Yes |
| Industry–Post Reform Fixed Effects | No | No | No | Yes |

Probability change based on regression 1: 8.25% to 8.4% 7.65% to 7.78% (at means)

### 5.4 Proxy voting

In Germany, banks are allowed to exercise voting rights on behalf of their customers unless the customer instructs the bank how to vote. This proxy-voting is often seen as an additional channel of bank influence (e.g. Gorton and Schmid (2000)) and may be a reason why voting rights from equity stakes are less relevant in Germany. We examine the extent of proxy voting using data from the German Central Bank on the shares that banks hold in custody (*Depotstatistik*). The data is only available from 2005. Since private investors stock market participation did not dramatically change in this time period, the 2005 values should be a good approximation for 1999. On average, all private customers of a bank combined hold only 0.66% of shares in a sample company (median is 0.05%, 90$^{th}$ percentile is 1.5%). Thus, even if none of the private customers voted themselves, the importance of proxy-voting is small compared to the importance of equity stakes, which had an average size of 14.6% (median 10.5%).

## 6. Conclusion

This paper studies how a bank's equity stake in a borrowing firm affects lending to that firm. Several papers have argued that equity stakes may be beneficial for lending because the control rights of the equity stake provide the lender with an advantage in monitoring the borrower and the cash flow rights align the incentives of debt and equity holders. Indeed, the prior literature has documented that equity stakes and lending are positively correlated. However, such a positive cross-sectional correlation does not necessarily mean that equity stakes benefit lending, but may also be driven by endogeneity issues.

In this paper, we address such endogeneity issues by using the German capital gains tax reform in 2000 as a natural experiment. The tax reform abolished the corporate capital gains tax of 50%, enabling banks to divest their equity stakes in industrial companies. We find that banks sell most of their equity stakes in industrial firms after the tax reform. However, we cannot find any evidence that banks reduced lending to these firms following the divestitures. If anything, there is an (insignificant) increase in lending. This suggests that the positive cross-sectional correlation between equity stakes and lending does not imply that equity stakes benefit lending. Rather equity stakes seem to be immaterial to lending.

Thus, the positive *cross-sectional* correlation between equity stakes and lending, which we also confirm in our sample, seems to be driven by endogeneity issues. For example, banks may use their private information from lending to invest into a firm's equity (*reverse causality*) or good relationships with a company may cause a bank to invest in

both, the firm's debt and equity (*omitted variable bias*). An alternative interpretation is that an equity stakes might facilitate the initiation of a lending relationship, but provide no further benefits afterward. We can only speculate which mechanism is at work here, but our results suggest that the cross-sectional evidence is misleading for established lending relationships.

Our findings have important policy implications for bank-based economies such as Germany and Japan as well as for the United States where banks are allowed to hold large equity stakes in their borrowers since the repeal of the Glass–Steagall Act. Our results indicate that the benefits of equity stakes for lending may be overstated in the literature. We find no evidence that regulation preventing banks from owning equity in industrial companies adversely affects lending. More broadly, this finding suggests that conflicts between debt and equity holders are of minor importance in our sample. Our findings are also relevant for institutional investors that participate in lending syndicates because these "shadow banks" often hold both debt and equity of the same company (Jiang, Li and Shao (2010), Lim, Minton, and Weisbach (2012)).

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# Appendix 1: Variable definitions

This table displays the variable definitions for all variables used in the regressions.

*Panel A: Bank-firm-quarter-level variables*

| Variable Name | Definition |
|---|---|
| Loan Size | The aggregate exposure of a bank to a firm at the end of each quarter from the *German Large Credit Register (Millionenkreditevidenz)*. It includes on-balance sheet lending such as loans and bonds as well as off-balance sheet exposures through guarantees, derivatives and undrawn credit lines. Loan Size is set to missing if either the firm or the bank are not in the database for other loans in that quarter. |
| Loan Size (log) | Log $(Loan\ size)$<br>Where log is the natural logarithm and the size of the loan is measured in EUR. |
| Loan Size (EUR million) | Loan size in EUR million. This variable is winsorized at the 1% and 99% threshold. |
| Bank Share | $\frac{Loan\ size}{Sum\ of\ all\ loans\ of\ a\ firm}$<br>All loan data for this variable comes from the *German Large Credit Register*. In the sum of all loans we include also loans of banks that are not in our sample. Bank Share is set to missing if either the firm or the bank are not in the database for other loans in that quarter. |
| Borrower Percentile | We sort all borrowers of a bank by the average size of their loans in the quarter and assign percentiles with the largest borrower receiving 100% and the smallest borrower 0%. We include only borrowers from the respective sample. If a firm does not borrow from this bank, but both the bank and the firm are in the database, we assign a zero. |
| Equity Link is Divested | Dummy variable equal to 1 in the years after an equity stake was divested. More specifically:<br>If Equity Link 1999 is equal to 1 and we know the divestiture time, this variable is 0 before the divestiture and 1 starting in the year when it was divested.<br>If Equity Link 1999 is equal to 0, this variable is equal to 0.<br>If Equity Link 1999 is equal to 1 and the divestiture time is missing, this variable is missing. |

*Panel B: Bank-firm-level variables*

| Variable Name | Definition |
|---|---|
| Lending Relationship | Dummy variable equal to one if the company receives a loan from the bank in December 1999. Set to missing if either the firm or the bank is not covered in the *German Large Credit Register* in December 1999. |
| Equity Link 1999 | Dummy variable equal to one if the bank holds an industrial firm's equity of less than 50%, which is held either directly or through a chain of subsidiaries at the 75% threshold. Unless stated otherwise, we take these holdings as of December 1999. We use data from the "*Who owns Whom?*" database and manually add holdings of banks reported in *Hoppenstedt Aktienführer* 2001 (these holdings are as of December 1999). We exclude holdings in other banks, private equity companies and vehicles of project finance. |
| Divested Equity Link | This variable is the same as Equity Link 1999, but is set to missing if the equity stake was not divested by 2005 or the divestiture information is missing. |
| Same City | Dummy variable equal to one if the bank is located in the same city as the firm (based on the address in "*Who owns Whom?*"). |
| Same Region | Dummy variable equal to one if the bank is located in the same region as the firm. Regions are based on the first two digits of the German postal code (based on the address in "*Who owns Whom?*"). |
| Board Link 1999 | Board Link 1999 is a dummy variable equal to one if a representative of the bank sits on the firm's supervisory board. As bank representative we count: any employee of the bank (in almost all cases they are members of the bank's management board), any former management board member of the bank that does not have a new job and the chairman of the supervisory board of the bank if he does not have a full-time job at another company. This variable is missing if we do not have information on the firm's supervisory board composition. |
| Equity Link with Board Link 1999 | Dummy variable equal to 1 if Equity Link 1999 and Board Link 1999 are equal to 1. It is zero for all other bank-firm pairs. |
| Equity Link without Board Link 1999 | Dummy variable equal to 1 if Equity Link 1999 is equal to 1 and Board Link 1999 is not equal to 1. It is zero for all other bank-firm pairs. |
| Public Equity Link 1999 | Dummy variable equal to 1 if Equity Link 1999 is equal to 1 and the firm is publicly listed. It is zero for all other bank-firm pairs. |
| Private Equity Link 1999 | Dummy variable equal to 1 if Equity Link 1999 is equal to 1 and the firm is not publicly listed. It is zero for all other bank-firm pairs. |
| Difference in Loan Size (log) | $Mean_{2000-2005}(\log(Loan\ Size)) - mean_{1998-1999}(\log(Loan\ Size))$ |
| Difference in Loan Size (EUR million) | $Mean_{2000-2005}(Loan\ Size) - mean_{1998-1999}(Loan\ Size)$. Then this variable is winsorized at the 1% and 99% thresholds. |
| Difference in Bank Share | $Mean_{2000-2005}(Bank\ Share) - mean_{1998-1999}(Bank\ Share)$ |
| Difference in Borrower Percentile | $Mean_{2000-2005}(Borrower\ Percentile) - mean_{1998-1999}(Borrower\ Percentile)$ |

*Panel C: Firm-level variables and firm-quarter level variables*

| Variable Name | Definition |
|---|---|
| Firm Size (log) | Log (total firm assets in 1999)<br>Log is the natural logarithm and firm assets are taken from Worldscope for publicly listed companies and from JALYS/USTAN for privately listed companies. |
| Firm Leverage | The firm's book value of debt divided by the firm's total assets in (both in 1999). |
| Firm Tangibility of Assets | The firm's cash and equivalents plus net PPE divided by the firm's total assets (both in 1999). |
| Repurchase Dummy | Dummy variable equal to one if there was an increase in the number of treasury shares in a year and equal to zero if the change was zero (and neither value was missing). We base this variable first on number of treasury shares from USTAN/Jalys. If it cannot be determined (because either value is missing), we use data from Compustat Global instead. |

*Panel D: Other variables and definitions*

| Variable Name | Definition |
|---|---|
| Post Reform | Dummy variable equal to one for quarters from 2000 to 2005 and equal to zero in 1998 and 1999. |
| Value of Equity Stake | We determine the value of an equity stake by multiplying the firm's market capitalization with the share that the bank holds. If the firm is privately listed, we estimate the market capitalization using a multiple of its book equity, where this multiple is the median of the book to equity ratio of publicly listed companies. |

## Appendix 2: The German banking system

The German banking system consists mostly of universal banks offering a broad range of financial services, including deposits, loans, payment services, and securities transactions. They can be classified into commercial sector banks, public sector banks and cooperative sector banks (Hackethal (2004)).16 Specialized banks (such as mortgage banks, building societies, securities brokers etc) only account for a market share of around 20% in terms of total business volume and are not covered in our data.

Commercial sector banks are organized on the basis of private-sector principles with a clear for-profit orientation. This sector includes large universal banks, which are usually listed on the German stock exchange, regional banks and smaller "private bankers". Compared to others, commercial sector banks have a stronger market position in the securities trading and underwriting business, and they generally provide all domestic and international banking services.

Public sector banks include Landesbanken and savings banks ("Sparkassen"), which are entities under public law with ultimately public ownership. Savings banks are smaller institutions with a regionally specified mandate and a less sophisticated business model. On the other hand, Landesbanken are larger and usually operate in one or more of Germany's 16 states and offer more complex financial products. Furthermore, it is important to note that many savings banks are not allowed to take equity stakes in industrial firms due to their respective articles of association.

Finally, the cooperative sector consists of small credit cooperatives with a regional orientation as well as their central institutions. Compared to commercial sector banks, institutions in the public or cooperative sector rely more strongly on retail than on wholesale funding and on retail and small business lending rather than on lending to large businesses. While the commercial banking sector has the largest market share (around 40% of total business volume according to statistics of the German Central Bank), it is relatively concentrated. In contrast, more than three-quarters of German banks are in the public sector (with a market share of 35%) or cooperative sector (with a market share of 12%).

[16] Please note that "public" refers to "state- owned" and not to "publicly listed".

## Appendix 3: German corporate governance

Germany has a two-tier board system. The management board (Vorstand) is responsible for operative decisions and the supervisory board (Aufsichtsrat) is responsible for representing the interests of shareholders and employees. All stock companies (Aktiengesellschaften) must have a supervisory board, even if they are not publicly listed. A limited company (Gesellschaft mit beschränkter Haftung (GmbH)) must have a supervisory board if it has more than 500 employees and can always have a supervisory board voluntarily. The supervisory board consists of shareholder representatives and representatives of employees. If the company has above 2,000 employees, there are an equal number of shareholder and employee representatives. If there are between 500 and 2000 employees, employee representatives make up one-third of the supervisory board. Below 500 employees, there are no employee representatives. In either case, the chairman of supervisory board (Aufsichtsratsvorsitzender) decides in the case of a tied vote. Thus theoretically, shareholder representatives can always overrule employee representatives if they vote in unison.