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List of Abbreviations

adj.	adjusted
AQ	accounting quality
BilMoG	Bilanzrechtsmodernisierungsgesetz (German Accounting Law Modernization Act)
bp	basis points
C	control
coef.	coefficient
Diff	absolute difference between control and treatment firms
Diff-in-diff	difference in difference
e.g.	for example (“exempli gratia”)
EBIT	earnings before interest and taxes
EDGAR	Electronic Data Gathering, Analysis, and Retrieval system
EHUG	Gesetz über elektronische Handelsregister und Genossenschaftsregister sowie das Unternehmensregister (act about electronic trade registers and cooperative registers as well as the company register)
eq.	equation
et al.	and others (“et alii”)
EURIBOR	Euro InterBank Offered Rate
FE	fixed effects
GAAP	Generally Accepted Accounting Principles
GICS	Global Industry Classification Standard
HHI	Herfindahl-Hirschman index
i.e.	that is (“id est”)
IFRS	International Financial Reporting Standards
MiMiK	Mikrodatenbank Millionenkredite (credit register of large loans, unique database from Deutsche Bundesbank)
mn	million

N	number of observations
NAICS	North American Industry Classification System
OLS	ordinary least squares
P&L	profit and loss
p.	page
pp.	pages
PPE	property, plant and equipment
RMFI	interest rate of banks and other financial institutions for non-financial companies in Germany for short and long term debt, calculated as an average of the interest rate on debt with maturity less than 1 year, between 1 and 5 years, and over 5 years.
ROA	return on assets
SEC	Securities and Exchange Commission
SMEs	small and medium enterprises
stat	statistic
std. dev.	standard deviation
T	treatment
US	United States
USTAN	Unternehmensbilanzen (firms' annual financial statement data, unique database from Deutsche Bundesbank)
vs.	versus

List of Symbols

Latin Symbols

$-(Number\ of\ lenders)_{j,t}$	negative value of the number of lenders firm j in year t
$\Delta AR_{j,t}$	change in accounts receivable for firm j in year t
$\Delta CA_{j,t}$	change in current assets for firm j in year t
$\Delta Cash_{j,t}$	change in cash for firm j in year t
$\Delta CL_{j,t}$	change in current liabilities for firm j in year t
$\Delta Rev_{j,t}$	change in revenue for firm j in year t
$\Delta STDEBT_{j,t}$	change in debt in current liabilities for firm j in year t
$AA_{j,t}$	abnormal level of accruals for firm j in year t
$AQ_{j,t}$	accruals quality measure for firm j in year t, accruals quality is the decile rank (by year) of accruals quality according to McNichols 2002 estimated with eq. (2) and based on rolling 5-year window std. dev.
AQ(sdDD)	decile rank (by year) of accruals quality according to Dechow and Dichev estimated with eq. (8) and based on rolling 5-year window std. dev.
AQ(sdBS)	decile rank (by year) of accruals quality according to Ball and Shivakumar (2006) estimated with eq. (9) and based on rolling 5-year window std. dev.
AQ(J)	decile rank (by year) of accruals quality according to Jones estimated with eq. (10) and based on absolute values
AQ(mJ)	decile rank (by year) of accruals quality according to modified Jones estimated with eq. (11) and based on absolute values
$Asset_{j,t-1}$	lagged total assets, total assets for firm j in year t-1

ASSOCIATE	loans from associated corporations divided by total liabilities
$AvgIntBLiab_{j,t}$	average interest bearing liabilities over the years t and t-1
$Bank\ Debt_{j,t+1}$	total bank debt, one-year ahead value
$CFO_{j,t}$	cash flow from operations
$COD\_adj_{j,t+1}$	adjusted cost of debt
$COD_{j,t}$	cost of debt for firm j in time t
$Control\ Variable_i$	control variable
COVRATIO	interest expense divided by operating income
Dep	depreciation and amortization expense
$D_{j,t}$	dummy equal to one if ΔCFO<0
$DURATION_{j,t}$	relationship duration = number of subsequent years with the same main lender
DURATION(HIGH 50%)	dummy =1 if firms DURATION > sample's median DURATION
DURATION(HIGH 75%)	dummy =1 if firms DURATION > sample's 75th percentile DURATION
DURATION(LN)	natural logarithm of DURATION
FACCESS	one-year ahead access to bank debt
FACCESS2	one year ahead access to bank debt calculated as bank debt divided by total assets
FCOD	one-year ahead cost of debt, proxied as interest expense divided by interest bearing debt
FMATURITY	one-year ahead maturity, proxied by the proportion of total debt that being financed long-term
FSECURED	one-year ahead collateralization, as proxied by the proportion of collateralized debt of total interest bearing debt

$GROWTH_{j,t}$	annual sales growth
HHI	Herfindahl-Hirschman index
i	control variable index
Industry	industry dummy
$Interest\ Bearing\ Debt_{j,t+1}$	interest bearing debt
$Inte_{j,t}$	interest expense over the years t and t-1
j	firm index
k	industry index
L	number of lenders
Legalform	legal form dummies
$LEVERAGE_{j,t}$	total liabilities divided by total assets for firm j in year t
LN	natural logarithm
$LNASSETS$	natural logarithm of total assets
$loan\ from\ main\ lender_{j,t}$	main lender's debt for firm j in year t
$loans\ from\ all\ lenders_{j,t}$	the firm's j overall debt in year t
LoanALender	loan from all lenders
$LoanLender_i$	loan of lender i
$LoanShare_i$	loan share of lender i
m	legal form index
$NA_{j,t}$	normal level of accruals for firm j in year t
$OTHER_{j,t}$	other interest bearing liabilities for firm j in year t
$OWNER_{j,t}$	loans from owners for firm j in year t
$PENSION_{j,t}$	pension liabilities for firm j in year t
$PPE_{j,t}$	gross value of property, plant and equipment for firm j in year t
$POST_{j,t}$	time of the disclosure enforcement initiative for firm j in year t
$ROA_{j,t}$	return on assets for firm j in year t

$SECURED_{j,t}$	secured debt divided by total debt for firm j in year t
$SIZE_{j,t}$	firm size, measured as the logarithm of total assets, for firm j in year t
$STRENGTH_{j,t}$	relationship strength for firm j in year t
$STRENGTH(COUNT)_{j,t}$	negative value of the number of lenders for firm j in year t
$STRENGTH(HIGH\ 50\%)$	dummy =1 if firms STRENGTH > sample's median STRENGTH
$STRENGTH(HHI)_{j,t}$	borrowers' concentration index for firm j in year t
t	year index
$TA_{j,t}$	total accruals for firm j in year t
$TANGIBLE_{j,t}$	asset collateralizability, measured as tangible assets over total assets, for firm j in year t
$TCA_{j,t}$	total current accruals for firm j in time t
$TREATMENT_{j,t}$	treatment status for firm j in year t
$VOLUNTARY_{j,t}$	voluntary disclosure status for firm j in year t
Year	year dummy
$Z\_SCORE_{j,t}$	probability of default, Altman Z-score, for firm j in year t

Greek Symbols

α_0		intercept in a regression
α_i	$i = 1,2,\ldots,6$	coefficients in a regression
β_0		intercept in a regression
β_i	$i = 1,2,\ldots,5$	coefficients in a regression
γ_i	$i = 1,2,3$	coefficients in a regression
$\hat{\gamma}_i$	$i = 1,2,3$	estimated coefficients in a regression
Δ		delta, change or difference
$\varepsilon_{j,t}$,		error term, residual of a regression
$\eta_{j,t}$		error term, residual of a regression
$\nu_{j,t}$		error term, residual of a regression
$\xi_{j,t}$		error term, residual of a regression
σ		standard deviation
$\sigma(\varepsilon_t)_{j,t}$		rolling standard deviation of the residual values
σ(NIBE)		standard deviation of net income before extraordinary items as a rolling 5-year window, scaled by average total assets
ϕ		intercept in a regression
ϕ_i	$i = 1,2,3,4$	coefficients in a regression

1. Introduction

1.1. Research field and motivation

Information asymmetry between lender and borrower is a main problem in debt contracting. Its consequences are adverse selection and moral hazard. On the one hand, adverse selection is the problem that lenders face firms of unknown quality. On the other hand, moral hazard arises since firms' managers' intention and performance is unpredictable. [1] Therefore, lenders use different information sources to decrease information asymmetry and overcome the mentioned problems (e.g., Berger and Udell 2006; Cassar *et al.* 2015; Danos *et al.* 1989). Two main sources are private information (soft factors) and accounting information (hard factors).[2] A central research question is how these different information sources interact with each other in reducing information asymmetry (Beyer *et al.* 2010). Recent research addresses this question and leads to contrary results. The results of Kano *et al.* (2011) indicate that audited statements and relationship duration complement each other. Contrary, Cassar *et al.* (2015) show that the use of accrual accounting (instead of cash accounting) and the duration of a relationship substitute each other in reducing information asymmetry. Furthermore, Bharath *et al.* (2011) illustrate in their study that firms with low accounting quality get more benefits of relationship lending. The mentioned studies do not only have contradicting results, but the latter study is also an examination of public firms in a market-based environment where lenders rely mostly on financial statements. Hence, it is interesting to shed light on the contradicting results and examine the mentioned research question in a bank-based environment where lenders mostly rely on relationship lending (Ball and Shivakumar 2005; Burgstahler *et al.* 2006).

Until now, European research examined the influence of private and accounting information on debt contracting separately. The accounting research shows that better accounting quality leads to higher access to bank debt (García-Teruel *et al.* 2014) and to lower cost of debt (Vander Bauwhede *et al.* 2015) for small and medium private firms.

[1] For a detailed explanation, see e.g. Scott (2012).
[2] See Berger and Udell (2006) for explanation of soft and hard information factors.

However, debt contracting is traditionally based on relationship lending for aforementioned firms in a bank-based environment (Ball and Shivakumar 2005; Burgstahler *et al.* 2006). Therefore, the first part of this doctoral thesis tries to fill this gap and answers the question how relationship lending affects the influence of accounting quality in reducing information asymmetry in a bank-based environment. Using different measures for relationship lending, we find that accounting and private information, substitute as well as complement each other. Accordingly, the first part of this doctoral thesis demonstrates that it is difficult to disentangle the particular role of each information source for existing borrowers. Thus, inspired by Danos *et al.* (1989), who state that accounting information is particularly valuable in evaluating new borrowers, we analyze in the second part of this doctoral thesis if mandatory publication of accounting information leads to lower information asymmetry in the form of firms' higher access to bank debt. In particular, we use the fact, that information asymmetry exists between different parties. The first considered is the already mentioned information asymmetry between inside lender (i.e. housebank) and the private firm, which is reduced through private and accounting information. The inside lender already has granted loans and is continuously monitoring and screening the existing borrower. The second possible information asymmetry is between outside (i.e. potential) lender and private firm. In particular, the outside lender has the goal to establish a debt contract with the private firm as a potential new borrower. The third conceivable information asymmetry is between inside and outside lender. Thus, the outside lender has an informational disadvantage compared to the potential borrower as well as compared to the inside lender. The outside lender could reduce the mentioned information asymmetry with publicly available accounting information (Ball *et al.* 2008; Kim, Simunic *et al.* 2011). The regulatory environment in Germany gives the possibility to simulate the information asymmetry between the mentioned parties. A regulatory change, where private firms have to make their accounting information publicly available, allows examining, if accounting information decreases information asymmetry between the previously discussed parties.

1.2. Research questions, results, and contributions

This doctoral thesis is based on studies examined using datasets of the Deutsche Bundesbank. In the following, we summarize the research questions, results, and contribution of each study.

In the first study "Does accruals quality matter for German private firms' cost of debt? The role of relationship lending" we examine how relationship lending influences the effect of accruals quality on cost of debt. A standard assumption in valuation is that investors evaluate securities based on expected future cash flows. The accounting literature proposes that accruals quality reflects the information uncertainty of cash flows. If firms have low accruals quality, then investors should anticipate higher information risk and should require higher cost of debt (Francis *et al.* 2005). Several studies find that firms with better accruals quality get lower lending rates for debt issuances (Bharath *et al.* 2008; Francis *et al.* 2005; Karjalainen 2011; Vander Bauwhede 2007). However, in Germany there is a bank-based financial system, where banks rely more on private information than on financial statements (Burgstahler *et al.* 2006). Therefore, this study tries to answer the questions, if accruals quality has an effect on cost of debt and how relationship lending changes this effect.

In this study, we use two unique databases from Deutsche Bundesbank, the credit register of large loans (MiMiK) and the firms' annual financial statement data (USTAN). Our final sample includes 10,024 observations for 2,159 small and medium sized firms during 2002 to 2008. We initially exhibit that banks require lower cost of debt from firms with better accruals quality. This indicates that better accruals quality helps banks to better assess firm risk. We then document that firms with better accruals quality get a lower reduction in the cost of debt the larger the amount they borrow from the main bank. This suggests that banks complement accounting information with additional private information channels if the loan amount warrants more scrutiny. Finally, we find that better accruals quality firms get a larger reduction in cost of debt the longer their relation to the same main bank. An explanation could be that repeated interactions with the same firm lead banks to interpret accounting information better. This study makes two contributions. First, to the best of our knowledge, we are the first to examine how

relationship strength mitigates the effect of accruals quality on cost of debt for a sample of German private small and medium enterprises. Second, we show that relationship duration increases the effect of accruals quality.

The second study "What happens if private accounting information becomes public?" analyzes the effect of mandatory public disclosure on firms' access to bank debt. The housebank can monitor the firm more effectively than an outside lender, as it has access to its financial statements and additional private information. Housebanks aim to be the firm's exclusive lender (Diamond 1984) and have an incentive that firms cover up their financial statements (Bigus and Hillebrand 2016). Furthermore, also proprietary costs of public disclosure (Bernard *et al.* 2015) can result in firms' sharing financial statements only with their house banks. However, from 2006 on, German private firms have to publicize their financial statements in the online federal gazette. Therefore, we analyze if this mandatory publication leads to benefits for firms. Do outside lenders use these publicly available financial statements to assess firms' quality and offer (additional) bank debt?

In this empirical analysis, we use USTAN of the Deutsche Bundesbank and the commercial dataset Amadeus of Bureau van Dijk, propensity score matching and a difference-in-difference design. The final sample includes 48,623 firm-year observations from 2004 to 2009. Employing the act about electronic trade registers and cooperative registers as well as the company register (EHUG), which increased enforcement and first established fines for firms that do not publicly disclose their financial statements, at first glance surprising, we hypothesize and find that the information asymmetry between inside and outside lenders decreases, and firms' access to bank debt increases. Accordingly, our study shows that mandatory public disclosure results in increased competition between lenders. As such, it decreases hold-up problems for private firms. Thus, it indicates short-term positive effects of the EHUG regulation for debt contracting of small and medium private firms. Since we lack credit data, our results do not show whether the inside or outside lender grants additional debt. After accounting information becomes public, it is possible that inside lenders provide additional bank debt to fend of new lenders, or outside lenders make use of the decreased information asymmetry and

offer bank loans. Therefore, in an additional analysis, we examine the influence of mandatory publication on firms' price and non-price credit terms (i.e. interest rate, maturity, and collateral). We hypothesize, that credit terms will improve (worsen) if they are granted by inside (outside) lenders. First, regarding the price credit term, it is possible that the inside lender already used its monopoly position and can offer lower interest rates (Boot and Thakor 1994), whereby the outside lender will probably ask for higher interest rates due to the "winner's curse"[3] (Degryse and van Cayseele 2000; Thadden 2004). Second, concerning the non-price credit terms, the inside lender can use the established relationship to monitor the firm and does not need to impose shorter maturity and more collateral (worse credit terms) as a substitute for monitoring. Contrary, the outside lender will, due to the absence of relationship lending, use shorter maturity and more collateral to decrease adverse selection and moral hazard (Holmstrom and Tirole 1997). Our results show that once private accounting information becomes public it leads to a deterioration of the interest rate and collateral and to an improvement of maturity. Since the credit terms worsen as well as enhance, we conclude that inside as well as outside lender grant additional debt following the EHUG enforcement. Results of this quasi-natural experiment, and our novel dataset in a non-voluntary private firm setting, contribute to the discussion revolving around the nexus between private and public information in debt contracting. Contrary to the first study of this thesis, where we use accruals quality as a measure for accounting information, mandatory accounting publication does not suffer of endogeneity problems. Thus, with this quasi-natural experimental setting we decrease self-selection problems connected to discretionary accounting disclosure choices (Cassar 2011; Cassar *et al.* 2015; Minnis 2011).

The remainder of this doctoral thesis consists of two main parts. Chapter 2 examines the effect of accruals quality on cost of debt. Chapter 3 analyzes the influence of publicly available accounting information on firm's access to bank debt and credit terms. Chapter 4 summarizes the main findings and gives direction for future research.

[3] The winner's curse comes from auctions with incomplete information where the winner overpays and is therefore "cursed" (Thaler 1988). Furthermore, Engelbrecht-Wiggans *et al.* (1983) show that the informed bidder has positive expected profits and the uninformed bidder has zero expected profits. Thus, in our context, the uninformed bidder is the outside lender that tries to compensate for the winner's curse.

2. Does accruals quality matter for German private firms' cost of debt? The role of relationship lending

In this chapter, we examine the role of accruals quality for German private firms' cost of debt. The main idea is to proof if accruals quality matters for small and medium enterprises in a bank-based environment where strong relationship lending exists. We provide empirical evidence that accruals quality influences firms' cost of debt even after interacting it with several relationship lending measures. The following analyses are conducted as part of the research project "The role of accruals quality for German firms' cost of debt" in cooperation with Deutsche Bundesbank. The views expressed in this study are those of the authors and do not necessarily reflect those of Deutsche Bundesbank.[4] We have presented a previous version of this study at the EAA Annual Congress in Maastricht 2016.[5]

This chapter is organized as follows. Section 2.1 gives an introduction. Section 2.2 provides a brief literature overview and the hypotheses. Section 2.3 describes the cost of debt, relationship lending and accruals quality metrics and the model. Section 2.4 explains the data. Section 2.5 illustrates the main results. Section 2.6 reports the results of robustness checks. Section 2.7 concludes.

2.1. Introduction

Accounting quality clearly influences debt contracting of public firms in a capital market environment (Bharath *et al.* 2008; Francis *et al.* 2005). These firms lend more money from arm's length investors, which use financial statements as the prime source to lower information asymmetry (Ball and Shivakumar 2005; Burgstahler *et al.* 2006), than from banks. Yet, the role of accounting quality for lenders of private firms in a bank-based environment is still questionable. Indeed, previous bank-based studies find that accounting quality influences debt contracting of private firms (Karjalainen 2011; Vander Bauwhede *et al.* 2015). However, they do not control for relationship lending, which

[4] The data used in this study is not publicly available due to confidentiality agreements with Deutsche Bundesbank.

[5] The paper version of this study is co-authored with Carsten Homburg (University of Cologne), Julia Nasev (University of Cologne), and Stefan Goldbach (Deutsche Bundesbank).

should be the prime information source for lenders within these circumstances (Ball and Shivakumar 2005; Burgstahler *et al.* 2006). To address this issue, we investigate how accounting and private information interact in reducing information asymmetry of private firms in a bank-based system.

We analyze a large sample of German private small and medium enterprises (SMEs)[6] and use two unique databases from Deutsche Bundesbank, the credit register of large loans (MiMiK) and the firms' annual financial statement data (USTAN). Our final sample includes 10,024 observations for 2,159 firms from 2002 to 2008. Our measure for accounting quality is accruals quality on the basis of firms' financial statements estimated with the modified Dechow and Dichev (2002) model by McNichols (2002) as the rolling 5-year window standard deviation of residuals. Furthermore, to approximate for relationship lending, we use two relationship intensity measures (Degryse and van Cayseele 2000; Kano *et al.* 2011; Stein 2015). The first measure, relationship strength, is defined as the fraction of loans from the main bank to total loans, since this proxy most probably best reflects banks' incentives to monitor and to access private information (Diamond 1984). Thus, if the loan amount warrants more scrutiny, the main bank has incentives to acquire costly private information. The second measure, relationship duration, is defined as the number of subsequent years in which the main bank remains the same. It represents the bank's learning process due to frequent interactions. Longer relationships should increase the bank's competence to interpret accounting information properly.

We find that higher accruals quality leads to lower cost of debt indicating that banks rely on accounting based lending. Furthermore, we exhibit that the larger the amount a firm borrows from the main bank (i.e. higher relationship strength) the smaller is the effect of accruals quality on the cost of debt, which is a signal of the use of an additional private information channel. Finally, the outcomes suggest that longer relationships with the main bank lead to an increase in the cost of debt benefit of accruals

[6] According to the European Commission, a firm which has less than 250 staff headcount and either turnover less or equal to €50 million or total assets less or equal to €43 million is considered a SME. The European SME definition is available at: http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition/index_en.htm, last access: 20/08/2017.

quality. A potential explanation for this observation is that the bank learns to better assess the accuracy of accounting information as the length of the relationship increases.

Our study makes two contributions to the literature. First, to the best of our knowledge, we are the first to examine how relationship strength mitigates the effect of accruals quality on cost of debt for a sample of German private SMEs. Second, we show that relationship duration increases the effect of accruals quality.

The studies of Bharath *et al.* (2011), Cassar *et al.* (2015), and Kano *et al.* (2011) are the most related papers to our analysis. First, Bharath *et al.* (2011) analyze how relationship benefits change according to information opacity[7] using loans of listed US firms. Firms with higher information opacity have higher relationship benefits according to their estimates. Second, Cassar *et al.* (2015) examine the effect of a firm's choice to use accrual accounting on cost of debt and if relationship duration as an alternative source of information complements or substitutes this effect. According to them, firms with longer relationships get less benefit from using accrual accounting. They use a sample of small businesses from the US with 855 firms for the year 2003. Finally, Kano *et al.* (2011) analyze how information verifiability (audit vs. no audit) influences the effect of relationship lending (relationship scope and relationship duration) and conclude that firms with no verified information are more locked in. Their sample consists of 1,775 SMEs in Japan for the year 2002. In line with Bharath *et al.* (2011), Cassar *et al.* (2015), and Kano *et al.* (2011) we show that a strong relationship moderates the effect of accruals quality for German private firms. Thus, if the bank is the main lender, it has incentives to acquire costly private information. In addition, we show that a longer relationship enhances the effect of accruals quality. A possible explanation is that the bank better interprets accounting information. As the relationship continues, the bank will gain a data history on accounting information and can generate additional knowledge.

We contribute especially to the European research on the consequences of accruals quality and relationship lending. Previous European research focuses either exclusively on the influence of accruals quality (Karjalainen 2011; Vander Bauwhede *et*

[7] Information opacity is approximated with discretionary accruals out of the modified Dechow and Dichev (2002) model by McNichols (2002) and higher information opacity means lower accruals quality.

al. 2015) or on the impact of relationship lending on cost of debt (Angelini *et al.* 1998; D'Auria *et al.* 1999; Degryse and van Cayseele 2000; Elsas and Krahnen 1998; Harhoff and Körting 1998; Lehmann and Neuberger 2001; Machauer and Weber 1998; Stein 2015), but it does not consider the joint effect. We address this concern and investigate the collective influence of accruals quality and relationship lending in debt pricing.

Finally, it is important to emphasize, that the German environment is especially worthwhile for the analyses of accruals quality, relationship lending, and cost of debt since Germany exhibits a traditional bank-based financial system and German private firms strongly depend on bank debt (Allen and Gale 1995; Bigus *et al.* 2009; Francfort and Rudolph 1992). Furthermore, Germany is well known for its house banks with strong relationships to their borrowers (Elsas and Krahnen 2003). In addition, German private firms are subject to several mandatory publication rules[8], which possibly lead to an increased importance of financial statements for lenders.

2.2. Related literature and hypotheses

We consider two possible sources to reduce lenders' information risk[9] and therefore to lower firms' loan rate: on the one hand accounting based lending, which refers to the assessment of firms earnings quality, and on the other hand, relationship lending related to monitoring, accessing private information, and banks' learning process.

Since accruals quality is our proxy for earnings related information risk, we start with the explanation of the theoretical relationship between earnings related information risk and cost of debt. Moreover, we discuss empirical findings, which show that the importance of accounting information in debt contracting differs among market-based and bank-based systems and among private and public firms. Then, we argue that especially for privately held firms in bank-based financial systems, as in Germany, the

[8] The mandatory disclosure for corporations is defined in 2003 in the German Commercial Code, Section 325 (https://www.gesetze-im-internet.de/hgb/__325.html, last access: 22/09/2016). Furthermore, the publication of financial statements is strongly regulated since the introduction of the EHUG (Act on Electronic Commercial Registers, Registers of Cooperatives and Business Registers) in 1.1.2007. From this moment on, firms had to pay monetary penalties if not publicizing their financial statements on time (http://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBl&start=//*%255B@attr_id=%27bgbl106s2553.pdf%27%255D#__bgbl__%2F%2F*%5B%40attr_id%3D%27bgbl106s2553.pdf%27%5D__1474545682099, last access: 22/09/2016.).

[9] Information risk is the probability that investors get poor quality information about the firm (Francis *et al.* 2005).

analyses of the effect of accruals quality on the debt pricing should include relationship lending as an important alternative information source. Finally, we derive our hypothesis that relationship strength moderates the accruals quality effect on cost of debt. However, at the same time relationship duration enhances the effect of accruals quality on cost of debt.

The theoretical link between the quality of accounting information and the cost of debt arises from information asymmetries between lenders and borrowers in debt markets (Easley and O'Hara 2004; Leuz and Verrecchia 2005). To determine interest rates on debt contracts lenders assess the borrower's ability to repay debt (García-Teruel *et al.* 2014) by estimating the borrower's future cash flows. Poor accounting quality reduces the precision with which lenders can predict those future cash flows. To compensate for this information risk, lenders charge higher interest rates (Leuz and Verrecchia 2005). Francis *et al.* (2005) propose accruals quality as a proxy for the quality of accounting information which is related to information risk. Accruals map earnings into cash flows such that a lower accruals quality reflects a poorer mapping and leads to higher information risk for the lender.

The importance of accounting information for the lender depends on the underlying financial system and the firms being private or public. The literature differentiates between market-based and bank-based financial systems, which arise due to different developments of financial institutions, banking systems and legislation (see Allen and Gale 1995; Leuz *et al.* 2003, for a review). Allen and Gale (1995) characterize US and Germany as two extreme versions of financial systems. In the US, a market-based system, financial markets play the dominant role. Firms mostly incur debt from arm's-length lenders, who make decisions primarily based on financial statements. In contrast, Germany is a bank-based system, where financial markets play a weaker role in refinancing operations. Firms borrow money primarily from banks, which rely mostly on private information rather than on firms' financial statements (Burgstahler *et al.* 2006). Consequently, accounting information seems to be less important for lenders in bank-based than in market-based systems. Furthermore, Ball and Shivakumar (2005) show that the importance of financial statements in debt contracting differs between private and

public firms. The results suggest that lenders of private firms get more "inside access" to information through relationship lending and do not demand high quality accounting. In contrast, lenders of public firms reduce information asymmetry problems through financial statements. To sum up, the effect of accruals quality on cost of debt should be the smallest for privately held firms in bank-based financial systems as it is the case in our setting of German private firms.

The empirical evidence in market-based and bank-based financial systems supports the theoretical link between the quality of financial information and the perception of lenders' information risk. First, prior studies in market-based financial systems find that higher accruals quality is associated with lower cost of debt (Francis *et al.* 2005), longer maturity, and lower collateral requirements (Bharath *et al.* 2008). This is consistent with the notion that creditors in market-based systems rely on financial statements to infer accounting quality and information risk. Second, recent empirical research for privately held firms in bank-based systems indicates that higher accruals quality entails lower cost of debt (Karjalainen 2011; Vander Bauwhede *et al.* 2015) and better access to bank loans (García-Teruel *et al.* 2014). However, keeping in mind that especially lenders of private firms in bank-based system rely mostly on relationship lending, the effects of accruals quality could be estimated incorrectly. Thus, neglecting the influence of relationship lending in reducing information asymmetry between lender and borrower leads to an omitted variable bias and consequently to improper inferences about the role of accruals quality.

Therefore, we investigate how relationship lending influences the effect of accruals quality on cost of debt. Previous studies use different relationship intensity measures (for a detailed overview, see Degryse *et al.* 2009). To capture two aspects of relationship lending, we simultaneously use two relationship intensity measures: relationship strength and relationship duration (Degryse and van Cayseele 2000; Kano *et al.* 2011; Stein 2015).

The first hypothesis relates to the influence of relationship strength on the effect of accruals quality on firms' loan rate. Relationship strength measures the amount the firm borrows from the main bank in relation to its overall debt. Previous theoretical and

empirical research shows that high relationship strength enhances lenders' monitoring and accessing private information (Bharath *et al.* 2011; Elsas 2005; Stein 2015) even though both is costly for the bank (Diamond 1984). If the bank is the main lender of the firm and high relationship strength exists, the gains from monitoring exceed the underlying costs. Hence, the bank has the incentive to maintain the position of being a firm's exclusive lender and invests in the relation with the firm. If the firm receives credit from multiple banks (i.e. low relationship strength exists), then the main bank has less incentive to acquire costly private information due to a potential free rider problem (Diamond 1984). In sum, if the firm borrows the majority of its debt from one bank, then this bank replenish accounting information with additional private information channels. According to these considerations, we expect that relationship strength decreases the effect of accruals quality on cost of debt.

The second hypothesis deals with the influence of relationship duration on the effect of accruals quality on firms' loan rate. Relationship duration captures the subsequent years where the main lender does not change and describes the bank's learning process. As the relationship goes on, banks will gain accounting and private information, which will lead to a better interpretation of accruals quality. On the one hand, as the relationship proceeds, banks acquire accounting information through the financial statements handed in by firms. On the other hand, repeated interactions and tracking firms' bank accounts enables banks to learn about firms' cash flow patterns. Since accruals quality is a measure which shows how well earnings match into past, present, and future cash flows, the knowledge about cash flow dynamics leads to a better understanding of accruals quality. Another conceivable explanation is that banks accumulate other information, which indirectly help them interpret accruals quality better. First, it is reasonable to assume that banks keep regular contact with firms' managers, to talk about future projects and get to know managers' skills. Through private information about future projects, the bank can better predict future cash flows based on the same financial report. Furthermore, if banks are familiar with managers' skills, they can better differentiate between innate and discretionary accruals quality (Dechow and Dichev 2002; Demerjian *et al.* 2013). A second example of other information is gathering

knowledge about a firm's industry. This helps banks to position firms relative to their industry peers. Firms in volatile industries will possibly have lower accruals quality due to larger estimation errors, even if they have highly skilled managers (Dechow and Dichev 2002). In sum, repeated interactions with firms' manager and gathering knowledge about firms' industry will lead banks to understand accruals quality better. Altogether, the longer the relationship, the better the bank measures and interprets earnings related information risk. Therefore, we expect that relationship duration increases the effect of accruals quality on the cost of debt.

2.3. Variable measurement

2.3.1. Cost of debt

To calculate our cost of debt proxy, we rely on the balance sheet approach and define the measure as follows:

$$COD_{j,t} = \frac{Inte_{j,t}}{AvgIntBLiab_{j,t}} * 100, \quad (1)$$

where Inte=interest expense, AvgIntBLiab=average interest bearing liabilities over the years t and t-1, j=1,…,N is the firm index, and t=1,…,T the year index.

Several prior studies use this ratio with some differences in the measurement of the denominator (Bigus *et al.* 2009; Francis *et al.* 2005; Karjalainen 2011; Minnis 2011; Pittman and Fortin 2004; Stein 2015; Vander Bauwhede *et al.* 2015). Another possibility to define cost of debt relies on information about the interest rate on a firm's loan. Petersen and Rajan (1994) use the interest rate on a firm´s most recent loan and Elsas and Krahnen (1998) employ the interest rate spread[10]. However, each approach has its pros and cons. The advantage of credit data is a more precise cost of debt measure. The drawback is a very limited sample size that exacerbates generalizability and impedes the examination of questions that require larger panels. In contrast, even though cost of debt estimates based on the balance sheet approach can be noisy, more observations for the econometric analysis are available. Since we lack data on the interest rate on a firm's loan, we calculate cost of debt with the balance sheet approach.

[10] The interest rate spread is defined as the difference between the interest rate on firm loans and the prime rate, which is for the Euro area the three-month EURIBOR.

Two reasons cause the noisiness of the cost of debt measure from eq. (1). The first relates to the denominator (AvgIntBLiab) with only two values, at the beginning and end of the year. Hence, the value of the denominator could be very small at the end of the year (Lev and Sunder 1979). Dropping extreme outliers mitigates this problem. Even though the balance sheet approach leads to noisy estimates, the literature accepts this drawback (Pittman and Fortin 2004). The second reason is a special case for German firms and concerns the non-financial part of the numerator and denominator of eq. (1), resulting especially from the accountancy of pension provisions[11]. More specifically, we include financial liabilities (short and long term loans from financial institutions, connected companies and owners) and non-financial liabilities (pension provisions[12]) in the cost of debt denominator (AvgIntBLiab). The numerator (Inte) consistently includes financial interest expense and non-financial interest expense[13]. However, we are interested only in the cost of debt charged by the lenders to examine our main research question. We solve this problem by controlling for the share of pension provisions, loans from owners and associated corporations in our regression analysis. Additionally, we introduce an adjusted cost of debt proxy in the robustness section (Section 2.6.1), which reflects the cost of debt charged by banks.

2.3.2. Accruals quality

Our accruals quality proxy is based on the modification of the Dechow and Dichev (2002) model by McNichols (2002). The original Dechow and Dichev (2002) model is a regression of current accruals on past, current, and future cash flows. The current accruals,

[11] German firms traditionally fund the defined-benefit pension plans internally via provisions, whereby US companies use external funding via pension funds. German firms report the pension liabilities on the balance sheet as part of other non-current liabilities. Rajan and Zingales (1995) report that 29% of German firms' liabilities are other liabilities (for US firms it is only 5.8%) and 50% of other liabilities are pension provisions. At the end of 2002 pension provisions equaled one third of the German equity market capitalization (Gerke *et al.* 2005) and have a significant share in the balance sheet of German firms.

[12] Bigus *et al.* (2009) examine German firms and conjecture that peculiarities of the German Tax Law and German GAAP bias their cost of debt measure upward for two reasons. First, the interest expense of off-balance leasing agreements increases the numerator (Inte), while the off-balance leasing agreements do not increase the denominator (AvgIntBLiab). Second, the interest expense of some forms of equity (e.g. silence partnerships) increases the numerator without increasing the denominator. We suggest pension provisions as a third factor – specific to the German institutional setting - that potentially biases German cost of debt estimates.

[13] The future expenses for pensions have to be incorporated in the balance sheet. Therefore, the pension expectations are discounted to the present value and this amount is included in the balance sheet under the item "other liabilities". In the following years, those initially booked pension provisions increase by the yearly discounted amount and are booked against interest expense (Baetge *et al.* 2012).

which cannot be explained through past, present, and future cash flows are defined as abnormal accruals (representing low accruals quality). In the modification by McNichols (2002), property, plant and equipment, and change in revenue are added as additional explanatory variables to the Dechow and Dichev (2002) approach. McNichols (2002) argues that cash flows cannot cover the complete variation in accruals and that proxies for the uncertainty of the environment would increase the explanation of the accrual changes.

On the one hand, changes in a firm's environment lead to variation in normal accruals which is explained by the exogenous variables of the regression. On the other hand, variations in abnormal accruals are the result of management discretion and the driver of bad accruals quality, and hence represent the unexplained part of the regression estimation. Therefore, to calculate accruals quality, we first estimate eq. (2) for each of the 374 industry-year clusters[14] of our sample and require a minimum of 20 firms in each cluster:

$$TCA_{j,t} = \alpha_0 + \alpha_1 CFO_{j,t-1} + \alpha_2 CFO_{j,t} + \alpha_3 CFO_{j,t+1} + \alpha_4 \Delta Rev_{j,t} + \alpha_5 PPE_{j,t} + \varepsilon_{j,t}, \quad (2)$$

where TCA=total current accruals[15]=ΔCA - ΔCL - ΔCash + ΔSTDEBT, CFO=cash flow from operations=NIBE - TA, NIBE=net income before extraordinary items, TA[16]=total accruals=ΔCA - ΔCL - ΔCash + ΔSTDEBT – Dep - ΔProv, ΔCA=change in current assets, ΔCL=change in current liabilities, ΔCash=change in cash, ΔSTDEBT=change in debt in current liabilities[17], Dep=depreciation and amortization expense, ΔRev=change in revenue, PPE=gross value of property, plant and equipment, j=1,…,N firm index, and t=1,…,T year index. All variables of the regression are divided by average total assets of the previous (t-1) and current year (t).

[14] We use two-digit industry codes that are comparable to three-digit NAICS, Fama and French 48 industries or six-digit GICS, all of which give a similar number of observations per industry (Bhojraj *et al.* 2003).

[15] Since we do not have data from cash flow statements, we calculate total current accruals with the indirect balance sheet method according to Francis *et al.* (2005). They show that the results with the indirect balance sheet method are comparable to the results calculated with the data out of the cash flow statement.

[16] Daske *et al.* (2006) propose the modification of TA including changes in provisions (ΔProv). In unreported analyses, we calculate total accruals without including changes in provisions as: TA=ΔCA - ΔCL - ΔCash + ΔSTDEBT – Dep. Our results are robust to this modification.

[17] We use change in loans instead of change in debt in current liabilities.

Accruals quality is measured using the residuals of the estimated eq. (2). It is calculated as the rolling standard deviation (std. dev.) of the residual values over the past five years (from *t* to *t-4*). Since accruals quality is a result of a rolling std. dev. with the window five, there are a few annual results for each firm. To get accruals quality in year *t*, years *t* to *t-4* are needed to calculate an annual accruals quality measure for each firm, $\sigma(\varepsilon_t)_{j,t}$[18].We follow the recent literature (García-Teruel *et al.* 2014) to proxy accruals quality and use the negative value of the std. dev. of residuals: $-\sigma(\varepsilon_t)_{j,t}$, where larger values of $-\sigma(\varepsilon_t)_{j,t}$ represent better accruals quality. Similarly as Demerjian *et al.* (2013), we rank accruals quality by year using deciles to make the estimates more comparable across time and to decrease the influence of extreme observations. Thus, our accruals quality measure is defined as: $AQ_{j,t}=[-\sigma(\varepsilon_t)_{j,t}]_{\text{DECILE}}$[19].

2.3.3. Relationship lending

We use relationship strength and relationship duration as relationship intensity measures. Relationship strength is usually measured as the proportion of a lender's debt in the firm's overall debt. We focus on the relationship with the main lender (Bharath *et al.* 2011; Stein 2015). If the main lender holds a high proportion of the firm's debt the relationship is assumed to be strong (Elsas and Krahnen 1998). We calculate relationship strength as:

$$STRENGTH_{j,t} = \frac{loan\ from\ main\ lender_{j,t}}{loans\ from\ all\ lenders_{j,t}}. \quad (3)$$

We use this measure since it reflects the lender's incentive to acquire private information and to monitor the firm (Diamond 1984). The main lender has more incentives to acquire private information and to monitor the firm if relationship strength is large.

Relationship duration serves as another proxy for relationship lending (e.g. Berger and Udell 1995; Degryse and Ongena 2005; Degryse and van Cayseele 2000; Elsas and Krahnen 1998; Petersen and Rajan 1994; Stein 2015). The duration of the relationship between lender and borrower is measured in years and represents the repeated interaction between lender and borrower. We do not have data on the duration of the relationships.

[18] E. g. a firm with 12 years of data will have 7 annual accruals quality observations.
[19] In unreported analysis, we use a continuous variable and the results remain similar.

Nevertheless, we measure relationship duration as the number of subsequent years a firm has the same main lender. If the firm changes the main lender, the duration is set to 1 (Stein 2015). Thus, relationship duration is defined as follows:

$$DURATION_{j,t} = number\ of\ subsequent\ years\ with\ the\ same\ main\ lender. \quad (4)$$

2.3.4. Model specification

To test the effect of accruals quality on the cost of debt we specify the following model:

$$\begin{aligned} COD_{j,t+1} = {} & \beta_0 + \beta_1 AQ_{j,t} \\ & + \beta_2 AQ_{j,t} * STRENGTH_{j,t} \\ & + \beta_3 AQ_{j,t} * DURATION_{j,t} \\ & + \beta_4 STRENGTH_{j,t} + \beta_5 DURATION_{j,t} \\ & + \sum \beta_i Control\ Variable_i + \sum \beta_t Year_t + \sum \beta_k Industry_k \\ & + \sum \beta_m Legalform_m + \nu_{j,t}, \end{aligned} \quad (5)$$

where COD=Inte divided by AvgIntBLiab times 100 defined in eq. (1), AQ=decile rank (by year) of accruals quality estimated with eq. (2), STRENGTH=relationship strength between main lender and firm defined in eq. (3), DURATION=relationship duration of the relationship with the main lender defined in eq. (4), $\sum \beta_i Control\ Variable_i$ includes other control variables, which are: LEVERAGE=total liabilities divided by total assets, LNASSETS=natural logarithm of total assets, ROA=net income before extraordinary items divided by lagged assets, COVRATIO=interest expense divided by operating income, σ(NIBE)=rolling 5-year window std. dev. of net income before extraordinary items, scaled by average total assets, ASSOCIATE=loans from associated corporations divided by total liabilities, OWNER=loans from owners divided by total liabilities, PENSION=pension provisions divided by total liabilities, SECURED=secured debt divided by total debt, $\sum \beta_t Year_t$=year dummies, $\sum \beta_k Industry_k$=industry dummies, $\sum \beta_m Legalform_m$=legal form dummies, j=1,…,N firm index, n=1,…,N control variable index, t=1,…,T year index, k=1,…,K industry index, and m=1,…,M legal form index. All variables are defined formally in Table 1.

Table 1: Variable definitions

Variable	Definition	Source
Cost of debt proxies		
COD	Cost of debt calculated as interest expense to average interest bearing liabilities	USTAN
COD_adj	Adjusted cost of debt estimated with eq. ((6)	USTAN
Accruals quality proxies		
AQ	Decile rank (by year) of accruals quality according to McNichols 2002 estimated with eq. (2) and based on rolling 5-year window std. dev.	USTAN
AQ(sdDD)	Decile rank (by year) of accruals quality according to Dechow and Dichev estimated with eq. (8) and based on rolling 5-year window std. dev.	USTAN
AQ(sdBS)	Decile rank (by year) of accruals quality according to Ball and Shivakumar (2006) estimated with eq. (9) and based on rolling 5-year window std. dev.	USTAN
AQ(J)	Decile rank (by year) of accruals quality according to Jones estimated with eq. (10) and based on absolute values	USTAN
AQ(mJ)	Decile rank (by year) of accruals quality according to modified Jones estimated with eq. (11) and based on absolute values	USTAN
Relationship lending proxies		
STRENGTH	Loans from main lender divided by overall loans	MiMiK
STRENGTH(HIGH 50%)	Dummy =1 if firms STRENGTH > sample's median STRENGTH	MiMiK
STRENGTH(HHI)	Borrowers' concentration index as defined in eq. (14)	MiMiK

(Continued)

Table 1 (Continued)

STRENGTH(COUNT)	Negative of number of lenders	MiMiK
DURATION	Subsequent years where main lender is the same	MiMiK
DURATION(HIGH 50%)	Dummy =1 if firms DURATION > sample's median DURATION	MiMiK
DURATION(HIGH 75%)	Dummy =1 if firms DURATION > sample's 75th percentile DURATION	MiMiK
DURATION(LN)	Natural logarithm of DURATION	MiMiK
Control variables		
LEVERAGE	Total liabilities divided by total assets	USTAN
LNASSETS	Natural logarithm of total assets	USTAN
ROA	Net interest before extraordinary items divided by lagged total assets	USTAN
COVRATIO	Interest expense divided by operating income	USTAN
σ(NIBE)	Rolling 5-year window std. dev. of net interest before extraordinary items, scaled by average total assets	USTAN
ASSOCIATE	Loans from associated corporations divided by total liabilities	USTAN
OWNER	Loans from owners divided by total liabilities	USTAN
PENSION	Pension provisions divided by total liabilities	USTAN
SECURED	Secured debt divided by total debt	USTAN

The dependent variable is the one-year-ahead cost of debt. The coefficient β_1 measures the main effect of accruals quality if the interaction terms (β_2 and β_3) are not included in the regression estimation.

The main contribution of this study is captured in β_2, which represents the coefficient of the interaction between accruals quality and relationship strength and in β_3, which represents the coefficient of the interaction of accruals quality and relationship duration.

According to theory, higher accruals quality should reduce information risk for the lender and therefore decrease cost of debt. Following this argumentation, the main effect of accruals quality is expected to be negative ($\beta_1<0$). Regarding the interaction between accruals quality and relationship strength, we expect the coefficient of AQ*STRENGTH to be positive (H1), since accruals quality and relationship strength should behave as substitutes (i.e. $\beta_2>0$). Therefore, the main effect (β_1) and the interaction term (β_2) are expected to show opposing signs. Furthermore, we expect the interaction term concerning relationship duration (AQ*DURATION) to be negative (H2) because banks learn to interpret accounting information better with longer relationship duration (i.e. $\beta_3<0$). Thus, the main effect (β_1) and the interaction term regarding relationship duration (β_3) should have the same sign.

We control for relationship lending (STRENGTH and DURATION), other control variables, year, industry and legal form fixed effects[20]. We determine other control variables according to Kaplan and Urwitz (1979) which identify the following financial ratio categories to explain ex-ante cost of debt: leverage ratios, size variables, profitability ratios, interest coverage ratios, and stability variables (earnings stability or instability). Since the ex-post cost of debt (measured with the balance sheet approach) is a consequence of ex-ante cost of debt (debt ratings), we take these ratios as control variables in the cost of debt analysis[21]. Therefore, similar to other studies in this field we apply the following basic control variables in our cost of debt model: LEVERAGE, LNASSETS, ROA, COVRATIO[22], σ(NIBE)[23], and SECURED. Furthermore, we employ other commonly used control variables in previous bank-based studies (Bigus *et al.* 2009; Francis *et al.* 2005; Stein 2015; Vander Bauwhede *et al.* 2015). The proportion of loans from associated corporations (ASSOCIATE) and owners (OWNER) serve as additional

[20] Since we do not calculate the debt price as a spread we include yield on corporate bonds to control for macroeconomic effects in our robustness analysis (not reported). The results do not change.

[21] German firms largely rely on private debt provided by house banks. To determine a firm's loan price, house banks use their own credit ratings. The credit rating of a firm typically depends on available securities, the business strategy and its financial performance. The rating determines the premium above the base rate that firms must pay to receive a loan (Palepu 2007).

[22] Other studies use interest coverage (Francis *et al.* 2005) or the natural logarithm of interest coverage (Bharath *et al.* 2008). To avoid multicollinearity, we use the coverage ratio, which is the reciprocal value of interest coverage. If we do not control for the coverage ratio our results remain the same (not reported).

[23] Other empirical studies use similar control variables, e.g. Francis *et al.* (2005), Karjalainen (2011), and Bigus *et al.* (2009).

controls. Moreover, we control for the proportion of pension liabilities (PENSION), since a yearly amount is accounted for as interest expense and leads to an overestimation of interest expense.

The predicted signs for the relationship lending variables is according to theory and previous empirical results ambiguous. The relationship lending theory agrees that stronger relationship (longer and wider relationship between firm and bank) leads to more accumulation of soft information, to cost savings for the bank and to higher potential benefits for the firm (Kano *et al.* 2011). The potential benefits are for example better credit terms (lower cost of debt, lower probability to pledge collateral and longer loan maturity). The consequential hypothesis would be that more intense relationships between firm and bank lead to better credit terms for the firm. However, empirical evidence on the effect of relationship variables on credit terms is controversial. Longer relationships leads in some studies to lower COD (Berger and Udell 1995), other studies report no effect on COD (Elsas and Krahnen 1998; Harhoff and Körting 1998; Machauer and Weber 1998) and some report even higher COD (Angelini *et al.* 1998; Degryse and van Cayseele 2000; Stein 2015). Using STRENGTH as relationship variable, studies report no effect (Elsas and Krahnen 1998; Harhoff and Körting 1998; Lehmann and Neuberger 2001; Machauer and Weber 1998) or lower COD (D'Auria *et al.* 1999; Degryse and van Cayseele 2000; Stein 2015). There are two possible explanations why these findings are inconsistent with the above hypothesis. First, theoretically the bank can keep all cost savings from an intense relationship for itself and not shift it to the firm. This could be in situations where the bank acquires private information and gains an information monopoly over other non-informed banks, which can lead to a lock in problem for the firm where the bank can keep all cost savings and even extract further profit (Sharpe 1990). Second, independently of the benefit shifting between bank and firm, other factors can influence the benefits of the relationship. Kano *et al.* (2011) show that financial statement lending, bank organizational structure and bank competition influence the relationship benefit effect. In summary, the predicted sign of STRENGTH and DURATION can be positive or negative, depending on the willingness of the bank

to share cost savings with the borrower and depending on other factors, which influence the benefits of the relationship.

The predicted signs of the remaining control variables are in most cases theoretically and empirically unambiguous. Larger firms and firms with higher profitability are recognized as less risky and therefore we predict a negative sign for the coefficients of LNASSETS and ROA. The volatility of earnings (σ(NIBE)) is an additional proxy for credit risk, since risk not only depends on profitability but also on the stability of earnings. Thus, we predict a positive relationship between σ(NIBE) and cost of debt (Francis *et al.* 2005). Secured loans (SECURED) should lead to higher cost of debt, in consideration of riskier borrowers have to provide more security and have to pay higher interest rates for debt issuances (e.g. Bharath *et al.* 2008; Pittman and Fortin 2004). In addition, the relationship between leverage and cost of debt could be positive or negative. It could be positive because higher leveraged firms have higher financial risk (Petersen and Rajan 1994; Pittman and Fortin 2004). However, there is some evidence of a negative relationship (Francis *et al.* 2005; Minnis 2011; Vander Bauwhede *et al.* 2015) and the reasons for this are threefold. First, it can be that the firm is highly leveraged, since it has large loans and large loans are offered at lower interest rates (Vander Bauwhede *et al.* 2015). Second, the inverse relation could be a mechanical relationship, since COD is decreasing and LEVERAGE is increasing in interest bearing liabilities (Karjalainen 2011). Third, it is argued that the negative relationship with leverage is a result of cost of debt being a noisy proxy (Francis *et al.* 2005; Pittman and Fortin 2004). Furthermore, interest coverage is often defined as operating income divided by interest expense and shows how capable the firm is to pay back the interest expense of current loans (Francis *et al.* 2005; Minnis 2011; Vander Bauwhede *et al.* 2015). Therefore, higher interest coverage should be negatively related to cost of debt. However, to avoid multicollinearity between interest coverage and ROA, we define interest coverage inversely as interest expense divided by operating income (Ahmed *et al.* 2000; Koren *et al.* 2014). Therefore, we predict a positive relationship between the coverage ratio (COVRATIO) and cost of debt. Finally, for loans from associated corporations (ASSOCIATE), loans from owners (OWNER), and for pension liabilities (PENSION)

the relationship to cost of debt could be negative or positive. Considering cost of debt being a proxy, which includes firms' overall interest expense and interest bearing liabilities (previous mentioned liabilities and bank loans), the estimated sign for ASSOCIATE, OWNER, and PENSION will indicate if banks' interest rate is lower or higher compared to the interest expense which is a result of ASSOCIATE, OWNER, and PENSION. First, the interest rates of loans from associated corporations and owners are the result of inter firm negotiations and could be lower or higher than interest rates charged by banks. Second, the legislator does not set the discount rate for pension liabilities and each firm is free to estimate an individual discount rate, which can be lower or higher than the interest rate charged by banks. Finally, the predicted sign for ASSOCIATE, OWNER, and PENSION could be negative because of a mechanical relationship with COD (the numerator of the former and the denominator of the latter increases with interest bearing liability).

2.4. Data

2.4.1. The peculiarities of the German setting

The German setting is for various reasons especially valuable for the analyses of accruals quality, relationship strength, relationship duration, and cost of debt. Germany has a bank-based financial system (Allen and Gale 1995) where firms rely mostly on private bank debt[24]. This system is characterized by house banks which traditionally lend money to firms (Elsas and Krahnen 2003) and built strong relationship ties to the particular firms. In addition, we analyze not listed companies that are especially dependent on bank debt. Furthermore, the German law requires banks to report large credit exposures for the particular quarter to the Deutsche Bundesbank. Moreover, to the best of our knowledge, the credit register from Deutsche Bundesbank is the only register tracking the loan records on lender-borrower level for German firms. This allows us to test the effect of accruals

[24] Dickopf *et al.* (2007) report that German private SME firms rely more on private bank loans (53% of total liabilities) compared to US firms (23% of total liabilities), Furthermore, Francfort and Rudolph (1992) give the first empirical evidence on the difference in debt importance for Germany and US. They show that German firms use relatively more debt compared to US firms controlling for other important variables. Bigus *et al.* (2009) note that the median debt ratio for German firms in their sample is 86%, whereas Berger and Udell (1998) show only about 50% for US firms.

quality on firms' loan rate according to the level of relationship strength and relationship duration. Finally, Burgstahler *et al.* (2006) explicitly highlight the German system as an example of "insider access" to information. Hence, it is in particularly worthwhile to test the influence of this "insider information" on the role of accruals quality for German private firms.

2.4.2. Sample construction

We work with two matched datasets, the credit register (MiMiK) and the firms' annual financial statement data (USTAN), both provided by Deutsche Bundesbank. To merge both data sets a propensity score matching algorithm based on string matching was used (Goldbach and Nitsch 2014). The underlying data set for the relationship lending variables is MiMiK[25]. All other variables are based on USTAN[26].

Table 2: Sample construction

	Firm-year observations		
	Dropped	Remained	Period
Initial sample		**253,702**	**1987-2013**
Less:			
1. Firm-years with consolidated, IFRS or US-GAAP financial statements	2,610	251,092	1987-2013
2. Firm-year with opening balances	2,776	248,316	1987-2013
3. Quoted Firms	4,308	244,008	1987-2013
4. Firms from the financial services industry	233	243,775	1987-2013
5. Firm-years with missing industry classifications	559	243,216	1987-2013
6. Firms without bank debt	36,427	206,789	1987-2013
7. Years of financial crisis and years after BilMoG (2009-2013)	37,135	169,654	1987-2008
8. Not SMEs	34,293	135,361	1987-2008
9. Missing data for the calculation of variables, missing lagged and forward data required by our models	59,023	76,338	1987-2008
10. Firms with less than 12 years of observations and industry-year clusters with less than 20 firms	30,419	45,919	1987-2008

(Continued)

[25] Schmieder (2006) explains the dataset in detail.

[26] This data is collected directly from Deutsche Bundesbank due to exchange transactions of banks. Goldbach and Nitsch (2014) provide more information on this dataset.

Table 2 (Continued)

11.	Missing accruals quality values (accruals quality is calculated using rolling 5-year windows)	14,961	30,958	1997-2008
12.	Missing relationship lending values (we do not have data for the years before 2002)	20,934	10,024	2002-2008
Final sample			**10,024**	**2002-2008**

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 1997-2008, MiMiK, 2002-2008, own calculations.
Notes: We use a matched sample of the MiMiK and USTAN database from Deutsche Bundesbank. The source for the data on relationship lending is the MiMiK database (i.e. credit register) and data for all other variables comes from the USTAN database (i.e. financial statements).
The final sample includes accruals quality based on rolling 5-year windows, which is calculated using firm data beginning with 1997.

The initial sample (merged MiMiK with USTAN) comprises 253,702 firm-years for 19,481 firms from 1987-2013. Table 2 shows the sample selection to get the final sample of 10,024 firm-years for 2,159 firms between 2002[27] and 2008. We also winsorize all variables used in eq. (2) and eq. (5) at the 1th and 99th percentiles[28].

Our final sample includes non-consolidated financial statements of German private firms, which are under the German GAAP. We do not include publicly listed firms, firms from the financial industry and firm-years with missing industry classifications. Furthermore, we use only the pre-financial crisis period, because the period between 2009 and 2014 (crisis and post-crisis) includes a change in the accounting standard and the financial crisis. The German Accounting Law Modernization Act (BilMoG) was established in 2009. The application of the BilMoG starts in the year 2010 and a voluntary adoption was already in 2009 allowed.

Therefore, we drop in our main analysis the years 2009-2014, to account for both, the BilMoG adoption and the financial crisis. In addition, we focus only on SMEs, since we analyze the effect of accruals quality (an indicator of information asymmetry) on cost

[27] The accruals quality proxies are calculated using firm data beginning with 1997.
[28] In studies where cost of debt is calculated following the balance sheet approach, interest bearing debt - the denominator of this cost of debt proxy - is noisy due to the calculation with only two observations Dechow (1994) and extreme outliers have to be dropped. In a not reported analysis, we additionally drop outliers of cost of debt at different percentile values. The results do not change.

of debt and according to Elsas and Krahnen (1998) the role of information asymmetry is especially high for firms of moderate size.

Our sample incorporates some limitations[29]. According to German Banking Act (Section 14), banking institutions have to report exposure to individual borrowers or single borrower units, which are above €1.5 million at the respective quarter. This means the exposure could be to an individual borrower or the sum of exposures to borrowers belonging to one borrower unit. Thus, a large part of single exposures in our dataset are below €1.5 million, since the exposure criteria is used on a group level (Schmieder 2006; Stein 2015). However, our sample contains relatively large loans and therefore relatively large SMEs compared to the total population of German SMEs. However, in line with Bigus *et al.* (2009), we observe that our median firm has total assets less than €8 million and conclude that we still observe enough small firms in our sample. Furthermore, since we calculate our relationship lending variable with respect to the main lender, this problem should not be that important (Stein 2015).

2.5. Main results

In this section we validate the cost of debt measure, provide some descriptive statistics and univariate tests. Then, we show the main regression results.

2.5.1. Descriptive statistics

Table 3, Panel B, confirms that our cost of debt measure is reliable compared to macroeconomic reports. The average one-year ahead cost of debt for our sample in the period from 2003 to 2008 is 4.96% which is similar to the public statistics of annual interest rates[30] (5.04%) in the same period (reported in Table 3 as RMFI[31]).

The graph in Table 3, Panel A, shows that in some parts of the period cost of debt underestimates and in other parts cost of debt overestimates the RMFI. Cost of debt reflects the average interest rate for current loans but also for previous loans, whereby the

[29] Stein (2015) and Bigus *et al.* (2009) discuss the limitations of the data in detail.

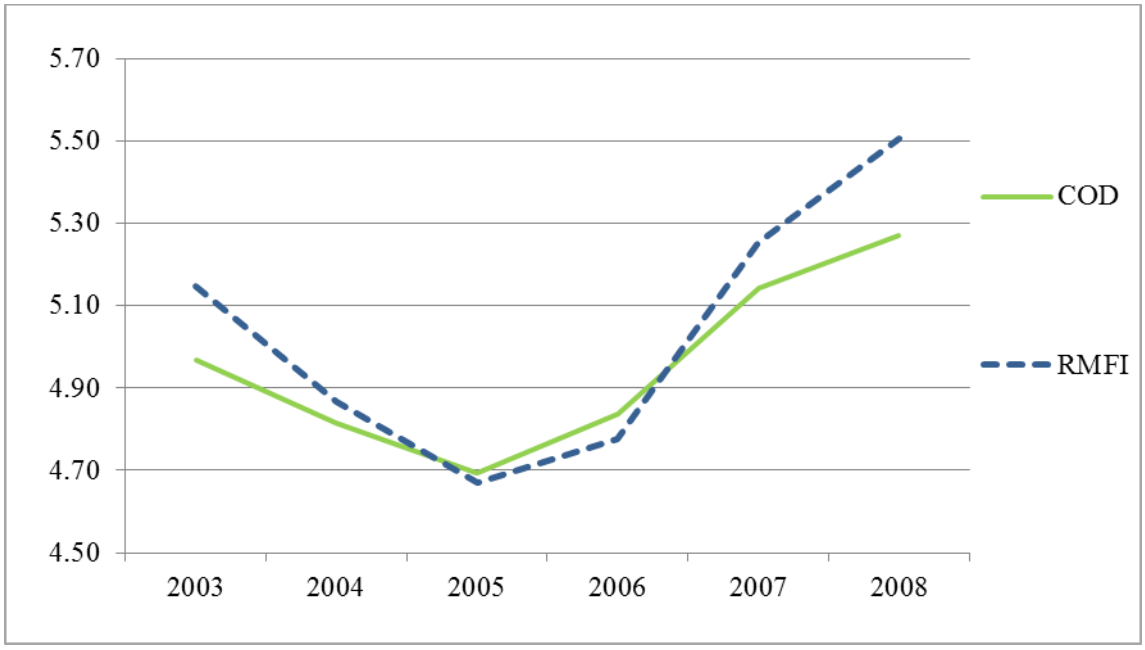
[30] The interest rate of banks and other financial institutions to non-financial companies in Germany for short and long term debt is a time series from the European System of Central Banks and available at: http://www.bundesbank.de/Navigation/EN/Statistics/Time_series_databases/ESCB_Time_Series/eszb_zeitreihen_node.html?openNodeId=500220, last access: 16/11/2015.

[31] Calculated as an average of the interest rate on debt with maturity under 1 year, between 1 and 5 years, and over 5 years.

RMFI corresponds to the new approved credit lines of the particular year – being a public statistic of the yearly charged interest rates. This fact could be the explanation for the observed differences.

Table 3: Cost of debt validation

Panel A: COD and RMFI historical development



Panel B: Yearly average COD, RMFI, and firm-year observations

Year[a]	RMFI	COD	Observations
2003	5.15	4.97	1,932
2004	4.87	4.82	1,838
2005	4.67	4.69	1,771
2006	4.78	4.84	1,641
2007	5.25	5.14	1,480
2008	5.51	5.27	1,362
Ø[b]	5.04	4.96	-

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 1997-2008, MiMiK, 2002-2008, own calculations.
Notes: Panel A and B compare yearly mean values of cost of debt with the yearly mean values of RMFI. COD= cost of debt calculated as interest expense to average interest bearing liabilities and RMFI=interest rate of banks and other financial institutions for non-financial companies in Germany for short and long term debt, calculated as an average of the interest rate on debt with maturity less than 1 year, between 1 and 5 years, and over 5 years.
[a] We show only cost of debt used in the regression analysis, which are one-year-ahead values and therefore cost of debt for 2002 is not displayed in this table.
[b] The mean of cost of debt (ØCOD=4.96) differs from the sample mean from Table 4 (4.94), since it is calculated using the yearly mean values.

The descriptive statistics in Table 4 reveal that our sample consists of small and medium privately held firms. Thus, the mean (median) assets equal €12 (€8) million and the mean (median) revenue is about €21 (€16) million. In detail, about 60% of our sample consists of small firms (assets below €10 million) and 40% are medium size firms (assets between €10 and €50 million)[32].

Table 4: Descriptive statistics

Variables	Mean	Std. Dev.	10th	Median	90th	90th -10th
FINANCIALS						
Assets (€ million)	12.171	16.804	2.715	7.912	22.721	20.006
Revenue (€ million)	20.527	17.996	3.504	15.771	43.414	39.910
DEPENDENT VARIABLE						
COD (%)	4.938	1.990	2.669	4.791	7.212	4.543
VARIABLE OF INTEREST						
AQ	5.499	2.873	1.000	6.000	9.000	8.000
RELATIONSHIP LENDING CONTROLS						
STRENGTH	0.778	0.245	0.412	0.893	1.000	0.588
DURATION	2.759	1.590	1.000	2.000	5.000	4.000
OTHER CONTROLS						
LEVERAGE	0.800	0.151	0.589	0.828	0.972	0.383
LNASSETS	8.984	0.867	7.907	8.976	10.031	2.124
ROA	0.057	0.085	-0.022	0.039	0.166	0.188
COVRATIO	0.419	1.290	0.023	0.370	1.105	1.082
σ(NIBE)	0.039	0.031	0.010	0.031	0.080	0.070
ASSOCIATE	0.048	0.113	0.000	0.000	0.162	0.162
OWNER	0.161	0.200	0.000	0.077	0.470	0.470
PENSION	0.055	0.099	0.000	0.002	0.181	0.181
SECURED	0.272	0.321	0.000	0.070	0.785	0.785

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 1997-2008, MiMiK, 2002-2008, own calculations.
Notes: The sample includes 10,024 firm-years, 2,159 firms from 2002-2008. The accruals quality proxy based on rolling 5-year windows is calculated using firm data beginning with 1997. All variables are defined in Table 1.

[32] The thresholds for small and medium-sized firms are according to the EU commission and available at: http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition/index_en.htm, last access: 14/12/2016.

The average firm in our sample is profitable (mean return on assets equals 0.057) and highly leveraged (mean leverage ratio equals 0.800), confirming the observation that German firms mostly rely on debt financing. Furthermore, the main lender has on average 78% (STRENGTH) of the overall credit exposure and the average duration of the relationship with the main lender is 2.8 years. The last column of the table shows the distance between the 90th and the 10th percentile for each variable. The relationship between the main bank and a firm at the 10th percentile lasts one year, whereby the duration of a firm at the 90th percentile lasts 5 years. Therefore, the distance between the firm at the 90th and the firm at the 10th percentile is 4 years. This distance is especially important in explaining the regression effect of accruals quality on cost of debt.

Pearson correlations are shown in Table 5, indicating high correlation between σ(NIBE) and AQ (-0.5059) as well as between σ(NIBE) and ROA (0.2796). In unreported analysis, we use accruals quality measures which are not highly correlated with σ(NIBE). This is the case if we calculate accruals quality with absolute values of residuals. The results stay the same. Second, in unreported tests we use Altman Z-score (García-Teruel *et al.* 2014) as an alternative proxy of risk instead of σ(NIBE) and show again that our results are not affected.

Table 5: Correlations

	COD	AQ	STRENGTH	DURATION	LEVERAGE	LNASSETS	ROA	COVRATIO	σ(NIBE)	ASSOCIATE	OWNER	PENSION	SECURED
	1												
AQ	**-0.0263**	**1**											
STRENGTH	**-0.0518**	**-0.0715**	**1**										
DURATION	**0.0368**	**0.0217**	**0.1639**	**1**									
LEVERAGE	**0.0390**	0.0056	**0.0742**	-0.0180	**1**								
LNASSETS	**-0.0744**	**0.1682**	**-0.5038**	0.0192	**-0.1862**	**1**							
ROA	**-0.1169**	**-0.1153**	0.0097	**0.0706**	**-0.2110**	**0.0387**	**1**						
COVRATIO	**0.0583**	**0.0673**	0.0047	0.0107	**0.0602**	0.0026	**-0.0613**	**1**					
σ(NIBE)	**-0.0219**	**-0.5059**	**0.0560**	**-0.0338**	**-0.0685**	**-0.1207**	**0.2796**	**-0.1123**	**1**				
ASSOCIATE	**-0.1128**	**-0.0568**	**-0.0640**	**-0.0242**	**-0.0682**	**0.0939**	**-0.0621**	**-0.0272**	**0.0363**	**1**			
OWNER	**-0.1618**	**-0.0695**	**0.0446**	**0.0521**	**0.1128**	0.0194	**0.2200**	**-0.0231**	**0.1168**	**-0.0878**	**1**		
PENSION	**-0.1971**	**-0.0984**	**0.0613**	0.0043	**-0.1159**	-0.0163	-0.0044	**-0.0379**	**0.0688**	**-0.0457**	**-0.1723**	**1**	
SECURED	**0.0740**	**0.1291**	**-0.0722**	**0.0858**	**-0.0638**	**0.1705**	**-0.0507**	**0.0513**	**-0.0737**	**-0.1087**	**-0.1794**	**-0.0544**	**1**

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 1997-2008, MiMiK, 2002-2008, own calculations.
Notes: This table displays Pearson correlation coefficients for the final sample. Bold parameters are significant at the 5% level or below. All variables are defined in Table 1.

2.5.2. Regressions

Table 6, Panel A reports the estimated coefficients of eq. (5) without and with interaction terms. We examine the effect of accruals quality on cost of debt by including only accruals quality as explanatory variable (Column 1) and add afterwards the interaction terms of accruals quality and relationship lending (Column 2-4). However, we include in all specifications relationship lending and other control variables.

Coefficient estimates for the relationship lending controls confirm the discussed ambiguity from section 2.3.4. On the one hand, STRENGTH has a negative and significant coefficient in all four specifications (Column 1-4) confirming the theory that banks are willing to share relationship benefits with their borrowers. On the other hand, DURATION is in most cases positive and significant, giving a hint towards a lock in problem of relationship lending.

The estimated coefficients for the remaining control variables have the predicted signs in all four specifications (Column 1-4). As expected, COVRATIO has a positive and significant influence on the cost of debt. In contrast, LNASSETS, ROA, ASSOCIATE, OWNER and PENSION exhibit a negative and significant effect on the cost of debt. The coefficient for LEVERAGE, σ(NIBE) and SECURED have the expected sign, but are insignificant[33].

Table 6, Panel A, Column 1, shows the main effect of accruals quality on cost of debt if we control for relationship lending, but do not include interactions. The coefficient estimate of AQ is highly significant and negative (β_1=-0.0412). Moving from the 10th to the 90th percentile of AQ[34], cost of debt decreases by 32.96 bp. The distance between the 90th and the 10th percentile of AQ equals 8 (see descriptive statistics from Table 6). Therefore, the effect of accruals quality on cost of debt is calculated as follows β_1 * 8 AQ differences=-0.0412 * 8 AQ differences = 0.3296% or 32.96 bp. This means, the firm will gain 32.96 bp cost of debt benefits, which corresponds to 6.67% of the sample's average

[33] We show in unreported tests that σ(NIBE) is significant in all specifications if we use the Fama-Macbeth regression approach Fama and MacBeth (1973).

[34] For the ease of interpretation, we calculate all economic effects on cost of debt comparing a high accruals quality (relationship strength, relationship duration) firm (value of 90th percentile) with a low accruals quality (relationship strength, relationship duration) firm (value of 10th percentile).

cost of debt by improving its accruals quality from the 10th to the 90th percentile. The economic effect of accruals quality reported by Francis *et al.* (2005) equals 13% and is far more higher[35]. Yet, if we, analogous to them, do not include relationship controls at all in the regression, the coefficient of accruals quality is slightly higher in magnitude (β_1=-0.0421) and significance (t=-3.25) but still lower as reported by Francis *et al.* (2005). Certainly, we compare an effect of two studies with different firms and time periods. Nevertheless, this gives a first hint towards accruals quality to be less important in bank-based financial systems, but still playing an essential role.

Column 2-4 reveal the estimates of eq. (5) with interaction terms. In Column 2 and 3 we introduce only one interaction term separately and in Column 4 both interaction terms are considered simultaneously. Column 2 shows how relationship strength influences the main effect of accruals quality on firms' loan rate. We find a significantly positive coefficient estimate for the interaction term AQ * STRENGTH confirming the first hypothesis. This outcome indicates that relationship strength decreases the effect of accruals quality. The cost of debt benefit from accruals quality equals 56.85 bp for a firm with STRENGTH at the 90th percentile compared to only 18.32 bp for a firm with STRENGTH at the 10th percentile. Specifically, the effect of accruals quality on cost of debt according to different levels of relationship strength is calculated as follows: (β_1 + β_2 * STRENGTH) * 8 AQ differences = (-0.1048 + 0.0819 * STRENGTH) * 8 AQ differences. Therefore, the effect of accruals quality for a firm with STRENGTH at the 10th percentile equals = (-0.1048 + 0.0819 * 0.412) * 8 AQ differences = -0.5685% or -56.85 bp and for a firm with STRENGTH at the 90th percentile = (-0.1048 + 0.0819 * 1) * 8 AQ differences = -0.1832% or -18.32 bp. Thus, we find that a firm with high relationship strength gets 3 times less cost of debt benefits from accruals quality than those with low relationship strength. The reason for this result might be that if banks have strong relationships, they are the exclusive lender and motivated to monitor the firm and acquire private information (Diamond 1984). Consequently, the bank relies more on the

[35] Francis *et al.* (2005) compare the highest accruals quality (AQ=10) to the lowest accruals quality (AQ=1) which leads to 9 decile differences. If we calculate our economic effects according to them we get a cost of debt benefit of -37.08 bp (represents 7.51% of the sample' average cost of debt) which is half of the economic effect reported by Francis *et al.* (2005).

costly gathered private information and less on accounting information. Our results are in line with the intuition of Cassar *et al.* (2015) who conclude that alternative information sources substitute each other.

Column 3 shows how relationship duration impacts the effect of accruals quality on firms' loan rate. The estimated coefficient for the interaction term is negative and highly significant, thus indicating that the accruals quality effect increases with the level of relationship duration and confirming the second hypothesis. Specifically, the cost of debt benefit of accruals quality increases from 13.28 bp to 57.12 bp going from the 10th percentile to the 90th percentile of DURATION. Peculiarly, the effect of accruals quality on cost of debt according to different levels of relationship duration is calculated as follows: ($\beta_1 + \beta_3$ * DURATION) * 8 AQ differences = (- 0.0029 - 0.0137 * DURATION) * 8 AQ differences. So, the effect of accruals quality for a firm with a short duration equals (- 0.0029 - 0.0137 * 1) * 8 AQ differences = -0.1328% or -13.28 bp and for a firm with long duration (- 0.0029 - 0.0137 * 5) * 8 AQ differences = -0.5712% or -57.12 bp. The result suggests, the longer the relationship lasts, the more data is available which generates additional knowledge about accounting quality for the bank. This learning has a desired effect on a firms cost of debt, since it enhances the interest rate impairment.

Column 4 presents estimates when both interaction terms are included simultaneously. The effects do not change significantly compared to the findings before.

The economic effects are illustrated in Table 6, Panel B. As before, the impact of accruals quality on cost of debt decreases with higher relationship strength and increases with longer duration of the relationship. A firm with relationship duration at the 90th percentile and STRENGTH at the 10th percentile gets the highest cost of debt benefit from accruals quality (89.79 bp).

Table 6: The effect of accruals quality on cost of debt

Panel A: Regression

	Dependent variable: COD							
	(1)		(2)		(3)		(4)	
	Coef.	(t stat.)	Coef.	(t stat.)	Coef.	(t stat.)	Coef.	(t stat.)
MAIN EFFECT								
AQ	-0.0412***	(-3.19)	-0.1048***	(-3.00)	-0.0029	(-0.15)	-0.0727**	(-2.01)
INTERACTION EFFECTS								
AQ * STRENGTH			0.0819**	(1.97)			0.0981**	(2.35)
AQ * DURATION					-0.0137**	(-2.52)	-0.0160***	(-2.93)
RELATIONSHIP LENDING CONTROLS								
STRENGTH	-0.6394***	(-4.11)	-1.1022***	(-3.54)	-0.6318***	(-4.10)	-1.1850***	(-3.79)
DURATION	-0.0001	(0.00)	0.0007	(0.03)	0.0747*	(1.68)	0.0883**	(1.97)
OTHER CONTROLS								
LEVERAGE	0.1746	(0.65)	0.1691	(0.63)	0.1813	(0.68)	0.1757	(0.66)
LNASSETS	-0.2189***	(-4.01)	-0.2185***	(-4.01)	-0.2171***	(-4.00)	-0.2162***	(-3.99)
ROA	-2.5433***	(-5.88)	-2.5361***	(-5.86)	-2.5711***	(-5.93)	-2.5671***	(-5.93)
COVRATIO	0.0624***	(3.74)	0.0632***	(3.79)	0.0625***	(3.76)	0.0635***	(3.82)
σ(NIBE)	0.1950	(0.14)	0.1996	(0.14)	0.3090	(0.23)	0.3335	(0.24)
ASSOCIATE	-2.7377***	(-9.45)	-2.7530***	(-9.52)	-2.7263***	(-9.38)	-2.7427***	(-9.47)
OWNER	-2.1624***	(-10.23)	-2.1685***	(-10.26)	-2.1587***	(-10.21)	-2.1653***	(-10.25)
PENSION	-5.1862***	(-13.49)	-5.1681***	(-13.43)	-5.1975***	(-13.51)	-5.1776***	(-13.44)
SECURED	0.0974	(1.04)	0.0977	(1.04)	0.1005	(1.08)	0.1015	(1.09)
CONSTANT	7.8332***	(11.24)	8.1908***	(11.31)	7.5880***	(11.10)	7.9754***	(11.21)
N	10,024		10,024		10,024		10,024	
Adj. R^2	0.157		0.158		0.158		0.159	

(Continued)

Table 6 (Continued)

Panel B: Economic effects of accruals quality on cost of debt according to different levels of relationship strength and relationship duration (in basis points and based on estimates from Column 4)

			STRENGTH		
	Percentile		10th	50th	90th
		Value	0.412	0.893	1
DURATION	10th	1	-38.59	-0.88	7.52
	50th	2	-51.39	-13.68	-5.28
	90th	5	-89.79	-52.08	-43.68

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 1997-2008, MiMiK, 2002-2008, own calculations.
Notes: Panel A reports pooled OLS estimates with robust standard errors which are clustered at the firm level. Dummies for year, industry and legal form are included, but not reported. T statistics are in parentheses. *, **, *** represent significance at the 10%, 5% and 1% level. All variables are defined in Table 1.
Panel A shows the estimates for eq. (5), whereby Column 1 does not include any interaction term, Column 2 and 3 include only one interaction term, and Column 4 includes all interaction terms of the model:

$$COD_{j,t+1} = \beta_0 + \beta_1 AQ_{j,t} + \beta_2 AQ_{j,t} * STRENGTH_{j,t} + \beta_3 AQ_{j,t} * DURATION_{j,t} + \beta_4 STRENGTH_{j,t} + \beta_5 DURATION_{j,t} + \sum \beta_i Control\ Variable_i + \sum \beta_t Year_t + \sum \beta_k Industry_k + \sum \beta_m Legalform_m + \nu_{j,t},$$

Panel B displays the economic effects of accruals quality on cost of debt based on the estimation of Column 4. Thus, the table reports cost of debt benefits when improving from the 10th percentile to the 90th percentile of AQ for different levels of relationship strength and relationship duration. The values for DURATION and STRENGTH are the values of their distribution, which are displayed in the descriptive statistics (Table 4). The distance between the 90th and the 10th percentile of AQ equals 8 (see descriptive statistics from Table 4). Therefore, the effect of accruals quality on cost of debt according to different levels of relationship strength and relationship duration is calculated as follows: $(\beta_1 + \beta_2 * \text{STRENGTH} + \beta_3 * \text{DURATION}) * 8\ \text{AQ differences} = (-0.0727 + 0.0981 * \text{STRENGTH} - 0.016 * \text{DURATION}) * 8\ \text{AQ differences}$.

Whereby, a firm with DURATION at the 10th percentile and STRENGTH at the 90th percentile does not get any economically significant cost of debt benefits from accruals quality. Contrary, it gets 7.52 basis points higher cost of debt, which represents 1.52% of the sample's average cost of debt. This would mean that better accruals quality firms are penalized and this is not in line with our predictions. However, the economic effect is not high and this is the only case we get an increasing effect of accruals quality on cost of debt. The explanation could be the noisy measure of cost of debt. Using the adjusted cost of debt measure we only observe decreasing effects on cost of debt (see robustness Table 7, Panel A).

In detail explained, the effect of accruals quality on cost of debt according to different levels of relationship strength and relationship duration is calculated as follows: (β_1 + β_2 * STRENGTH+ β_3 * DURATION) * 8 AQ differences = (-0.0727 + 0.0981 * STRENGTH - 0.0160 * DURATION) * 8 AQ differences. This means, a firm with DURATION at the 90th percentile and STRENGTH at the 10th percentile gets 89.79 bp COD benefit of accruals quality, calculated as (-0.0727 + 0.0981 * 0.412 - 0.0160 * 1) * 8 AQ differences. Whereby a firm with DURATION at the 10th percentile and STRENGTH at the 90th percentile does not get any COD benefit.-Specifically, this is the only case where the effect of accruals quality on COD has a positive sign, equaling (-0.0727 + 0.0981 * 1 - 0.0160 * 5) * 8 AQ differences = +0.0752% or +7.52 bp.

In summary, we examine how accruals quality affects firms' cost of debt in a bank-based financial system and how relationship lending influences this effect. The results show that accruals quality decreases German private firms' cost of debt and that this effect differs significantly with respect to relationship lending.

2.6. Robustness

In this section, additional proxies of cost of debt, accruals quality, relationship strength, and relationship duration are specified. Then, we report the regression results for each proxy.

2.6.1. Adjusted measure of cost of debt

We adjust the cost of debt measure (see descriptive statistics for COD in Table 7) by eliminating the non-financial part of cost of debt. To obtain this adjusted measure, we regress the cost of debt on all non-financial interest bearing liabilities. Since we omitted financial liabilities (bank debt) in the regression, the residuals should reflect the variation of cost of debt affected by bank loans. First, we perform the following industry-year specific regressions:

$$COD_{j,t} = \phi + \phi_1 \frac{ASSOCIATE_{j,t}}{AvgIntBLiab_{j,t}} + \phi_2 \frac{OWNER_{j,t}}{AvgIntBLiab_{j,t}} + \phi_3 \frac{PENSION_{j,t}}{AvgIntBLiab_{j,t}} + \phi_4 \frac{OTHER_{j,t}}{AvgIntBLiab_{j,t}} + \xi_{j,t}, \quad (6)$$

where COD=cost of debt calculated with eq. (1), AvgIntBLiab=average of interest bearing liabilities over the years t and t-1, ASSOCIATE=loans from associated corporations, OWNER=loans from owners, PENSION=pension liabilities, OTHER=other interest bearing liabilities. In a next step, to proxy for the variation of cost of debt charged by banks, we use the residuals of the estimated eq. ((6): $COD\_adj_{j,t}=\xi_{j,t}$. Finally, to test the effects on COD_adj, we specify the following model:

$$\begin{aligned} COD\_adj_{j,t+1} = {} & \beta_0 + \beta_1 AQ_{j,t} \\ & + \beta_2 AQ_{j,t} * STRENGTH_{j,t} \\ & + \beta_3 AQ_{j,t} * DURATION_{j,t} \\ & + \beta_4 STRENGTH_{j,t} + \beta_5 DURATION_{j,t} \\ & + \sum \beta_n Control\ Variable_n + \sum \beta_t Year_t + \sum \beta_k Industry_k \\ & + \sum \beta_m Legalform_m + \nu_{j,t}. \end{aligned} \quad (7)$$

where COD_adj=adjusted cost of debt estimated with eq. ((6), AQ=decile rank (by year) of accruals quality estimated with eq. (2), STRENGTH=relationship strength between main lender and firm defined in eq. (3), DURATION= relationship duration of the relationship with the main lender defined in eq. (4), $\sum \beta_n Control\ Variable_n$ includes other control variables, which are: LEVERAGE=total liabilities divided by total assets, LNASSETS=natural logarithm of total assets, ROA=net income before extraordinary items divided by lagged assets, COVRATIO=interest expense divided by operating

income, σ(NIBE)=rolling 5-year window std. dev. of net income before extraordinary items, scaled by average total assets, SECURED=secured debt divided by total debt, $\sum\beta_t Year_t$=year dummies, $\sum\beta_k Industry_k$=industry dummies, $\sum\beta_m Legalform_m$=legal form dummies, j=1,…,N firm index, n=1,…,N control variable index, t=1,…,T year index, k=1,…,K industry index, and m=1,…,M legal form index. All variables are defined in Table 1.

COD_adj represents the fraction of the cost of debt charged by banks. Eq. (5) and eq. (7) only differ in the coverage of control variables: pension provisions and loans from owner and associated corporations are excluded from eq. (7) because they are considered in COD_adj.

Table 7 reports the estimated regressions for the adjusted cost of debt. The structure of the columns coincides with those of Table 6. In Column 1, we again find a highly significant negative coefficient estimate for AQ. Moving from the 10th to the 90th percentile of AQ is associated with 30.8 bp lower cost of debt. Column 2 highlights that the accruals quality effect on cost of debt changes according to the level of relationship strength. The interaction term is positive and significant. Going from the 10th to the 90th percentile of STRENGTH decreases the effect of accruals quality on cost of debt by 46.60%. A firm at the 10th percentile of STRENGTH gets 55.03 bp cost of debt benefits from accruals quality, while a firm at the 90th percentile of STRENGTH receives only 23.68 bp cost of debt benefits from accruals quality. Confirming the previous results, the interaction term between accruals quality and relationship duration is negative and significant. A firm with DURATION at the 10th percentile gets only 18.72 bp cost of debt benefits from accruals quality, whereby a firm at the 90th percentile of DURATION gets 56.16 bp cost of debt benefits from accruals quality. Including both interaction terms simultaneously does not significantly change the results.

Table 7: Adjusted cost of debt

	Dependent variable: COD_adj							
	(1)		(2)		(3)		(4)	
	Coef.	(t stat.)	Coef.	(t stat.)	Coef.	(t stat.)	Coef.	(t stat.)
MAIN EFFECT								
AQ	-0.0385***	(-2.83)	-0.0963***	(-2.83)	-0.0117	(-0.64)	-0.0691**	(-1.96)
INTERACTION EFFECTS								
AQ * STRENGTH			0.0667*	(1.65)			0.0806**	(1.98)
AQ * DURATION					-0.0117**	(-2.23)	-0.0136**	(-2.58)
RELATIONSHIP LENDING CONTROLS								
STRENGTH	-0.5101***	(-3.06)	-0.9249***	(-3.06)	-0.5410***	(-3.57)	-0.9957***	(-3.27)
DURATION	0.0062	(0.22)	0.0062	(0.22)	0.0693	(1.62)	0.0805*	(1.87)
OTHER CONTROLS								
LEVERAGE	0.3033	(1.20)	0.3033	(1.20)	0.3170	(1.26)	0.3101	(1.23)
LNASSETS	-0.1948***	(-3.64)	-0.1948***	(-3.64)	-0.1933***	(-3.62)	-0.1928***	(-3.62)
ROA	-2.2244***	(-5.50)	-2.2244***	(-5.50)	-2.2503***	(-5.55)	-2.2497***	(-5.56)
COVRATIO	0.0615***	(3.71)	0.0615***	(3.71)	0.0609***	(3.69)	0.0617***	(3.74)
σ(NIBE)	0.1577	(0.12)	0.1577	(0.12)	0.2578	(0.20)	0.2739	(0.21)
SECURED	0.0734	(0.81)	0.0734	(0.81)	0.0743	(0.82)	0.0760	(0.84)
CONSTANT	2.1891***	(3.09)	2.1891***	(3.09)	1.6831**	(2.52)	2.0048***	(2.88)
N	10,024		10,024		10,024		10,024	
Adj. R^2	0.036		0.036		0.037		0.037	

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 1997-2008, MiMiK, 2002-2008, own calculations.
Notes: The table reports pooled OLS estimates with robust standard errors which are clustered at the firm level. Dummies for year, industry and legal form are included, but not reported. T statistics are in parentheses. *, **, *** represent significance at the 10%, 5% and 1% level. All variables are defined in Table 1.
The table shows the estimates for eq. (7) using adjusted cost of debt as dependent variable. Column 1 does not include any interaction term, Column 2 and 3 include only one interaction term, and Column 4 includes all interaction terms of the model.

2.6.2. Accruals quality proxies

Next, we test the robustness of our findings for alternative accruals quality measures. We start with the measures of the unmodified Dechow and Dichev (2002) model. It excludes property, plant and equipment, and change in revenue as independent variables. Total current accruals are only explained by past, present and future operational cash flows. To calculate accruals quality, we estimate eq. (8) for each of the 374 industry-year clusters:

$$TCA_{j,t} = \alpha_0 + \alpha_1 CFO_{j,t-1} + \alpha_2 CFO_{j,t} + \alpha_3 CFO_{j,t+1} + \varepsilon_{j,t}, \quad (8)$$

where TCA=total current accruals, CFO=cash flow from operations, j=1,…,N firm index, and t=1,…,T year index. All variables of the regression are divided by average total assets. The detailed description of all variables is reported in Table 1.

The residuals of the estimated eq. (8) represent the abnormal accruals. The first additional proxy of accruals quality is defined as: $AQ(sdDD)_{j,t}=[-\sigma(\varepsilon_t)_{j,t}]_{\text{DECILE}}$[36], where larger values of $AQ(sdDD)_{j,t}$ represent better accruals quality.

Another possibility to modify the measure of Dechow and Dichev is a version by Ball and Shivakumar (2006). This model integrates the asymmetry in gain and loss recognition as additional control variables into the following regression model:

$$\begin{aligned} TCA_{j,t} = {} & \alpha_0 + \alpha_1 CFO_{j,t-1} + \alpha_2 CFO_{j,t} + \alpha_3 CFO_{j,t+1} \\ & + \alpha_4 \Delta CFO_{j,t} + \alpha_5 D_{j,t} + \alpha_6 D_{j,t} * \Delta CFO_{j,t} + \varepsilon_{j,t}, \end{aligned} \quad (9)$$

where TCA=total current accruals, CFO=cash flow from operations, ΔCFO=change in cash flow from operations, D=dummy equal one if ΔCFO<0, j=1,…,N firm index, and t=1,…,T year index. All continuous variables of the regression are divided by average total assets. The detailed description of all variables is reported in Table 1.

We define the second additional accruals quality proxy as: $AQ(sdBS)_{j,t}=[-\sigma(\varepsilon_t)_{j,t}]_{\text{DECILE}}$[37]. A third method to identify accruals quality relies on Jones (1991) who predicts the level of normal accruals in the first step and measures the level of abnormal accruals afterwards. In the Jones model, normal accruals are explained only by the change

[36] The approach is analogous to the procedure described before (see Section 2.3.2).

[37] In unreported tests, we calculate accruals quality using negative values of the absolute residuals, i.e. $-|\varepsilon_{j,t}|$, instead of the rolling std. dev. from the three perspective models. The resulting three measures are $AQ(McN)_{j,t}$ for eq. (2), $AQ(DD)_{j,t}$, for eq. (8), and $AQ(BS)_{j,t}$, for eq. (9) where higher values represent better accruals quality. The effects on cost of debt remain similar.

in revenue (ΔRev) and property, plant and equipment (PPE). The unexplained part of the regression estimation represents the abnormal accruals.To calculate accruals quality, we estimate eq. (10) for each of the 374 industry-year clusters:

$$\frac{TA_{j,t}}{Asset_{j,t-1}} = \gamma_1 + \gamma_2 \frac{\Delta Rev_{j,t}}{Asset_{j,t-1}} + \gamma_3 \frac{PPE_{j,t}}{Asset_{j,t-1}} + \eta_{j,t}, \quad (10)$$

where $TA_{j,t}$ = total accruals, $\Delta Rev_{j,t}$= revenue, $PPE_{j,t}$= gross[38] value of property, plant and equipment. All variables are divided by lagged total assets ($Asset_{j,t-1}$). The firm-specific normal accruals are defined as fitted values based on the coefficients estimates:

$$NA_{j,t} = \hat{\gamma}_1 + \hat{\gamma}_2 \frac{\Delta Rev_{j,t}}{Asset_{j,t-1}} + \hat{\gamma}_3 \frac{PPE_{j,t}}{Asset_{j,t-1}}, \quad (11)$$

where $NA_{j,t}$ = normal level of accruals.The abnormal level of accruals is measured as the difference between realized total accruals and estimated normal accruals: $AA_{j,t} = \frac{TA_{j,t}}{Asset_{j,t-1}} - NA_{j,t}$. To proxy for accruals quality, we use the negative value of the absolute value of abnormal accruals: $AQ(J)_{j,t} = -|AA|_{j,t}$, where larger values of $-|AA|_{j,t}$ represent better accruals quality. In the regression analysis we use again decile ranks by year: $AQ(J)_{j,t}=[-|AA|_{j,t}]_{DECILE}$.The last proxy is the modification of the previous Jones model by Dechow *et al.* (1995). They subtract accounts receivables from revenue to control for potential earnings management that aims to increase revenue by overstating accounts receivables. Thus, the firm-specific normal accruals are calculated as follows:

$$NA_{j,t} = \hat{\gamma}_1 + \hat{\gamma}_2 \frac{\Delta Rev_{j,t} - \Delta AR_{j,t}}{Asset_{j,t-1}} + \hat{\gamma}_3 \frac{PPE_{j,t}}{Asset_{j,t-1}}, \quad (12)$$

where $NA_{j,t}$ = normal level of accruals, $\Delta AR_{j,t}$ = change in accounts receivable. Finally, the abnormal level of accruals is again calculated as the difference between realized total accruals and estimated normal accruals: $AA_{j,t} = \frac{TA_{j,t}}{Asset_{j,t-1}} - NA_{j,t}$. The last accruals quality proxy is defined as: $AQ(J)_{j,t}=[-|AA|_{j,t}]_{DECILE}$.

[38] Note that the Jones (1991) model requires gross values of property, plant and equipment and accordingly we use gross PPE. Net PPE equals gross PPE minus accumulated depreciation. Culvenor and Godfrey (1999) show that using net PPE in the Jones model provides also reliable results.

Table 8: Accruals quality proxies

	AQ(sdDD)		AQ(sdBS)		AQ(J)		AQ(mJ)	
	Coef.	(t stat.)	Coef.	(t stat.)	Coef.	(t stat.)	Coef.	(t stat.)
MAIN EFFECT								
AQ(PROXY)	-0.1064***	(-2.95)	-0.0727**	(-2.01)	-0.0433*	(-1.71)	-0.0460*	(-1.82)
INTERACTION EFFECTS								
AQ(PROXY) * STRENGTH	0.1252***	(2.98)	0.0981**	(2.35)	0.0542*	(1.78)	0.0570*	(1.86)
AQ(PROXY) * DURATION	-0.0121**	(-2.30)	-0.0160***	(-2.93)	-0.0079*	(-1.81)	-0.0077*	(-1.74)
RELATIONSHIP LENDING CONTROLS								
STRENGTH	-1.3407***	(-4.27)	-1.1850***	(-3.79)	-0.9249***	(-3.75)	-0.9398***	(-3.78)
DURATION	0.0675	(1.56)	0.0883**	(1.97)	0.0422	(1.08)	0.0407	(1.04)
OTHER CONTROLS								
LEVERAGE	0.1787	(0.67)	0.1757	(0.66)	0.1740	(0.65)	0.1740	(0.65)
LNASSETS	-0.2185***	(-4.03)	-0.2162***	(-3.99)	-0.2293***	(-4.24)	-0.2292***	(-4.24)
ROA	-2.5541***	(-5.92)	-2.5671***	(-5.93)	-2.6164***	(-6.04)	-2.6179***	(-6.05)
COVRATIO	0.0630***	(3.81)	0.0635***	(3.82)	0.0618***	(3.68)	0.0618***	(3.68)
σ(NIBE)	0.1217	(0.09)	0.3335	(0.24)	1.7485	(1.37)	1.7485	(1.37)
ASSOCIATE	-2.7394***	(-9.51)	-2.7427***	(-9.47)	-2.7180***	(-9.33)	-2.7172***	(-9.33)
OWNER	-2.1659***	(-10.26)	-2.1653***	(-10.25)	-2.1379***	(-10.11)	-2.1379***	(-10.11)
PENSION	-5.1612***	(-13.37)	-5.1776***	(-13.44)	-5.1411***	(-13.38)	-5.1419***	(-13.38)
SECURED	0.1024	(1.09)	0.1015	(1.09)	0.0861	(0.91)	0.0857	(0.91)
CONSTANT	8.2008***	(11.48)	7.9754***	(11.21)	7.8627***	(11.06)	7.8763***	(11.06)
N	10,024		10,024		10,024		10,024	
Adj. R^2	0.159		0.159		0.156		0.156	

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 1997-2008, MiMiK, 2002-2008, own calculations.
Notes: The table reports pooled OLS estimates with robust standard errors which are clustered at the firm level. Dummies for year, industry and legal form are included, but not reported. T statistics are in parentheses. *, **, *** represent significance at the 10%, 5% and 1% level. All variables are defined in Table 1. The table shows estimates for eq. (5) with all interaction terms for different accruals quality proxies. The depedent variable is COD. The used AQ(PROXY) is outlined in the header of each column.

Table 8 reports in Column 1-4 the estimates of eq. (5) for the four previous explained accruals quality proxies. The estimated coefficients of AQ(PROXY) have the predicted signs and are all significant. The same holds for both interaction terms (relationship strength and relationship duration with accruals quality). Therefore, changing the definition of accruals quality does not change our main results.

2.6.3. Relationship strength proxies

Finally, we introduce three variables to scale relationship strength.

The first is a dummy, which differentiates only between low and high relationship strength. We transform the continuous relationship measure (STRENGTH) used in our main analysis in eq. (3) into a dummy indicating high relationship strength if the relationship strength is higher than a chosen threshold (Stein 2015). We define this threshold as the sample's median relationship strength as shown in the eq. (13):

$$STRENGTH(HIGH\ 50\%)_{j,t} = 1\ if\ STRENGTH_{j,t} > Sample's\ median\ of\ STRENGTH, \quad (13)$$

where STRENGTH=loans from main lender divided by loans from all lenders as defined in eq. (3).

Until now, we focused only on the main lender. The second and third additional proxies consider the relationship with all lenders. We are able to calculate these measures, since the MiMiK dataset includes quarterly loan amounts between a particular lender and borrower[39]. A firm can have loans from more than one lender per quarter. We use the number of lenders a firm has in a particular year, the annual main lender and the loan amounts of each lender to calculate our next two relationship strength proxies.

The second proxy measures relationship strength as a firm's borrowing concentration using the Herfindahl-Hirschman index (Hirschman 1964), computed as follows[40]:

[39] Hence, we get needed relationship data for each firm on an annual level and therefore convert the dataset from quarterly into annual data. We start with 1,520,191 quarterly firm-lender loan amount data and get the final sample of 10,024 firm-years for 2,159 firms from 2002-2008.

[40] In unreported regressions, we also use a dummy variable based on HHI. The dummy indicates high borrowing concentration when a firm's HHI is higher than a certain threshold. For example, when we use a threshold which equals the sample's median HHI ($HHI_{HIGH(50\%)}$) the results remain similar.

$$STRENGTH(HHI)_{j,t} = \left[\sum_{i=1}^{L}(LoanShare_i)^2\right]_{j,t} \quad (14)$$

where STRENGTH(HHI)=borrowers' concentration index, LoanShare=loan share of lender i defined as $LoanShare_i$=$LoanLender_i$/LoanALender, $LoanLender_i$=loan of lender i, LoanALender=loan from all lenders, L=number of lenders, j=1,…,N firm index, and t=1,…,T year index. The HHI is obtained for every firm and year.

Finally, the third proxy counts the number of lenders a firm has in the perspective year. Since the number of lenders is an inverse measure of relationship strength, we define the variable in the following way:

$$STRENGTH(COUNT)_{j,t} = -(Number\ of\ lenders)_{j,t}, \quad (15)$$

where STRENGTH(COUNT)=negative value of the number of lenders, , j=1,…,N firm index, and t=1,…,T year index. In summary, all relationship strength measures we introduced in this section are expected to have a decreasing effect on cost of debt.

Table 9 shows the results for all relationship strength proxies. We find significantly positive coefficient estimates for the AQ*STRENGTH(PROXY) interaction term in all three columns. The opposite coefficient of the interaction term compared to the sole coefficient of accruals quality indicates that relationship strength moderates the effect of accruals quality on cost of debt.

Table 9: Relationship strength proxies

	STRENGTH(HIGH 50%)		STRENGTH(HHI)		STRENGTH(COUNT)	
	Coef.	(t stat.)	Coef.	(t stat.)	Coef.	(t stat.)
MAIN EFFECT						
AQ	-0.0148	(-0.71)	-0.0571*	(-1.82)	0.0449*	(1.91)
INTERACTION EFFECTS						
AQ * STRENGTH(PROXY)	0.0365*	(1.85)	0.0841**	(2.33)	0.0176***	(2.67)
AQ * DURATION	-0.0158***	(-2.87)	-0.0161***	(-2.94)	-0.0165***	(-3.05)
RELATIONSHIP LENDING CONTROLS						
STRENGTH(PROXY)	-0.3982***	(-2.88)	-1.0167***	(-3.79)	-0.2024***	(-3.95)
DURATION	0.0679	(1.52)	0.0857*	(1.92)	0.0796*	(1.84)
OTHER CONTROLS						
LEVERAGE	0.1943	(0.73)	0.1761	(0.66)	0.1934	(0.73)
LNASSETS	-0.1809***	(-3.49)	-0.2194***	(-4.05)	-0.2259***	(-4.16)
ROA	-2.5599***	(-5.88)	-2.5594***	(-5.9)	-2.5170***	(-5.79)
COVRATIO	0.0630***	(3.79)	0.0635***	(3.83)	0.0635***	(3.86)
σ(NIBE)	0.3064	(0.22)	0.3156	(0.23)	0.2911	(0.21)
ASSOCIATE	-2.7560***	(-9.46)	-2.7552***	(-9.52)	-2.8408***	(-9.89)
OWNER	-2.1964***	(-10.37)	-2.1676***	(-10.26)	-2.1836***	(-10.37)
PENSION	-5.2243***	(-13.60)	-5.1714***	(-13.42)	-5.1633***	(-13.38)
SECURED	0.0936	(1.00)	0.1024	(1.10)	0.1092	(1.17)
CONSTANT	6.9429***	(11.12)	7.8205***	(11.40)	6.6908***	(10.58)
N	10,024		10,024		10,024	
Adj. R^2	0.156		0.159		0.160	

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 1997-2008, MiMiK, 2002-2008, own calculations.
Notes: The table reports pooled OLS estimates with robust standard errors which are clustered at the firm level. Dummies for year, industry and legal form are included, but not reported. T statistics are in parentheses. *, **, *** represent significance at the 10%, 5% and 1% level. All variables are defined in Table 1. The table shows the estimates for eq. (5) with all interaction terms for different accruals quality, relationship strength, and relationship duration proxies. The depedent variable is COD. The used STRENGTH(PROXY) is outlined in the header of each column.

2.6.4. Relationship duration proxies

In addition to various measures for relationship strength, we use three different measures for relationship duration. The first and second additional proxy is a dummy, which differentiates only between low and high relationship duration. The dummy variable reveals high relationship duration when firm's relationship duration from the main analysis is higher than a chosen threshold (Stein 2015). We define this threshold as the sample's median and 75th percentile of relationship duration as shown in eq. (16):

$$DURATION(HIGH\ 50\%)_{j,t} = 1\ if\ DURATION_{j,t} > Samples' median\ DURATION, \quad (16)$$

and in eq. (17):

$$DURATION(HIGH\ 75\%) = 1\ if\ DURATION_{j,t} > Samples' 75th\ DURATION\ percentile, \quad (17)$$

where DURATION=number of subsequent years with the same main lender. The samples' median relationship duration equals 2 years and the 75th percentile equals 4 years. The third additional proxy is the natural logarithm of relationship duration:

$$DURATION(LN)_{j,t} = natural\ logarithm\ of\ DURATION_{j,t}, \quad (18)$$

where DURATION=number of subsequent years with the same main lender.

Table 10, Column 1-3, shows the estimation of eq. (5) for all three relationship duration proxies. We find significantly negative coefficient estimates for the AQ*DURATION(PROXY) interaction term in all three columns.

Table 10: Relationship duration proxies

	DURATION(HIGH 50%)		DURATION(HIGH 75%)		DURATION(LN)	
	Coef.	(t stat.)	Coef.	(t stat.)	Coef.	(t stat.)
MAIN EFFECT						
AQ	-0.0948***	(-2.69)	-0.1012***	(-2.90)	-0.0471	(-1.19)
INTERACTION EFFECTS						
AQ * STRENGTH	0.0907**	(2.19)	0.0942**	(2.27)	0.0971**	(2.33)
AQ * DURATION(PROXY)	-0.0344**	(-2.21)	-0.0701***	(-3.33)	-0.0560***	(-2.85)
RELATIONSHIP LENDING CONTROLS						
STRENGTH	-1.1420***	(-3.68)	-1.1554***	(-3.73)	-1.1863***	(-3.79)
DURATION(PROXY)	0.1786	(1.49)	0.3577**	(2.17)	0.3232**	(2.01)
OTHER CONTROLS						
LEVERAGE	0.1748	(0.65)	0.1763	(0.66)	0.1741	(0.65)
LNASSETS	-0.2164***	(-3.99)	-0.2170***	(-4.01)	-0.2165***	(-3.99)
ROA	-2.5567***	(-5.90)	-2.5583***	(-5.92)	-2.5650***	(-5.92)
COVRATIO	0.0633***	(3.80)	0.0638***	(3.84)	0.0634***	(3.82)
σ(NIBE)	0.2577	(0.19)	0.3418	(0.25)	0.3149	(0.23)
ASSOCIATE	-2.7483***	(-9.50)	-2.7496***	(-9.49)	-2.7417***	(-9.47)
OWNER	-2.1683***	(-10.26)	-2.1658***	(-10.25)	-2.1652***	(-10.25)
PENSION	-5.1792***	(-13.44)	-5.1690***	(-13.43)	-5.1782***	(-13.45)
SECURED	0.1007	(1.08)	0.0992	(1.06)	0.1017	(1.09)
CONSTANT	8.1033***	(11.29)	8.1274***	(11.30)	7.8350***	(11.08)
N	10,024		10,024		10,024	
Adj. R^2	0.158		0.159		0.159	

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 1997-2008, MiMiK, 2002-2008, own calculations.
Notes: The table reports pooled OLS estimates with robust standard errors which are clustered at the firm level. Dummies for year, industry and legal form are included, but not reported. T statistics are in parentheses. *, **, *** represent significance at the 10%, 5% and 1% level. All variables are defined in Table 1. The table shows the estimates for eq. (5) with all interaction terms for different relationship duration proxies. The depedent variable is COD. The used DURATION(PROXY) is outlined in the header of each column.

2.7. Conclusion

This paper deals with the question how accounting information and relationship lending interact in reducing information asymmetry between lender and borrower. We find that the effect of accruals quality on cost of debt decreases if the firm borrows more money from one bank. Thus, the bank uses an additional private information channel and accruals quality is less important. However, we also find that a longer relationship and therefore repeated interaction with the firm can lead to bank's learning to interpret accruals quality better which manifests itself through a higher cost of debt benefit of accruals quality for firms with longer relationships.

We use two unique datasets of Deutsche Bundesbank and find that higher accruals quality of German SMEs leads on average to an interest rate benefit of 32.96 basis points. This benefit significantly differs between firms with low and high relationship strength. Better accruals quality leads to a 56.82 (18.32) basis points lower cost of debt for firms with low (high) relationship strength. The findings suggest that main lenders have an incentive to acquire private information and to monitor firms if they are the exclusive lender of the firm. According to this, they focus on relationship lending and less on accounting based lending. However, in the long run, accruals quality gains relatively more importance. Thus, the results confirm that firms with longer relationships get 4.3 times higher cost of debt benefits from accruals quality. One possible explanation is that longer relationships lead to a data history. Then, banks tend to interpret accruals quality better.

The outcome of this study is relevant for firms and the accounting literature. First, our results are important for firms, since they show when banks use accruals quality in assessing firms' cost of debt. Better accruals quality leads to the highest cost of debt benefits if the firm has more than one lender (a lender portfolio) and if the firm keeps this portfolio for a long time. Second, we contribute to the accounting literature in pointing out that accruals quality is important in a strong relationship lending setting and that there are relationship lending dimensions which increase the importance of accruals quality.

Our study has two important limitations. First, the sample includes only information on relatively large loans. This might lead to a higher fraction of relatively large firms compared to the total population of German SMEs. Second, our study may

suffer from endogeneity problems of accruals quality and relationship lending. Firm's accounting choices might be driven, for example, by tax and dividend choices (Bigus *et al.* 2015; Szczesny and Valentincic 2013) or by relationship lending (Bigus and Hillebrand 2016). Furthermore, relationship lending may also be endogenous, since firm's decision to focus on a main lender can be determined by different firm characteristics (Bharath *et al.* 2011; Bigus and Hillebrand 2016). We do not provide solutions to these endogeneity issues since we do not have appropriate instrumental variables.

3. What happens if private accounting information becomes public?

In this chapter, we analyze the effect of accounting disclosure on access to bank debt. The main aim is to show that once private firms' accounting information becomes publicly available it leads to higher access to bank debt. The following analyses are conducted as part of the research project "The role of mandatory public disclosure in the access to bank debt" using the research place and databases of Deutsche Bundesbank[41]. The views expressed in this study are those of the authors and do not necessarily reflect those of Deutsche Bundesbank.

This chapter is organized as follows. Section 3.1 gives an introduction. Section 3.2 presents the institutional setting and research question. Section 3.3 discusses methodology and data. Section 3.4 presents results and Section 3.5. robustness checks. Section 3.6 shows the additional analysis. Section 3.7 concludes.

3.1. Introduction

The banking literature conjectures that relationship banks obtain an informational advantage over their competitors through private information about their clients (e.g., Boot 2000; Degryse and van Cayseele 2000). On the one hand, this might result in information rents for the incumbent bank (i.e., the "hold up"-problem). On the other hand, firms engaged in relationship lending might receive debt funding solely based on private information collected by their housebank. Moreover, there is the intermediate position that firms and incumbent banks might share the information rent associated with non-disclosure (Breuer *et al.* 2016). We examine the effects of a sudden external shock in public financial statement disclosure on firms' access to debt. As such, we exploit a regulatory change (in our case a move from private to public accounting information) as a quasi-natural experiment. The act about electronic trade registers and cooperative registers as well as the company register (EHUG) requires private companies to publish

[41] The paper version of this study is co-authored with Carsten Homburg (University of Cologne) and Thomas Loy (University of Bayreuth).

their financial statements mandatorily in the electronic federal gazette (i.e., the "eBundesanzeiger", similar to SEC EDGAR in the US) from 2006 onwards. Therefore, financial statements that the incumbent bank as well as a select group of stakeholders (e.g., minority owners, tax offices) received privately before 2006 became public information going forward. Before the regulatory change, enforcement of the already existing rules was rather weak. This weak enforcement environment resulted in a quasi-voluntary[42] publication of private firms' financial statements. After tightening regulation and enforcement, coverage in the electronic federal gazette increased tremendously over a short period to almost complete (e.g., Achleitner *et al.* 2011).

We contribute to the literature in multiple ways. Traditionally, researchers focused on voluntary disclosure and audit and its effects on access to credit and/or credit terms. As such, Minnis (2011) shows that private US firms benefit from lower interest rates after voluntarily obtaining financial statement verification. Moreover, Agarwal *et al.* (2015) use loan applications of small firms to a large bank and find that the (voluntary) availability of financial statement disclosures increases their access to bank debt. Similarly, Bird *et al.* (2016) show that voluntary disclosure of key financial ratios reduces financing costs and increases the amount of subsequent debt and equity issues. Along the same lines, Balsmeier and Vanhaverbeke (2016) exhibit that the propensity of foreign banks providing loans is positively associated to voluntary IFRS adoption by private firms. Our dataset includes financial statements that borrowers privately shared with their bank, and which the firm had to pass on confidentially to the Deutsche Bundesbank (German Central Bank) for trade bill refinancing purposes (Stöss 2001). Neither the firm, nor the bank or the central bank ever publicly disclosed the respective financial statements. In contrast to the publicly available electronic federal gazette or commercial databases with private firm information (such as Amadeus), the dataset of the Deutsche Bundesbank (USTAN) includes (1) both types of firms - with and without the obligation to disclose financial statements and (2) during both periods (i.e., pre- and post-increased disclosure enforcement regulation). After aforementioned enforcement act, the same

[42] Already since 2003, private German firms that exceed certain size thresholds would have had to publish their financial statements in the electronic federal gazette.

firms had to publicly disclose their financial statements. Thus, our setting alleviates severe self-selection concerns with respect to discretionary accounting disclosure choices prevalent in the private firm lending literature (for an in-depth discussion of self-selection and private firm financing, cf. Cassar 2011).

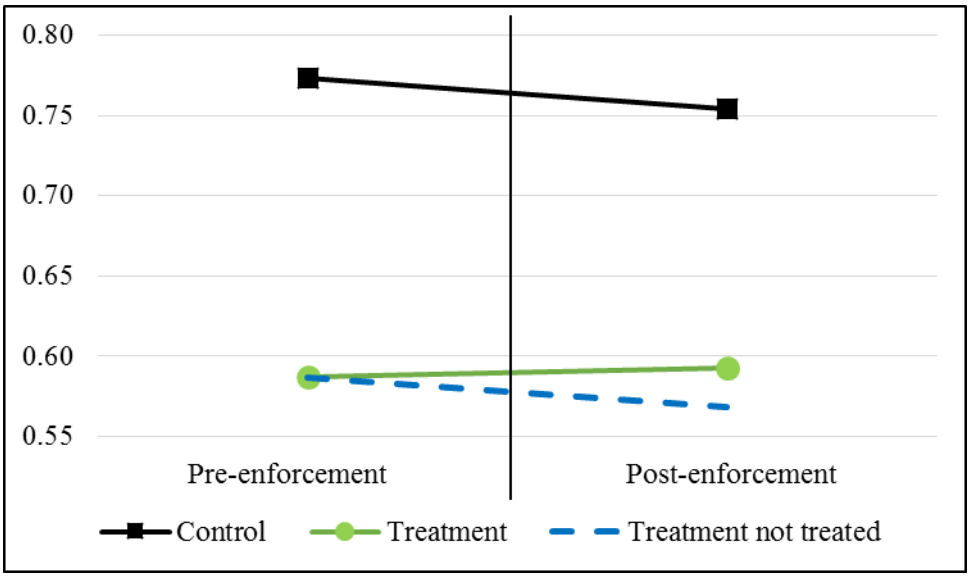
Second, we expand on prior research into the nexus of German private firm disclosure and bank relationships, which exploits the different disclosure thresholds in the German law (Breuer *et al.* 2016). Firms classified as "small" must only disclose a balance sheet, while firms classified as "medium" must disclose additional items, such as a management report with forward looking and risk disclosures, as well as an income statement.[43] While small firms still need to create an income statement to prepare a proper balance sheet, only medium-sized firms need to disclose this valuable piece of information. Therefore, both types of firms only differ in terms of disclosure but not in terms of internal information gathering. Breuer *et al.* (2016) show in a regression discontinuity design that medium-sized firms' just slightly above the threshold disclose almost double the amount of information compared to small firms slightly below the threshold. Moreover, they show that banks access the publicly available files in the electronic federal gazette significantly more often if the firm is subject to the additional disclosure requirement and that there is substantially more bank competition for these medium-sized clients - although they are just slightly larger in terms of actual firm size. Our setting adds to these findings, as we are able to use aforementioned confidential Deutsche Bundesbank dataset, which includes unpublished financial statements before increased disclosure enforcement. Thus, we can show the effect of public disclosure on banking through an external enforcement shock, rather than a regression discontinuity design which is based on additional, rather restrictive, assumptions. The most important being that the treatment is assigned "as good as randomized" (Lee 2008, 676) and, thus, not under managerial discretion. Nevertheless, there is evidence of firms' size management to deliberately remain below the disclosure threshold (Bernard *et al.* 2015).

[43] For a detailed overview of the applicable size thresholds of German Commercial Code (Section 267), see Table 11.

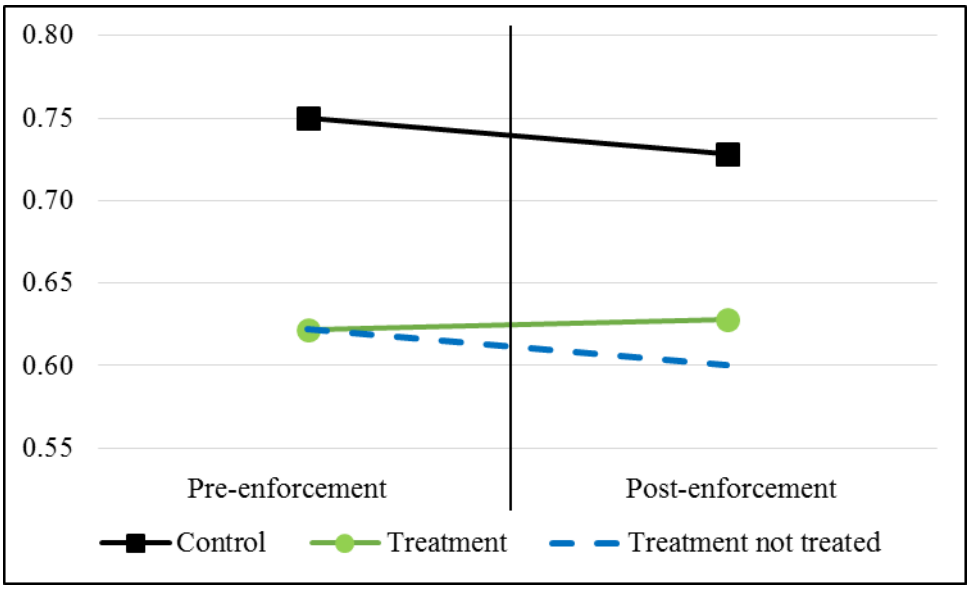
Our results indicate that increased financial statement publicity leads to significantly increased firm access to bank debt (Figure 1).

Figure 1: Access to bank debt for treatment and control firms in the pre- and post-enforcement periods

Panel A: Full sample



Panel B: Matched sample



Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 2004-2009, own calculations.
Notes: In the above figure the x-axis represents time and the y-axis represents FACCESS. The exact values of the graphical difference-in-difference analysis are displayed in Table 17.

This might either be a result of the inside lender expanding its engagement in the firm to fend off new lenders, or new lenders granting loans as their information asymmetry, compared to inside lenders, decreases. To alleviate concerns that the control group firms' characteristics might drive the result rather than the disclosure shock, we employ a matching procedure to create a comparable control group of firms, not subject to financial statement disclosure, neither before nor after the shock.

3.2. Institutional background and research question

3.2.1. The switch from private to public accounting information in Germany

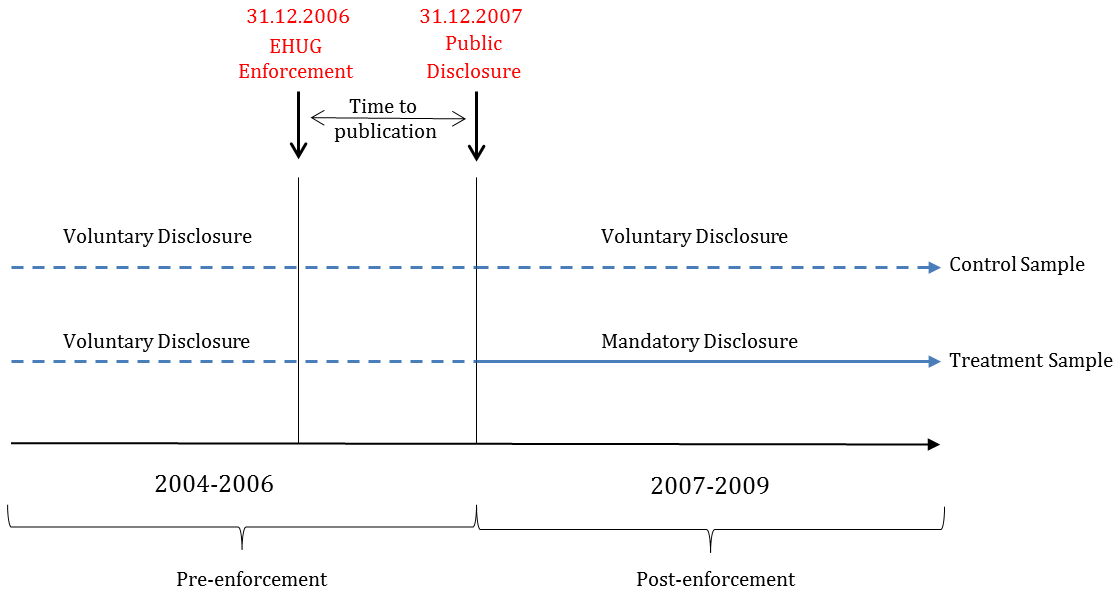
Since 2003, German corporations have to publicly disclose their financial statements in the electronic federal gazette.[44] Before 2006, only about 5% of the firms, which are subject to the disclosure rules, actually published their financial statements. With the introduction of EHUG, coverage increased to almost complete. Unwilling firms face monitoring by the Federal Department of Justice as well as severe penalties for both firms' and their managers, alike (Achleitner *et al.* 2011). Hence, prior to 2006 firms de facto prepared financial statements only for a small set of stakeholders, including owners and existing lenders. Since then, these financial statements became public information for everyone to look up on the internet – even free of charge.[45]

Furthermore, as shown in Figure 2, firms have up to one year to comply with the financial statement disclosure requirement. Since most firms make use of the full time available to disclose (Wittmann and Bravidor 2015), the 2006 financial statements will be publicly available towards the end of 2007. All potential effects of disclosure on access to bank debt are then recognizable in the 2008 financial statements.

[44] German Commercial Code (Section 325) defines mandatory disclosure for corporations. Private firms that are not corporations (i.e., *un*limited liability firms) have to disclose according to the Public Disclosure Act (Section 9).

[45] The electronic federal gazette is available at www.bundesanzeiger.de.

Figure 2: The switch from private to public accounting information in Germany



Notes: The x-axis represents time and the y-axis represents the treatment and control sample. The dashed line shows firms which voluntarily publicly disclose accounting information when it is not legally required. The solid line represents firms disclosing accounting information after it is mandatory following the EHUG enforcement shock. Our treatment sample consists of *limited* liability firms that have to publicly disclose due to the EHUG enforcement. The law defines that small *limited* liability firms have to disclose their balance sheet only, whereas middle-sized and large *limited* liability firms have to disclose their balance sheet as well as their profit and loss statement (see Table 11 for a formal definition of small, medium-sized, and large firms). The control sample are *un*limited liability firms that are not subject to this regulation. Following the EHUG enforcement effort, firms have to mandatorily disclose beginning with the financial statement of 31/12/2006, but the firms have one year to actually disclose, and the overwhelming majority take advantage of this rule (Wittmann and Bravidor 2015).

The obligation to disclose financial statements depends on the private firm's liability status as well as a range of size criteria. *Limited* liability firms (i.e. corporations) are in general subject to EHUG disclosure (German Commercial Code, Section 325). However, there are especially high size-dependent reliefs for small *limited* liability firms. Small *limited* liability firms meeting at least two out of the three following criteria, for two subsequent years, have only to submit a balance sheet (German Commercial Code, Section 267): 1) total assets below € 4.015 mn, 2) sales below € 8.030 mn, and 3) less than 50 employees[46].

[46] Firms had to apply these criteria for the period between 2005 and 2009. Table 1 shows in addition criteria for the period between 2000 and 2001 and between 2002 and 2004. The criteria were slightly changed from period to period due to inflationary adjustments.

Table 11: Public disclosure requirements and size thresholds for limited liability firms

	Public disclosure		Size threshold		
	Balance sheet	P&L statement	2000-2001	2002-2004	2005-2009
Small limited liability firm	Yes	No			
Total assets (€ mn)			≤3.438	≤3.438	≤4.015
Sales (€ mn)			≤6.875	≤6.875	≤8.030
Employees			≤50	≤50	≤50
Medium sized limited liability firm	Yes	Yes			
Total assets (€ mn)			≤13.750	≤13.750	≤16.060
Sales (€ mn)			≤27.500	≤27.500	≤32.120
Employees			≤250	≤250	≤250
Large limited liability firm	Yes	Yes			
Total assets (€ mn)			>13.749	>13.750	>16.060
Sales (€ mn)			>27.497	>27.500	>32.120
Employees			>250	>250	>250

Notes: The table shows public disclosure requirements for small, medium-sized, and large *limited* liability firms. *Limited* liability firms have to meet two out of the three size thresholds for two subsequent years to be classified as small, medium-sized, or large. The size thresholds are defined in the German Commercial Code (Section 267).

*Un*limited liability firms, such as partnerships and one-person businesses, are principally not subject to EHUG disclosure, except if being large. Thus, large *un*limited liability firms are meeting a considerably high disclosure threshold, which also consists of three criteria out of which two have to be met for three consecutive years (Public Disclosure Act, Section 1): 1) total assets over € 65 mn, 2) sales over € 130 mn, and 3) more than 5,000 employees. We exclude large *un*limited liability firms surpassing the aforementioned threshold. Hence, *un*limited liability firms, which remain in our sample, are not subject to mandatory financial statement disclosure. Therefore, we employ this particular difference in the disclosure requirements between *limited* and *un*limited liability firms to test for effects of the enforcement shock. Furthermore, to ensure comparability between treatment and control groups, we use a matching procedure. Post-matching both groups are closely similar in a wide range of firm characteristics (e.g., size, profitability, probability of default, sales growth), except for the disclosure requirement.

3.2.2. Accounting information and access to bank debt

Empirical evidence shows that (the quality of) accounting information influences firms' choice of debt (public vs. private, Bharath *et al.* 2008), firms' access to bank debt (Agarwal *et al.* 2015; García-Teruel *et al.* 2014) as well as credit terms (e.g., Minnis 2011). Banks use covenants based on financial statement information (i.e., arm's length lending) and additional private information (i.e., relationship lending) to reduce information asymmetries in (private) firm initial lending decisions and ex-post monitoring (Berger and Udell 1995; Bharath *et al.* 2008; Jiangli *et al.* 2008; Petersen and Rajan 1994). Yet, it is difficult to disentangle the particular role of each information source for existing borrowers. However, Danos *et al.* (1989) show that accounting information is particularly valuable in evaluating new borrowers.

Like other European economies, Germany is well known for strong relationship lending and widespread and longstanding housebank relationships. Especially private firms have little economically meaningful alternatives to bank financing (Alonso *et al.* 2005; Elsas and Krahnen 1998; Harhoff and Körting 1998; Machauer and Weber 1998). Banks aim to be the firm's exclusive lender (Diamond 1984) and have an incentive that firms obfuscate their financial statements through earnings management (Bigus and Hillebrand 2016; García-Teruel *et al.* 2014). Furthermore, firms might also have incentives to share their financial statements with the lowest possible number of stakeholders, attributable to proprietary costs of public disclosure. For instance, they want their profit margins to remain hidden to (potential) competitors (Bernard *et al.* 2015).

In the spirit of Easley and O'Hara (2004), we define accounting information which is shared only with the inside lender as private accounting information. When a firm publicly discloses its financial statement in the electronic federal gazette, outside lenders obtain first insights into its financial position and profitability. As such, formerly private accounting information becomes public. Contrary to inside lenders, (potential) outside lenders generally do not possess additional, private information about the firm. As a result, publicly available accounting information decreases information asymmetries between inside and outside lenders (Ball *et al.* 2008; Kim, Tsui *et al.* 2011). Decreased information asymmetry results in two possible outcomes. First, the outside lender takes chance of the

new publicly available accounting information, contacts the firm and offers (additional) bank debt. Second, the inside lender uses its more advantageous lending position and offers the firm additional loans to keep competing lenders at bay. However, once private accounting information becomes public, it likely results in more access to bank debt for the firm, either from inside or outside lenders.

3.3. Data, model, and variables

3.3.1. Data

We use the Unternehmensbilanzstatistiken (USTAN[47]) from the Deutsche Bundesbank (German Central Bank). USTAN contains both types of firms, with and without the obligation to disclose financial statements (i.e., *limited* liability private firms above and below aforementioned disclosure threshold as well as *un*limited liability firms not subject to disclosure). This database originates from Bundesbank's refinancing activities (Stöss 2001) and is composed almost entirely of standardized nonconsolidated financial statements of German private firms. It is available on-site and in an anonymized version. Furthermore, to control for firms, which voluntarily disclose before stricter EHUG enforcement, we use a match of USTAN and Bureau van Dijk's Amadeus database.[48]

[47] The digital object identifier (DOI) for this dataset is 10.12757/Bbk.Ustan.9915.02.02.
[48] For the detailed methodology, cf., Schild *et al.* (2017).

Table 12: Sample selection, treatment, and control samples

Panel A: Sample selection

	Firm-year observations
Initial sample (1990-2014)	1,074,401
Less:	
1. Quoted Firms and firm-years with bonds outstanding	
2. Firms from the financial services industry	
3. Firm-years with consolidated, IFRS or US-GAAP financial statements	
4. Firm-year with opening balances	
5. Firm-years with missing industry classifications	
6. Firms which change legal form	
7. Missing data for the calculation of variables and missing forward data required by our models	
8. Small firms with total assets less than €1 mn	
9. *Un*limited liability firms meeting the criteria of the Public Disclosure Act	
10. Firms which appear only in the pre EHUG period or only in the post EHUG period	
11. Firm-years before 2004 or after 2009	
Full sample (2004-2009)	48,623

Panel B: Treatment and control samples

	Firm-year observations
1) Full sample (without matching)	**48,623**
Treatment: *limited* liability firms	44,083
Control: *un*limited liability firms	4,540
2) Treatment firms matched with *un*limited liability firms	**6,278**
Treatment: *limited* liability firms	3,139
Control: *un*limited liability firms	3,139

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 2004-2009, own calculations.
Notes: **Panel A** shows the sample selection to get the full sample of treatment and control firms. **Panel B** shows two different treatment and control samples: 1) full sample (total number of treatment and control firms without matching procedure) and 2) treatment firms matched with control firms.

The initial sample includes 1,074,401 firm-year observations from 1990 to 2014. We limit our sample to non-financial private firms between 2004 and 2009. As such, we drop listed firms and financial services firms. Furthermore, we eliminate unlimited liability firms, which have to disclose accounting information according to Section 1 of the Public Disclosure Act, which entail a significantly higher disclosure threshold, as stated before. In line with literature, we also drop firms with total assets below €1 mn to ensure that our results are not driven by extremely small firms (Bernard *et al.* 2015; Hope *et al.* 2013). We restrict the pre-regulation (2004-2006) and post-regulation (2007-2009) period to three years each, to limit the effect of other factors essentially unrelated to EHUG's disclosure enforcement effort (Ahmed et al. 2013). Finally, we keep firm-years without missing values to calculate our models, with unconsolidated, local GAAP financial statements. The resulting final sample includes 48,623 (9,476) firm-year (firm) observations from 2004 to 2009.

3.3.2. Model specification

We employ a difference-in-difference design to estimate the effect of the EHUG public disclosure enforcement initiative on firms' access to bank debt. The following regression is estimated with fixed effects and robust standard errors, clustered at the firm-level[49] (Petersen 2009):

$$FACCESS_{j,t} = \beta_0 + \beta_1 POST_{j,t} * TREATMENT_{j,t} + \beta_2 SIZE_{j,t} + \beta_3 LEVERAGE_{j,t} + \beta_4 ROA_{j,t} + \beta_5 Z\_SCORE_{j,t} + \beta_6 \mathrm{GROWTH}_{j,t} + \beta_7 TANGIBLE_{j,t} + \beta_8 VOLUNTARY_{j,t} + y_t + \mu_i + \nu_{j,t}, \quad (19)$$

where j=1,…,N is the firm index, and t=1,…,T is the year index, y represents a vector of year indicators, while μ are firm indicators which control for unobservable characteristics that are constant over time. We measure access to bank debt (FACCESS), following García-Teruel *et al.* (2014), as total bank debt divided by total debt, which represents the part of debt financing obtained from banks. For our analysis, we use the one-year ahead

[49] If we alternatively cluster at the year-level or employ two-way clustering at the year- and firm-level our results are qualitatively unchanged (untabulated).

values of access to bank defined as $FACCESS_{j,t} = Bank\ Debt_{j,t+1} / Interest\ Bearing\ Debt_{j,t+1}$.

We define our treatment firms (TREATMENT) and the time of the disclosure enforcement initiative (POST). The coefficient β_1 on the interaction term (POST*TREATMENT) will show the effect of the EHUG disclosure enforcement on the treatment firms compared to the control firms not subject to public disclosure. The binary variable TREATMENT equals one (zero) if the firm is (not) subject to mandatory financial statement disclosure. The treatment firms have to make their financial statements publicly available in the online federal gazette. Those are *limited* liability firms, which meet two out of the following three criteria in two subsequent years: 1) assets above € 4.015 mn, 2) sales above € 8.030 mn, and 3) more than 50 employees (German Commercial Code, Section 267)[50]. The binary variable POST indicates the periods subject to public disclosure. The treatment firms are required to hand in their financial statements beginning with the year 2006. However, we define POST equal to one for fiscal year 2007 and subsequent periods, and zero otherwise. Our reasoning behind this is twofold. First, German private companies, in contrast to publicly listed stock corporations, have up to one year to disclose their financial statements to the public (German Commercial Code, Section 325). Moreover, there is empirical evidence that the far overwhelming majority of German private companies takes advantage of this rule and does not choose to disclose early (Wittmann and Bravidor 2015). Therefore, the financial statements of Dec 31st 2006 will be publicly available to outside investors towards the end of 2007. Finally, as POST correlates with year-fixed effects and TREATMENT is part of the firm-fixed effects, both base line indicators are absorbed by the inclusion of these fixed effects.

We also control for a range of additional firm characteristics which likely influence banks' lending decisions (Cassar 2004; Cassar and Holmes 2003; García-Teruel *et al.* 2014; Heyman *et al.* 2008; Michaelas *et al.* 1999). These are firm size, measured as the logarithm of total assets, total leverage, measured as total liabilities over total assets,

[50] The criteria are slightly different for the years between 2000 and 2004, due to inflationary adjustments. For a detailed overview, see Table 1.

return on assets, measured as earnings before interest and extraordinary items over total assets, probability of default (Altman Z-score), annual sales growth, and asset collateralizability, measured as tangible assets over total assets. Additionally, we control for (quasi-)voluntary [51] disclosure of financial statements before and additional disclosures above the legally required minimum after increased disclosure enforcement. We define all variables in Table 13.

The predicted signs of the control variables size, probability of default, and profitability depends on the financial possibilities of the sample firms. Large and listed firms in a market-based system choose between public debt and bank debt. Larger size, lower probability of default and higher profitability will result in more public and less bank debt (Denis and Mihov 2003). In particular, size proxies for information asymmetry in the lending literature (Berger and Udell 1995; Diamond 1991; Petersen and Rajan 1994). As the information environment generally improves with firm size, larger firms are subject to lower information asymmetry. However, the main financial sources for smaller, unlisted firms in a bank-based system are internal funds and bank debt (Alonso *et al.* 2005; García-Teruel *et al.* 2014). Germany is a bank based financial system and our sample consists of unlisted firms without bonds outstanding. As such, the main source for external financing is bank debt. Therefore, we expect a positive association between size and access to bank debt. Furthermore, the expected sign of probability of default depends also on the context. While, Denis and Mihov (2003) find that, in a market-based financial system, firms with higher probability of default choose more bank debt. However, García-Teruel *et al.* (2014) show that in a bank-based economy where firms choose between internal funds and bank debt, solvency helps borrowers to solve moral hazard problems. Nonetheless, given low recovery rates in private firm lending, banks might be inclined to extend lines of credit if they believe a downturn is temporary. In summary, in our context, it is not clear how probability of default and access to bank debt are related. Traditionally, banking theory suggests that more profitable firms choose public over private debt to circumvent potential hold-up problems. However, profitable firms in in a bank based

[51] As previously mentioned, the publication of financial statements is already required since 2003, but only strongly regulated since 2006. Thus, the period between 2003 and 2006 can be characterized as "quasi-voluntary".

system can use internal funds and do not need to raise additional bank debt (García-Teruel *et al.* 2014). Besides, the distribution of profits to owners might also result in banks demanding loan repayment to not increase their exposure to future downside risk. In sum, we expect that more profitability decreases future need for debt financing.

There are also two opposing theories regarding the predicted sign on growth. On the one hand, growth can result in firms consuming all internal funds and asking for more bank debt (Michaelas *et al.* 1999). On the other hand, growth can increase uncertainty and firm exposure to demand fluctuations. Therefore, growing firms might be inclined to resort to more equity than debt financing (Heyman *et al.* 2008). In bank-based systems empirical results confirm the latter argument (Alonso *et al.* 2005; García-Teruel *et al.* 2014; Heyman *et al.* 2008; López-Gracia and Sogorb-Mira 2008). Furthermore, asset collateralizability should be positively related to bank debt. According to theory, collateral helps borrowers to decrease moral hazard (Boot and Thakor 1994), and there is no reason why this mechanism should depend on the concrete context. Additionally, higher total leverage might indicate higher financial risk which would normally imply less access to bank debt. On the other hand, there might be a positive spill-over between trade credit and bank financing (Cook 1999). And finally, bank financing and trade credit might even be totally independent as suppliers also accumulate considerable amounts of private information making their lending decision independent of any bank lending signals (Petersen and Rajan 1997). As such, we do not predict a sign on leverage. Finally, we also control for firms' voluntary disclosure decisions before EHUG's disclosure enforcement effort (Petersen and Rajan 1997). Voluntary disclosure generally leads to lower information asymmetry between inside and outside lenders and therefore to increased access to bank debt (e.g., Agarwal *et al.* 2015; Bird *et al.* 2016). However, if firms' voluntarily disclose since a number of years, it is likely that now mandatory disclosure does not have an incremental effect.

We test our research question by estimating the empirical model on the full sample and a matched sample. The full sample includes all treatment (*limited* liability) and control (*un*limited liability) firms. It consists of 48,623 firm-year observations from 9,476 individual firms, having the advantage of a fairly large sample size. However, the results

of difference-in-difference analyses of unmatched treatment and control firms could be biased as we compare firms of different sizes, and thus potential differences in political costs and public interest (Watts and Zimmerman 1978). Therefore, we employ a matching procedure between *limited* and *un*limited liability firms. We describe the matching between *limited* liability firms and their *un*limited liability counterparts in the next section. Since our database includes only a small number of *un*limited liability firms, we end up with a matched sample of 6,278 firm-year observations for 1,214 firms. Nevertheless, the advantage of this sample is high similarity of our treatment and control firms in terms of size, profitability and business model.

Table 13: Variable definitions

Variable	**Definition**
Dependent variable	
FACCESS	One year ahead access to bank debt calculated as bank debt divided by interest bearing debt
Variables of interest	
POST	Binary indicator variable that equals 1 for firm-years ending on or after the EHUG introduction in 2007 (i.e. POST=1 if year>=2007)
TREATMENT	Binary indicator variable that equals one for firms which have to publicly disclose their financial statements (i.e., firms that have *limited* liability)
Control variables	
SIZE	Logarithm of total assets
LEVERAGE	Total liabilities divided by total assets
ROA	Net income before interest and extraordinary items divided by total assets
Z_SCORE	Altman's Z-Score computed as 1.2*(working capital/total assets) + 1.4*(retained earnings/total assets) + 3.3*(EBIT/Total Assets) + 0.6*(Book value of equity/Book value of total liabilities) + 1.0*(Sales/Total Assets)
GROWTH	Year-over-year growth in sales
TANGIBLE	Fixed assets divided by total assets

(Continued)

Table 13 (Continued)

VOLUNTARY	Binary indicator variable that equals one if firms publicly disclose their financial statements without any legal obligation to do so. In the pre-EHUG period, voluntary firms are *limited* or *un*limited liability firms which publish their balance sheet or their balance sheet and profit and loss (P&L) statement. In the post-EHUG period, voluntary firms are *un*limited liability firms, which publish anything (balance sheet or balance sheet in combination with the P&L statement), as well as small *limited* liability firms, which voluntarily publish their P&L statement.
Robustness	
FACCESS2	One year ahead access to bank debt calculated as bank debt divided by total assets
Additional analysis	
FMATURITY	One year ahead maturity calculated as long-term debt divided by total debt (short-term and long-term)
FCOD	One year ahead cost of debt calculated as interest expense divided by interest bearing debt
FSECURED	One year ahead collateralized debt calculated as collateralized debt divided by interest bearing debt

3.4. Main results

3.4.1. Matching procedure

We match treatment and control firms in the pre-regulation period. As such, we use propensity score matching to match firms according to the following continuous covariates (e.g. Ahmed *et al.* 2013), separately for each industry and pre-regulation year.[52] Specifically, we employ the averaged value of the covariates SIZE, LEVERAGE, ROA, Z_SCORE, GROWTH, and TANGIBLE from the pre-regulation period (2004-2006) and a logit regression to predict the propensity scores. Afterwards we employ nearest neighbor one-to-one matching with a caliper equaling 0.25 times standard deviation of the estimated propensity scores of the sample and without replacement (Rosenbaum and Rubin 1985).

Table 14, Panel A (Panel B) shows the mean values of the matching variables before (after) matching. The matching process is effective as it balances all matching variables resulting in no significant post-matching differences in means. The standardized

[52] Since we have an unbalanced dataset, we require matched firms to have the same number of observations.

bias (Rosenbaum and Rubin 1985) of the matching variables is below 10% in all cases which again shows that the treatment and control sample do not differ significantly.

Table 14: Mean values of matching variables in the pre EHUG period (2004-2006)

Panel A: Mean values of the matching variables before matching (N=23,958)

Variables	Control	Treatment	Diff	%bias	(t stat.)	p value
SIZE	8.343	9.172	-0.828	67.0	(27.46)	0.000***
LEVERAGE	0.721	0.755	-0.034	17.5	(8.67)	0.000***
ROA	0.079	0.065	0.014	-16.1	(-7.30)	0.000***
Z_SCORE	2.968	3.158	-0.190	10.7	(5.00)	0.000***
GROWTH	1.069	1.090	-0.021	10.1	(4.25)	0.000***
TANGIBLE	0.429	0.308	0.121	-44.7	(-20.61)	0.000***

Panel B: Mean values of the matching variables after matching (N=3,092)

Variables	Control	Treatment	Diff	%bias	(t stat.)	p value
SIZE	8.544	8.569	-0.025	2.3	(0.63)	0.526
LEVERAGE	0.744	0.734	0.010	-5.2	(-1.43)	0.152
ROA	0.079	0.074	0.005	-5.9	(-1.63)	0.103
Z_SCORE	3.094	3.118	-0.024	1.3	(0.36)	0.719
GROWTH	1.076	1.077	-0.001	0.5	(0.14)	0.885
TANGIBLE	0.373	0.367	0.007	-2.4	(-0.67)	0.504

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 2004-2009, own calculations.

Notes: This table shows descriptive statistics and the difference in means for the matching variables. Diff denotes the absolute difference between control and treatment firms, %bias denotes the standardized bias after Rosenbaum & Rubin (1985), t stat. and p value denote the significance of the two-sided t-tests. *, **, *** represent significance at the 10%, 5% and 1% level. All continuous variables are winsorized at the 1st and 99th percentiles. All variables are defined in Table 13.

3.4.2. Descriptive statistics, univariate analysis, and correlations

The descriptive statistics in Table 15 (Panel A) show the full sample. Treatment and control firms differ significantly according to size and other firm characteristics. The mean (median) assets equal € 35 (€ 8) mn for the treatment group and € 9 (€ 4) mn for the *un*limited liability control group. The treatment sample consists of small (assets below € 10 mn) and medium sized firms (assets between € 10 mn and € 50 mn), while the *un*limited liability control group firms are, on average, considerably smaller. The average firm is profitable, with mean return on assets (ROA) of 0.061 for treatment and 0.079 for

control firms, and highly leveraged, with mean leverage ratios of 0.743 for treatment and 0.716 for control firms.

Table 15 (Panel B) displays the matched sample. Since we match according to all listed observables, except for our variable of interest (FACCESS), the treatment and control firms are similar in size and other firm characteristics. Mean (median) assets equal € 14 (€ 5) mn for the treatment group and € 11 (€ 5) mn for the control group. Both, our unmatched and matched sample consists of small and medium-sized enterprises (SMEs)[53]. These firms rely most heavily on private debt, and strong information asymmetry is predominantly associated with small and moderately sized firms (Elsas and Krahnen 1998; Watts and Zimmerman 1978). Therefore, our setting is especially valuable for the analysis of the disclosure effect on access to bank debt.

Pearson correlations are shown in Table 16, indicating high correlation between Z_SCORE and ROA as well as between Z_SCORE and TANGIBLE. In unreported tests, we use the rolling standard deviation of net interest before extraordinary items as probability of default approximation (Francis *et al.* 2005) instead of the Z_SCORE and show that our results are not affected.

[53] According to the European Commission, a firm which has less than 250 employees and either turnover of less or equal to € 50 mn or total assets of less or equal to € 43 mn is considered a SME. The European SME definition is available at: http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition/index_en.htm, last access: 20/08/2017.

Table 15: Descriptive statistics

Panel A: Descriptive statistics for the full sample (N=48,623)

	Treatment						Control					
Variables	Mean	Std. Dev.	25th	Median	75th	N	Mean	Std. Dev.	25th	Median	75th	N
Financials												
ASSETS (€ mn)	34.908	88.722	3.484	8.295	23.902	44,083	9.069	24.995	1.720	3.523	9.474	4,540
TURNOVER (€ mn)	41.217	87.057	5.651	13.791	35.465	44,083	13.858	22.662	1.320	5.067	15.995	4,540
EMPLOYEE	173.401	892.342	22.000	57.000	147.000	44,083	48.877	137.320	1.000	18.000	53.000	4,540
Dependent variable												
FACCESS	0.590	0.303	0.344	0.634	0.857	44,083	0.764	0.285	0.617	0.887	1.000	4,540
Control variables												
SIZE	9.231	1.405	8.156	9.023	10.082	44,083	8.380	1.080	7.450	8.167	9.156	4,540
LEVERAGE	0.743	0.180	0.632	0.769	0.884	44,083	0.716	0.216	0.578	0.746	0.899	4,540
ROA	0.061	0.090	0.008	0.043	0.100	44,083	0.079	0.089	0.022	0.058	0.116	4,540
Z_SCORE	3.123	1.740	1.907	3.050	4.174	44,083	2.963	1.879	1.452	2.816	4.073	4,540
GROWTH	1.054	0.217	0.958	1.032	1.129	44,083	1.051	0.193	0.964	1.027	1.123	4,540
TANGIBLE	0.315	0.267	0.092	0.244	0.476	44,083	0.437	0.281	0.203	0.407	0.659	4,540
VOLUNTARY	0.252	0.434	0.000	0.000	1.000	44,083	0.040	0.197	0.000	0.000	0.000	4,540
Additional analyses												
FMATURITY	0.476	0.362	0.051	0.516	0.815	44,083	0.476	0.384	0.000	0.510	0.855	4,540
FCOD	0.046	0.023	0.033	0.045	0.056	44,083	0.049	0.022	0.037	0.049	0.059	4,540
FSECURED	0.282	0.331	0.000	0.113	0.548	44,083	0.095	0.234	0.000	0.000	0.000	4,540

(Continued)

Table 15 (Continued)

Panel B: Descriptive statistics for the matched sample (N=6,278)

	Treatment						Control					
Variables	Mean	Std. Dev.	25th	Median	75th	N	Mean	Std. Dev.	25th	Median	75th	N
Financials												
ASSETS (€ mn)	14.028	45.196	2.350	4.686	10.681	3,139	11.103	29.553	2.122	4.699	11.639	3,139
TURNOVER (€ mn)	16.042	30.965	3.094	7.003	17.877	3,139	17.187	25.520	2.231	7.273	22.407	3,139
EMPLOYEE	60.561	133.164	10.000	30.000	68.000	3,139	60.269	161.135	2.000	24.000	67.000	3,139
Dependent variable												
FACCESS	0.626	0.294	0.396	0.682	0.890	3,139	0.739	0.293	0.559	0.857	0.999	3,139
Control variables												
SIZE	8.611	1.122	7.762	8.452	9.276	3,139	8.580	1.106	7.660	8.455	9.362	3,139
LEVERAGE	0.722	0.185	0.609	0.748	0.866	3,139	0.739	0.202	0.603	0.769	0.906	3,139
ROA	0.069	0.090	0.013	0.050	0.110	3,139	0.080	0.089	0.023	0.060	0.117	3,139
Z_SCORE	3.094	1.861	1.651	3.041	4.291	3,139	3.087	1.871	1.709	3.028	4.165	3,139
GROWTH	1.055	0.214	0.961	1.025	1.117	3,139	1.053	0.194	0.963	1.030	1.127	3,139
TANGIBLE	0.376	0.292	0.113	0.313	0.590	3,139	0.383	0.265	0.160	0.352	0.560	3,139
VOLUNTARY	0.223	0.417	0.000	0.000	0.000	3,139	0.048	0.213	0.000	0.000	0.000	3,139
Additional analyses												
FMATURITY	0.492	0.367	0.059	0.538	0.843	3,139	0.446	0.375	0.000	0.440	0.816	3,139
FCOD	0.046	0.022	0.033	0.045	0.056	3,139	0.049	0.023	0.036	0.048	0.060	3,139
FSECURED	0.308	0.345	0.000	0.154	0.609	3,139	0.104	0.240	0.000	0.000	0.000	3,139

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 2004-2009, own calculations.
Notes: This table shows descriptive statistics for the treatment and control sample. Panel A shows the descriptive statistics for the full sample. Panel B shows the descriptive statistics for the matched sample. All variables are winsorized at the 1st and 99th percentiles. All variables are defined in Table 13.

Table 16: Correlations

Panel A: Pearson correlations for the full sample (N=48,623)

	FACCESS	SIZE	LEVERAGE	ROA	Z_SCORE	GROWTH	TANGIBLE	VOLUNTARY
FACCESS	**1**							
SIZE	**-0.0861**	**1**						
LEVERAGE	**0.3556**	**-0.1203**	**1**					
ROA	**-0.2242**	**-0.0793**	**-0.1488**	**1**				
Z_SCORE	**-0.2677**	**-0.2662**	**-0.1212**	**0.4667**	**1**			
GROWTH	-0.0025	**0.0199**	**0.0579**	**0.2113**	**0.1158**	**1**		
TANGIBLE	**0.3410**	**0.1374**	**-0.0738**	**-0.1150**	**-0.5335**	**-0.0186**	**1**	
VOLUNTARY	**-0.0461**	**-0.0819**	**-0.0128**	**0.0623**	**0.1481**	**0.0167**	**-0.1039**	**1**

Panel B: Pearson correlations for the matched sample (N=6,278)

	FACCESS	SIZE	LEVERAGE	ROA	Z_SCORE	GROWTH	TANGIBLE	VOLUNTARY
FACCESS	**1**							
SIZE	**-0.1525**	**1**						
LEVERAGE	-0.0009	**-0.1092**	**1**					
ROA	**-0.1487**	**-0.0393**	**-0.1687**	**1**				
Z_SCORE	**-0.0452**	**-0.1551**	**-0.2180**	**0.5304**	**1**			
GROWTH	**0.0263**	**0.0303**	**0.0544**	**0.1529**	**0.0854**	**1**		
TANGIBLE	**0.1855**	**0.0892**	-0.0041	**-0.1794**	**-0.5740**	-0.0038	**1**	
VOLUNTARY	**-0.0393**	**0.0397**	-0.0109	**0.0544**	**0.1530**	**0.0400**	**-0.1132**	**1**

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 2004-2009, own calculations.
Notes: This table displays Pearson correlation coefficients. * represents significance at the 5% level or below. All variables are winsorized at the 1st and 99th percentiles. All variables are defined in Table 13.

Table 17 shows the results for the univariate difference-in-difference analysis. One can observe that the difference-in-difference of access to bank debt is positive and significant for the full (Panel A) as well as the matched (Panel B) sample.

Table 17: Univariate difference-in-difference analysis of access to bank debt

Panel A: Difference in difference analysis for the full sample (N=48,623)

			Mean	diff	(t stat.)	p value
Pre EHUG (2004-2006)	Control		0.773			
	Treatment		0.587			
	Diff	$(T\text{-}C)_{pre}$		-0.186	(-27.90)	0.000***
Post EHUG (2007-2009)	Control		0.754			
	Treatment		0.593			
	Diff	$(T\text{-}C)_{post}$		-0.161	(-24.35)	0.000***
	Diff-in-diff	$\mathbf{(T\text{-}C)_{post}\text{-}(T\text{-}C)_{pre}}$		**0.026**	**(2.72)**	**0.006*** **

Panel B: Difference in difference analysis for the matched sample (N=6,278)

			Mean	diff	(t stat.)	p value
Pre EHUG (2004-2006)	Control		0.750			
	Treatment		0.622			
	Diff	$(T\text{-}C)_{pre}$		-0.128	(-12.10)	0.000***
Post EHUG (2007-2009)	Control		0.728			
	Treatment		0.628			
	Diff	$(T\text{-}C)_{post}$		-0.099	(-9.53)	0.000***
	Diff-in-diff	$\mathbf{(T\text{-}C)_{post}\text{-}(T\text{-}C)_{pre}}$		**0.029**	**(1.93)**	**0.054***

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 2004-2009, own calculations.
Notes: This table shows the difference in means for access to bank debt (FACCESS) for the treatment and control sample. Diff denotes the absolute difference between control and treatment firms, t stat. and p value indicate the level of significance. *, **, *** represent (two-sided) significance at the 10%, 5% and 1% level, respectively. Diff-in-diff is the incremental effect of the EHUG enforcement shock on the treatment firms access to bank debt compared to the control firms. All variables are defined in Table 13.

The disclosure enforcement shock results in a highly significant 2.6% difference-in-difference in access to bank debt (t-stat= 2.72, p-value=0.006). While control group firms, on average, lose access, the treated firms can close the observed gap quite visibly (Figure 1). The effect for the matched sample is similar (2.9%) and still significant (t-

stat=1.93, p-value=0.054). It likewise is economically meaningful. These significant difference-in-differences indicate that mandatory disclosure of previously private accounting information has a positive effect on access to bank debt, even after matching firms on a range of controls which likely also determine banks' lending decisions. Although our matching process is highly effective, resulting in insignificant differences between the treatment and control sample, we nevertheless perform the multivariate analyses, to control for remaining differences in firm characteristics and unobservable factors (captured in fixed effects).

3.4.3. The effect of mandatory public disclosure on access to bank debt

Table 18 reports the estimated coefficients of Eq. (19) for the full (Column 1) and the matched sample (Column 2). We employ firm-fixed effects in both regressions to control for a range of unobservable factors that are constant over time (Nikolaev and van Lent 2005).

For the full sample (Column 1), our coefficient estimates for the control variables exhibit the predicted signs. As previously expected, firm size (SIZE) and asset collateralizability (TANGIBLE) have a positive and significant association with access to bank debt (FACCESS). On the contrary, ROA and GROWTH show the expected negative association. The coefficient for the ambiguous controls Z_SCORE, LEVERAGE and VOLUNTARY are, with the exception of LEVERAGE, insignificant. In addition, results for the matched sample (Column 2) are generally similar. The only differences being that LEVERAGE loses its significant association and Z_SCORE undergoes a sign change, which does not draw the larger results in question given the ambiguous nature of the variable, as outlined before.

The coefficients on the interaction term between POST and TREATMENT represents the difference-in-difference estimator for testing our hypothesis. In both specifications, it is significant and exhibits the expected sign. For the full sample, the coefficient estimate of POST*TREATMENT is significant (at the 0.05 level) and positive (β_1=0.0139). Employing the matched sample it is larger but slightly less significant. The decrease in significance might be the result of the smaller sample size with less underlying variation in terms of the dependent variable. Nonetheless, we can confirm our prior notion,

that once private accounting information becomes public it increases firms' access to bank debt.

Table 18: The effect of switching from private to public accounting information on access to bank debt

	Pred. sign	Dependent variable: FACCESS			
		1) Full sample		2) Matched sample	
		coef.	(t stat.)	coef.	(t stat.)
POST*TREATMENT	**+**	**0.0139****	**(2.53)**	**0.0175***	**(1.76)**
SIZE	+	0.0657***	(9.92)	0.0570***	(3.34)
LEVERAGE	?	-0.1011***	(-5.49)	-0.0456	(-0.92)
ROA	-	-0.1680***	(-7.46)	-0.2620***	(-4.28)
Z_SCORE	?	-0.0020	(-0.83)	0.0120**	(2.12)
GROWTH	-	0.0018	(0.45)	0.0064	(0.58)
TANGIBLE	+	0.1584***	(8.91)	0.2012***	(4.05)
VOLUNTARY	?	0.0048	(1.64)	0.0105	(1.01)
YEAR FE		Yes		Yes	
FIRM FE		Yes		Yes	
Adj. R-squared		0.7989		0.7990	
Within R-squared		0.0185		0.0203	
N		48,623		6,278	
Firms		9,476		1,214	

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 2004-2009, own calculations.
Notes: This table reports results from regressing POST*TREATMENT and control variables on access to bank debt (FACCESS). The interaction term POST*TREATMENT represents the difference-in-difference estimator. Standard errors are robust and clustered at the firm-level (t-statistics are presented in parentheses). *, **, *** represent (two-sided) significance at the 10%, 5% and 1% level, respectively. All variables are defined in Table 13.

3.5. Robustness

3.5.1. Alternative proxy for access to bank debt

In Table 19 we define access to bank debt as total bank debt divided by total assets (García-Teruel *et al.* 2014). The results are similar compared to the main analysis.

Table 19: Alternative proxy for access to bank debt

	Pred. sign	Dependent variable: FACCESS2			
		1) Full sample		2) Matched sample	
		coef.	(t stat.)	coef.	(t stat.)
POST*TREATMENT	**+**	**0.0075****	**(2.09)**	**0.0002**	**(0.04)**
SIZE	+	0.0532***	(12.90)	0.0530***	(4.39)
LEVERAGE	?	0.1665***	(16.66)	0.2021***	(6.55)
ROA	-	-0.1378***	(-11.16)	-0.1355***	(-3.59)
Z_SCORE	?	-0.0003	(-0.22)	0.0017	(0.49)
GROWTH	-	-0.0079***	(-3.25)	-0.0025	(-0.36)
TANGIBLE	+	0.1606***	(13.23)	0.1977***	(5.94)
VOLUNTARY	?	0.0000	(0.00)	0.0011	(0.16)
YEAR FE		Yes		Yes	
FIRM FE		Yes		Yes	
Adj. R-squared		0.8503		0.8533	
Within R-squared		0.0699		0.0772	
N		48,623		6,278	
Firms		9,476		1,214	

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 2004-2009, own calculations.
Notes: This table reports results from regressing POST*TREATMENT and control variables on access to bank debt (FACCESS). The interaction term POST*TREATMENT represents the difference-in-difference estimator. Standard errors are robust and clustered at the firm-level (t-statistics are presented in parentheses). *, **, *** represent (two-sided) significance at the 10%, 5% and 1% level, respectively. All variables are defined in Table 13.

The difference-in-difference coefficient estimate for the full sample (β_1=0.0075, t-stat=2.09) has a smaller magnitude compared to the main analysis (β_1=0.0139, t-stat=2.53). The EHUG enforcement leads to 0.75% more access to bank debt for treatment firms compared to control firms. Unfortunately, the coefficient estimate for the matched sample is not significant (β_1=0.0002, t-stat=0.04).

3.5.2. Clustering by firm and year

As the Hausman test suggests, we use firm fixed effects in our main analysis and robust standard errors clustered at the firm level to control for serial correlation. If we use clustering according to year (untabulated) or according to both (year and firm) most of our results remain significant (Petersen 2009). Table 20, Column 1 and 2 show the results

when we cluster by year and firm. The coefficient estimate for POST * TREATMENT is significant at the 0.10 level for the full sample (Column 1). However, Column 2 shows that the coefficient estimate is barely insignificant for the matched sample (β_1=0.0175, t-stat=1.57).

Table 20: Clustering by year and firm

	Pred. sign	Dependent variable: FACCESS			
		1) Full sample		2) Matched sample	
		coef.	(t stat.)	coef.	(t stat.)
POST*TREATMENT	**+**	**0.0139***	**(2.21)**	**0.0175**	**(1.57)**
SIZE	+	0.0657***	(8.09)	0.0570**	(3.92)
LEVERAGE	?	-0.1011***	(-5.42)	-0.0456	(-0.72)
ROA	-	-0.1680***	(-4.31)	-0.262***	(-4.28)
Z_SCORE	?	-0.0020	(-0.88)	0.0120**	(2.77)
GROWTH	-	0.0018	(0.37)	0.0064	(0.42)
TANGIBLE	+	0.1584***	(8.06)	0.2012***	(4.03)
VOLUNTARY	?	0.0048	(1.63)	0.0105	(0.84)
YEAR FE		Yes		Yes	
FIRM FE		Yes		Yes	
Adj. R-squared		0.7989		0.799	
Within R-squared		0.0185		0.0203	
N		48,623		6,278	
Firms		9,476		1,214	

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 2004-2009, own calculations.

Notes: This table reports results from regressing POST*TREATMENT and control variables on access to bank debt (FACCESS). The interaction term POST*TREATMENT represents the difference-in-difference estimator. Standard errors are robust and clustered at the year and firm level (t-statistics are presented in parentheses). *, **, *** represent (two-sided) significance at the 10%, 5% and 1% level, respectively. All variables are defined in Table 13.

3.6. Additional analyses

3.6.1. Private and public accounting information and credit terms

In relationship lending, private information results in less information asymmetries between banks and borrowers and, thus, cost savings for banks in monitoring their clients. [54] However, effects on borrowers could be advantageous as well as disadvantageous. Banks could share these benefits with their borrowers and offer them better credit terms or increased access to bank debt. Nevertheless, they could also exploit their monopoly position to capture the firm (Kano *et al.* 2011). After a while, the firm can find itself in a "hold up" situation, where the incumbent bank can initially refuse to grant credit to subsequently force the firm to accept worsening credit terms (Lehmann and Neuberger 2001).

Along these lines, also the empirical evidence regarding the association of private information with credit terms is controversial. On the one hand, housebank relationships result in better credit terms such as more access to external finance, lower cost of debt, longer debt maturity, and less pledging of collateral (Harhoff and Körting 1998; Lehmann and Neuberger 2001; Petersen and Rajan 1994). On the other hand, there is also evidence to the contrary, which points towards a detrimental "lock-in" effect (Berger and Udell 1995; Degryse and van Cayseele 2000; Elsas and Krahnen 1998; Harhoff and Körting 1998; Lehmann and Neuberger 2001; Machauer and Weber 1998).

Hence, in addition to analyzing the effect of the regulatory change on firms' access to bank debt, we also try to establish a first look into its effects on additional price (i.e., interest rate) and non-price (i.e., maturity and collateral) credit terms. These analyses might help in gaining insights into which type of lender (i.e., inside or outside) provides the additional debt funding as this information is not available in our anonymized dataset. First, we examine *maturity*, proxied by the proportion of total debt that is financed long-term (FMATURITY). Banking theory suggests that maturity and monitoring are supplements (Diamond 1991). While lenders accept higher risk, which results of less stringent monitoring and little (costly) acquisition of private information, they, in turn,

[54] Relationship banks can monitor client cash flows directly and instantaneously, therefore relying less on accounting information (Loy 2014).

prefer shorter maturities. These allow them to obtain the loan principal sooner, or renegotiate interest rates more often in order to better reflect the firm's current risk. Thus, we expect maturity to increase if the existing housebank provides additional funds in response to decreased information asymmetry in an attempt to fend off competing banks. The inside lender still has the advantage of additional private information and has monitored the firm for a long time. Hence, it would benefit from longer maturities to make the client an unattractive target for competing banks. If outside lenders were to provide the additional funds, maturities will likely decrease. They might not have much incentive to set up extensive and costly screening and monitoring operations besides analyzing publicly available financial statements. To "get the foot in the door" and create additional future business, they might be inclined to offer loans at or below the incumbent bank's interest rate – but with lower maturities to compensate for the additional risk of monitoring less. Therefore, once private information becomes public, it can result in increasing or decreasing maturity, depending on the source of the lender. More specifically, the inside (outside) lender will most probably offer longer (shorter) maturities, and vice versa.

Our second additional credit term is *cost of debt*, proxied as interest expense divided by interest bearing debt (FCOD). As already mentioned, new banks might offer more favorable interest rates to acquire additional business and subsequently try to establish a "hold up" situation of their own which they can exploit to subsequently increase interest rates (Ioannidou and Ongena 2010). On the other hand, new lenders might be wary of their limited information and suspect that the incumbent will most likely fight the hardest for the most valuable clients. Thus, the actually acquired new business might be subject to the "winner's curse". Therefore, the outside lender might rather be inclined to offer a higher interest rate than the incumbent receives on its loans outstanding (Degryse and van Cayseele 2000; Thadden 2004). Thus, once private information becomes public, it can result in increasing or decreasing cost of debt, depending on the source of the lender. We expect, that the inside lender will offer lower interest rates to fend off the competition, whereas the outside lender will likely offer higher interest rates, attributable to the "winner's curse".

Third, we examine the effect of private accounting information becoming public on *collateralization*, proxied by the proportion of collateralized debt of total interest bearing debt (FSECURED). The pledging of collateral has its theoretical roots in the problems of moral hazard and adverse selection (Besanko and Thakor 1987; Boot *et al.* 1991; Holmstrom and Tirole 1997). Similar as maturity, pledging collateral is a substitute for monitoring the borrower to reduce moral hazard (Holmstrom and Tirole 1997). The incumbent bank already monitors the borrower and, for that reason, has no need to demand additional collateral. Furthermore, adverse selection is not a main issue for the inside bank, since it has reduced information asymmetry with private information (Bharath *et al.* 2011). Contrary, moral hazard and adverse selection is a greater problem to the outside lender. It will most probably demand collateral due to absence of monitoring and private information. Therefore, once private information becomes public, it can result in increasing or decreasing collateral, depending on the source of the lender. We expect, that the inside lender will demand less collateral to fend off competition whereas the outside lender will demand more collateral to substitute for monitoring and reduce the adverse selection problem.

Table 15 displays the descriptive statistics and Table 21 the difference-in-difference estimations for the credit terms maturity, cost of debt, and collateralization, each for the full (Panel A) sample and the matched (Panel B) sample. In the full sample, the average proportion of total debt financed long-term (FMATURITY) is 47.59% (47.64%) for the treatment (control) firm, respectively. The average cost of debt (FCOD) for treatment (control) firms is 461 (491) basis points. The cost of debt is comparable to the public statistics of annual interest rates[55] (473 basis points) during the same period, indicating that the firms in our sample are essentially similar to the full population. The average collateralized debt (FSECURED) for treatment (control) firms is 28.16% (9.45%). The coverage for FSECURED differs considerably between *limited* and *un*limited liability firms. The latter were not obliged to hand in this information to the Deutsche

[55] The interest rate of banks and other financial institutions to non-financial companies in Germany for short and long term debt is a time series from the European System of Central Banks and available at: http://www.bundesbank.de/Navigation/EN/Statistics/Time_series_databases/ESCB_Time_Series/eszb_zeitreihen_node.html?openNodeId=500220, last access: 11/09/2017.

Bundesbank. Therefore, the database displays values for FSECURED as zero (1) if the firm does not have collateral pledged for any of its debt, or (2) if the data item is truly missing. Attributable to this data limitation, we evaluate results for FSECURED with due caution. For brevity, we do not discuss descriptive statistics for the matched sample, which are essentially comparable.

Table 21 (Column 1) presents the difference-in-difference firm-fixed estimation results for maturity. The coefficient estimate of POST*TREATMENT is significantly positive (β_2=0.0250, t-stat.=2.59). Hence, when private accounting information becomes public, the proportion of debt financed long-term increases considerably. Following up on our earlier discussion, this result indicates that the treatment firms get more access to debt from the inside lender. Otherwise, increased access to bank debt in combination with shorter maturities would imply that outside lenders provide additional debt which is rather short-term.

Table 21 (Column 3) exhibits the results for cost of debt for our full sample. The difference-in-difference estimator is only slightly positive and barely significant (β_2=0.0008, t-stat.=1.66). The coefficient is not economically meaningful, since it represents only 1.7% (8 basis points compared to 461 basis points) of the treatment firms' average cost of debt. Based on the cost of debt results, we cannot make any inferences as to which type of lender provides the additional debt.

Table 21 (Column 5) presents the difference-in-difference estimation of collateralization for the full sample. The coefficient on the difference-in-difference estimator is significantly positive (β_2=0.0123, t-stat=2.33). Hence, it suggests that once private information become public, treatment firms have to pledge additional collateral for 1.23% of their outstanding debts, on average. We presume that this result points toward outside lenders requiring collateral for additional debt funding.[56]

For comparability, we also present results for the matched sample. While the coefficient signs are unanimously similar to their full sample counterparts', they are insignificant. There is a range of possible reasons for this effect. The small sample size

[56] Nevertheless, it might also be plausible that the inside lender demands more collateral pledging to make its clients less attractive for (potential) outside lenders for which less collateral would subsequently be available.

due to lost firms post-matching as well as low variability in terms of underlying firm characteristics goes hand-in-hand with little variance in credit terms between treated and control firms – especially since we also employ firm-fixed effects estimation. Finally, it is possible that both, inside and outside lenders give access to bank debt, which we cannot determine given our dataset. Therefore, negative and positive effects on credit terms might cancel each other out.

In summary, the effect of increased mandatory financial statement disclosure on price and non-price credit terms is ambiguous and merits further research with more comprehensive datasets (e.g., internal datasets from large creditors). Given the results for the unmatched sample, we provide initial evidence that both, inside and outside lenders provide the additional debt funding following the disclosure shock.

Table 21: Additional analysis on the effect of switching from private to public accounting information on credit terms

	Dependent variable: FMATURITY				Dependent variable: FCOD				Dependent variable: FSECURED			
	1) Full sample		2) Matched sample		3) Full sample		4) Matched sample		5) Full sample		6) Matched sample	
	coef.	(t stat.)	coef.	(t stat.)	coef.	(t stat.)	coef.	(t stat.)	coef.	(t stat.)	coef.	(t stat.)
POST*TREATMENT	**0.0250*** **	**(2.59)**	**0.0056**	**(0.38)**	**0.0008***	**(1.66)**	**0.0007**	**(0.81)**	**0.0123** **	**(2.33)**	**0.0108**	**(0.95)**
SIZE	0.0539***	(6.43)	0.0327	(1.30)	0.0011*	(1.77)	0.0022	(1.28)	0.0293***	(3.85)	0.0036	(0.18)
LEVERAGE	0.0053	(0.22)	0.0035	(-0.05)	-0.0031*	(-1.86)	0.0025	(-0.62)	0.0099	(0.53)	0.0450	(0.94)
ROA	0.0590*	(1.96)	-0.0076	(0.08)	-0.0210***	(-10.03)	-0.018***	(-2.86)	-0.0702***	(-2.98)	-0.0322	(-0.48)
Z_SCORE	-0.0077**	(-2.51)	-0.0120	(-1.36)	0.0001	(0.59)	0.0009	(1.18)	-0.0021	(-0.78)	-0.0003	(-0.04)
GROWTH	0.0119**	(2.07)	0.0292*	(1.71)	0.0000	(-0.01)	-0.0012	(-1.17)	-0.0050	(-0.95)	-0.0104	(-0.68)
TANGIBLE	0.2214***	(8.99)	0.1161*	(1.96)	0.0075***	(4.78)	0.0087*	(1.73)	0.1692***	(8.13)	0.1415***	(2.71)
VOLUNTARY	0.0026	(0.59)	0.0027	(0.17)	0.0001	(0.31)	-0.0011	(-1.22)	0.0089**	(2.23)	0.0038	(0.28)
YEAR FE	Yes		Yes		Yes		Yes		Yes		Yes	
FIRM FE	Yes		Yes		Yes		Yes		Yes		Yes	
Adj. R-squared	0.6860		0.6753		0.6904		0.7355		0.7060		0.7071	
Within R-squared	0.0083		0.0049		0.0100		0.0078		0.0059		0.0039	
N	48,623		6,278		48,623		6,278		48,623		6,278	
Firms	9,476		1,214		9,476		1,214		9,476		1,214	

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 2004-2009, own calculations.

Notes: This table reports results from regressing POST*TREATMENT and control variables on maturity (FMATURITY), cost of debt (FCOD), and secured loans (FSECURED). The interaction term POST*TREATMENT represents the difference-in-difference estimator. Standard errors are robust and clustered at the firm level (t-statistics are presented in parentheses). *, **, *** represent (two-sided) significance at the 10%, 5% and 1% level, respectively. All variables are defined in Table 13.

3.6.2. Limited liability and access to bank debt

As previously outlined, our matched control sample consists of *un*limited liability firms. Banks are restricted to the firm's assets if their defaulting borrower is a *limited* liability corporation rather than an *un*limited liability partnership. Therefore, the average corporation contains higher credit risk (e.g., Elsas and Krahnen 1998). Unsurprisingly, access to bank debt is distributed in favor of *un*limited liability partnerships (Figure 1). Our main multivariate results presented in Table 18 control for these differences through firm-fixed effects. We exclude firms, which change their legal form. Hence, only firms with the same liability status over the full period remain in the sample. Therefore, liability status represents a prime example of a constant underlying factor. To make the incremental contribution of *limited* liability on access to bank debt more visible, we re-estimate our main model employing industry- instead of firm-fixed effects. As such, the binary TREATMENT indicator is not suppressed (Table 22).

Table 22: The incremental effect of limited liability

		Dependent variable: FACCESS			
	Pred. sign	1) Full sample		2) Matched sample	
		coef.	(t stat.)	coef.	(t stat.)
TREATMENT	?	-0.1312***	(-13.45)	-0.1337***	(-9.00)
POST*TREATMENT	**+**	**0.0227*** **	**(3.51)**	**0.0215***	**(1.93)**
SIZE	+	-0.0180***	(-8.29)	-0.0304***	(-4.36)
LEVERAGE	?	-0.1471***	(-9.81)	-0.0945**	(-2.50)
ROA	-	-0.4391***	(-13.88)	-0.6127***	(-6.11)
Z_SCORE	?	0.0103***	(4.36)	0.0191***	(3.03)
GROWTH	-	0.0645***	(9.48)	0.0675***	(3.81)
TANGIBLE	+	0.3260***	(23.44)	0.2845***	(7.84)
VOLUNTARY	?	0.0443***	(8.44)	0.0269	(1.57)
YEAR FE		Yes		Yes	
FIRM FE		No		No	
INDUSTRY FE		Yes		Yes	
R-squared		0.1529		0.2037	
Adj. R-squared		0.1518		0.1981	

(Continued)

Table 22 (Continued)

N	48,623	6,278
Firms	9,476	1,214

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 2004-2009, own calculations.
Notes: This table reports results from regressing POST*TREATMENT and control variables on access to bank debt (FACCESS), controlling for the base line effect of limited liability. The interaction term POST*TREATMENT represents the difference-in-difference estimator. Standard errors are robust and clustered at the firm-level (t-statistics are presented in parentheses). *, **, *** represent (two-sided) significance at the 10%, 5% and 1% level, respectively. All variables are defined in Table 13.

Column 1 displays the difference-in-difference estimate for the full sample (β_2=0.0227, t-stat=3.51), which is larger in magnitude and significance compared to the coefficient estimate from the main analysis (β_1=0.0139, t-stat=2.53). Indicating that public disclosure leads to 2.27% more access to bank debt for treatment firms. The coefficient estimate for the matched sample (Column 2) does not change considerably, neither in magnitude nor in significance.

3.6.3. Industry and access to bank debt

There is evidence that industry composition is also an influential determinant of SME financing (Hall *et al.* 2000). More specifically, they exhibit that industry-specific growth, firm size, firm age and asset structure influence capital structure decisions in their sample of 3,500 private UK firms. As industry-fixed effects are absorbed in our main multivariate results attributable to the inclusion of firm-fixed effects, we implement the regression design of Kausar *et al.* 2016. Instead of year- and firm-fixed effects, we employ firm-fixed effects in combination with the interaction between industry- and year-fixed effects. This way we control for industry while still benefitting from the stricter firm-fixed effects estimation. Yet, our results are comparable to the main analysis (Table 18).

The coefficient estimate for POST*TREATMENT for the full (matched) sample equals 0.0136 (0.0171) and is significant at the 0.05 (0.10) level.

Table 23: Control for industry in the firm-fixed estimation

	Pred. sign	Dependent variable: FACCESS			
		1) Full sample		2) Matched sample	
		coef.	(t stat.)	coef.	(t stat.)
POST*TREATMENT	**+**	**0.0136****	**(2.40)**	**0.0171***	**(1.71)**
SIZE	+	0.0619***	(9.06)	0.0606***	(3.36)
LEVERAGE	?	-0.0983***	(-5.29)	-0.0550	(-1.10)
ROA	-	-0.1662***	(-7.27)	-0.2781***	(-4.47)
Z_SCORE	?	-0.0023	(-0.95)	0.0129**	(2.17)
GROWTH	-	0.0023	(0.55)	0.0031	(0.28)
TANGIBLE	+	0.1580***	(8.89)	0.2068***	(4.03)
VOLUNTARY	?	0.0038	(1.28)	0.0085	(0.80)
YEAR*INDUSTRY FE		Yes		Yes	
FIRM FE		Yes		Yes	
Adj. R-squared		0.7994		0.7973	
Within R-squared		0.0170		0.0212	
N		48,615		6,278	
Firms		9,475		1,214	

Source: Research Data and Service Centre (RDSC) of the Deutsche Bundesbank, USTAN, 2004-2009, own calculations.

Notes: This table reports results from regressing POST*TREATMENT and control variables on access to bank debt (FACCESS), controlling for industry-fixed effects. The interaction term POST*TREATMENT represents the difference-in-difference estimator. Standard errors are robust and clustered at the firm-level (t-statistics are presented in parentheses). *, **, *** represent (two-sided) significance at the 10%, 5% and 1% level, respectively. All variables are defined in Table 13.

3.7. Conclusion

This study shows that if private accounting information becomes public, it leads to significantly increased access to bank debt for private firms. The results hold using firm-fixed effects estimation as well as matching on other firm characteristics, potentially associated with access to bank debt in a continental European bank-based economy (García-Teruel *et al.*, 2014).

Our results are important for practitioners, since they show that mandatory financial statement disclosure does not only accrue proprietary cost (Bernard *et al.* 2015; Wittmann and Bravidor 2015), but also measurable benefits in the form of additional access to capital from banks. Second, we contribute to the literature with a natural experimental setting which decreases self-selection concerns with respect to discretionary accounting disclosure choices in prior private firm lending literature (Cassar 2011; Cassar *et al.* 2015; Minnis 2011). Furthermore, this setting allows us to better separate the effects of accounting information and private information on information asymmetry in debt contracting (Danos *et al.* 1989). Finally, analytical research shows that more information sharing decreases the formation of close bank relationships, in the long-term (Gehrig and Stenbacka 2007). Our results exhibit the short-term effects of an exogenous information shock on firms' banking. Therefore, it will be interesting for future research to follow-up on its long-term implications.

The main limitation of our study is that our treatment and control sample consists of firms with different legal forms. We match according to firm characteristics relevant to lenders (size, leverage, profitability, growth, probability of default, sales growth and asset collateralizability), but we cannot match according to the legal form. It is possible, that unlimited liability firms have a different business model and therefore other investment opportunities. However, sales growth should proxy for investment opportunities. Furthermore, entrepreneurs choose the legal form that matches the riskiness of their investments.[57] While debt provided to unlimited liability firms might be less risky, as the lender can also access assets in the entrepreneur's private realm,

[57] There is mixed evidence on the nexus between firm risk, legal liability and private firm debt financing. While Harhoff *et al.* (1998) suggest that limited liability firms are more risky and likely to default, Cassar (2004) deems that „limited liability gain is fictional in actuality" (p. 268).

potentially riskier firm assets might impair that effect. Having said that, we control for probability of default, making the distinction between limited and unlimited liability and its effect on bank financing even less of a concern. Finally, there is evidence that the introduction of the Basel II banking regulations, which overlap with our post-regulation period, has adverse effects on private firm lending (Schindele and Szczesny 2016). Yet, matching according to industry-year should control for business model and business cycle, respectively. Moreover, since we observe a decrease in access to bank debt of the control group (Figure 1), Basel II likely dampens our results.

4. Concluding remarks

This thesis analyzes the role of accounting information in debt contracting of German private firms. It includes empirical studies, which use unique combinations of datasets leading to important results and future research recommendations.

The study in Chapter 2 investigates the effect of accruals quality on German private firms' cost of debt and how relationship lending influences this effect.

The study benefits from an exclusive match[58] of two Deutsche Bundesbank datasets: (1) USTAN (firms' annual financial statement data) and (2) MiMiK (credit register of large loans). Using the USTAN database, we measure accruals quality according to the modified Dechow and Dichev (2002) model by McNichols (2002). Furthermore, we measure cost of debt as interest expense divided by average financial debt (Bigus *et al.* 2009; Francis *et al.* 2005). In addition, we approximate relationship lending using the MiMiK database. In this regard, the strength of the lending relationship is defined as the loan provided by the main lender divided by firms' total financial loans and the relationship duration is measured by the consecutive years in which the firm has the same main lender. To estimate the moderating effect of relationship lending on the association between accruals quality and cost of debt, we use panel regression techniques.

Our results exhibit that banks use accounting based lending in pricing debt of German small and medium private firms. Firms' with better accruals quality face lower cost of debt, even after controlling for all relevant firm characteristics. However, the intensity of this effect depends on relationship lending. First, the larger the debt a firm borrows from the main lender the smaller is the effect of accruals quality. This means stronger relationships moderate the effect of accruals quality, since banks use a supplementary private information channel. Second, we find that longer relationships with the main bank intensify the effect of accruals quality on cost of debt. Due to multiplied interaction, the bank learns to better interpret accounting information.

[58] The match was established by Stefan Goldbach, for detail description see Goldbach and Nitsch (2014).

In particular, the results show that firms with high[59] accruals quality get 32.96 basis points lower cost of debt than firms with low accruals quality, which represents 6.67% of the sample's average cost of debt. Yet, the cost of debt benefits from accruals quality differ significantly if we take into account relationship strength and relationship duration. We find that with low relationship strength, a high accruals quality firm gets 56.85 basis points lower cost of debt compared to a low accruals quality firm. However, the cost of debt benefit of accruals quality decreases to 18.32 basis points when the firm has a high relationship strength with its main bank. The reason for this result might be that if banks have strong relationships, they are the exclusive lender and thus motivated to monitor the firm more closely and acquire private information (Diamond 1984). Therefore, the bank builds less on accounting information and more on the costly gathered private information. Furthermore, we find that higher relationship duration enhances the cost of debt benefit from accruals quality. Our results show that firms with a low relationship duration get only 13.28 basis points cost of debt benefit from accruals quality, whereas firms with a high relationship duration get 57.12 basis points. Thus, as the relationship goes on, the bank generates a data history and can better interpret accruals quality.

In summary, these results show that accounting information plays a significant role for German small and medium private firms. In addition, we find that accounting and private information complement as well as substitute each other. Thus, it is hard to disentangle the influence of accounting information for existing borrowers (Danos *et al.* 1989). Therefore, the study in Chapter 3 examines the influence of accounting information for new borrowers in a quasi-natural experimental setting.

The study in Chapter 3 analyzes the consequences of a public disclosure law enforcement on German private firms' access to bank debt.

This study employs a unique match[60] of the Deutsche Bundesbank dataset USTAN and the commercial dataset Amadeus of the Bureau van Dijk. This data

[59] For the ease of interpretation, we calculate all economic effects on cost of debt comparing a high accruals quality (relationship strength, relationship duration) firm (value of 90th percentile) with a low accruals quality (relationship strength, relationship duration) firm (value of 10th percentile).

[60] The match was established by Schild *et al.* (2017).

combination allows investigating the effects of a law enforcement (i.e., an external shock) on private firms' access to bank debt. The former dataset includes firms that share their financial statements with a small round of stakeholders (e.g. housebank) and in addition had to submit these statements to the Deutsche Bundesbank for refinancing purposes (Stöss 2001). Thus, USTAN consists of firms with and without the obligation to publish financial statements. The latter dataset includes financial statements, which are publicly available in the electronic federal gazette (i.e., mandatory publicized financial statements and voluntary publications). Hence, this study is one of the first to use such a match of datasets enabling the analyses of a quasi-natural experiment.

The publication of financial statements is strongly regulated since the introduction of the EHUG (Act on Electronic Commercial Registers, Registers of Cooperatives and Business Registers) in 1/1/2007. Firms are forced to pay monetary penalties if not publicizing their financial statements (beginning with 2006) in the electronic federal gazette. Before 2006, there was no de facto enforcement of private firm financial statement disclosure in Germany. After 2006, almost all firms publish according to the EHUG requirements. Since the publication requirements differ between *limited* liability firms and *un*limited liability firms, we can clearly differentiate between treatment and control firms. Furthermore, we are able to control for firms, which voluntarily publicized their financial statements before the EHUG. Therefore, this setting allows us to set up a difference-in-difference analysis.

Hence, before the regulatory shock financial accounting information on private firms had been largely private. The firm only shared it with a small number of handpicked stakeholders, including its lenders. Therefore, those inside lenders had a considerable information advantage over competing banks, attributable to private financial accounting information as well as the accumulation of additional private information. However, after the EHUG regulatory enforcement, private accounting information becomes public for treatment firms. Our results show, that this fact results in additional access to bank debt for treatment firms. Accordingly, we find that mandatory public disclosure leads to 1.4% more access to bank debt for treatment firms compared to control firms. This means on average 138,723.23€ more access to bank debt, which is economically meaningful, since

our sample consists of small and medium sized firms. This might either be the result of the inside lender expanding its engagement to fend off new lenders, or new lenders granting loans as their information asymmetry compared to the inside lenders decreases.

The results hold in a difference-in-difference regression design with year and firm fixed effects and robust standard errors clustered at firm level. To further approach causality, we employ a matching procedure between private *limited* liability firms, subject to financial statement disclosure, and small and medium sized private *un*limited liability firms. Only very large *un*limited liability companies are subject to the financial accounting disclosure rules. Our results show again, that mandatory financial statement disclosure enables *limited* liability firms to close significantly the financing gap to their *un*limited liability counterparts.

In an additional analysis, we also attempt to show how this decreased information asymmetry affects price (cost of debt) and non-price (maturity and collateralization) credit terms. If the inside lender increases the loan amounts to fend off additional (outside) lenders, the credit terms would, in all likelihood, improve. The existing bank relationship has been costly to establish, as (ex ante-) screening and (ex post-) monitoring the client involve considerable bank resources. As established bank relationships therefore signal creditworthiness to (potential) outside lenders, these might offer additional loans to the client at similar rates without additional effort to acquire private information. Hence, if inside lenders grant additional loans, we would expect maturity to increase, cost of debt to decrease and the proportion of collateralized loans to decrease to keep the firm in an exclusive bank relationship. Whereas, it is also possible that if outside lenders with little to no additional private information were to provide the additional funds, we would not necessarily expect (much) improvement in credit terms. On the one hand, the new bank might offer more favorable credit terms to "get the foot in the door". Subsequently it could try to establish its own "hold up" (Ioannidou and Ongena 2010). On the other hand, the new lenders might be wary of their limited information and try to charge higher interest rates, require higher collateralization, and offer lower maturities to account for a potential "winner's curse" (Degryse and van Cayseele 2000; Thadden 2004). Our results show that while maturity increases (improvement in credit terms), cost of debt increases

slightly as well as does the proportion of collateralized loans (worsening in credit terms). Therefore, the effect of additional public disclosure on credit terms, and the likely provider of the additional bank loans (inside vs. outside lenders) remains ambiguous and merits further research.

Further research could use credit data to examine, if inside or outside lenders grant additional loans to the firm. Possible datasets for this analysis are more detailed credit data of private banks or the MiMiK of the Deutsche Bundesbank. Furthermore, using the MiMiK, the next possible research direction could be the influence of the EHUG enforcement on relationship lending. The answer to the question "Does mandatory publication lead to more lenders for private firms?" could clarify previous ambiguous results. Another possible direction for future research is to analyze if the extent of mandatory publication has an influence on firms' debt financing. After the EHUG enforcement, all corporations have to publicize their financial statements in the online federal gazette. However, the German Commercial Code (Section 326 and 327), reliefs small and medium firms regarding the extent of mandatory publication. It would be interesting to elaborate if medium firms who publicize their balance sheet and profit and loss statement have more access to bank debt than small firms who publicize only their balance sheet.

To conclude, this thesis contributes to the understanding of how accounting information influences debt contracting of German private firms. However, there is still potential for future research in using more detailed credit data to give further insights especially regarding the influence of accounting information on relationship lending.

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