The Transmission of Bank Funding to Corporate Loans: Deleveraging and Industry Specific Access to Loans in Germany

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Abstract

Healthy banks are crucially important for smooth lending. Correspondingly, bank regulations including Basel III intend to create a strong financial sector. However, the higher capital requirement may also worsen the access to finance especially during the transition period. Using data on firm-bank relationships in Germany between 2005 and 2007, we show that the debt ratio of banks is related to the bank loan risk. In order to assess the potential effect of tighter capital requirements due to regulatory changes, we analyze industry specific responses of loan conditions to bank debt levels. Our findings imply that manufacturing and financial services are potentially facing a more restricted access to bank loans after tightening of capital requirements.

Keywords: Bank lending, leverage, financial regulation, Basel III.

JEL Classifications: G21, G28, C33.

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1 Introduction

Bank lending is of crucial importance for economic growth and development. Only strong and healthy banks can provide appropriate loans. Our findings confirm that bank financing translates directly into corporate loans. As a result, a reduction in bank debt is likely to cause a more difficult access to loans which can be especially strong for specific industries. Our main results can be summarized as follows. First, we show that an increase in their debt ratio makes banks more willing to grant more risky loans. Second, we find high sectoral differences in the transmission mechanism of bank funding to corporate loans.

We use unique data on firm-bank relationships in Germany between 2005 and 2007. Debt ratio and short-term funding ratio are calculated from the balance sheet data, whereas the loan risk is proxied by by implicit lending rates at company level. Moreover, we utilize information on bank relationships of analyzed firms, which allows us to merge individual firm level data with the corresponding bank indicators.

Moreover, our multilevel modeling approach utilizes the information given by the structure of the data set with respect to different criteria. In particular, we use fixed and random effects for sectors, regions, and time periods.

Our discussion of Basel III is motivated by the question, whether the banks facing tighter capital requirements will respond by raising equity or deleveraging. Indeed, banks may find it necessary to reduce their loan exposure because new capital is not available for them on the financial markets. Moreover, we try to identify industry specific effects of deleveraging because banks will not reduce loans uniformly across the economy. Therefore, we estimate the sector-specific sensitivity of loans to banks' debt ratio and identify those sectors, which are likely to be influenced mostly by the ongoing regulatory changes.

Our empirical results reveal that the banks' debt ratio determines the lending conditions especially for manufacturing and financial services. Those industries will potentially be hit more by a regulatory caused decrease in banks' debt ratio.

Our discussion of deleveraging tries to identify the sectors which can be mostly affected by current regulatory changes. In particular, we do neither assess any sort of bank risk nor systemic risk. We also do not provide any measure related to the impact of deleveraging on economic growth. Our discussion aims to address the question of the potential effect of tighter capital requirements on the access to loans for specific industries in Germany. Hence, this study will contribute to the discussion regarding the implementation of tighter capital requirements introduced by Basel III, which have to achieved by 2018. Thus, we close a gap in the literature since most studies model the implementation of tougher capital requirements by equity raising whereas we focus on deleveraging due to tougher capital requirements. Finally, empirical insight regarding the connection of banks' financing and banks' granting of loans is provided.

The paper is structured as follows. In the following section, we discuss briefly Basel III regulations. In section 3, we review the previous literature on selected aspect of bank lending. Section 4 describes our data and explains how firm and bank data have been merged. Section 5 discusses the estimation strategy and empirical results. The final section summarizes and discusses our findings also from the policy perspective.

2 Basel III

With the ongoing regulation in the banking industry it becomes increasingly important to study the effects of proposed regulatory changes (Cochrane, 2013). Proposed changes that potentially influence the refinancing opportunities of banks are particularly important for Germany. In particular, the German economy is characterized by a strong role of small and medium enterprises (SMEs) which are mainly financed through bank loans. Therefore, Germany represents an example of bank-based financial system (Allen and Gale, 1995). Similarly, Cosimano and Hakura (2011) emphasize that there are cross-country variations with respect to the adjustment process of several variables in response to Basel III. A stable banking system is even more important for a country which faces a smaller capital market. In addi-

tion, SMEs cannot easily substitute bank loans with corporate debt during a credit crunch (Giesecke et al., 2012). Therefore, this requires not only a careful assessment of the effect of proposed regulations in general but in particular for Germany. Correspondingly, we identify industries which might suffer from limited access to bank loans if banks face higher capital requirements.

In general, regulatory attempts to assure capital adequacy of banks are motivated by the concern that banks naturally do not hold enough capital relative to bank risk. A socially optimal level of capital has to take into account negative externalities due to bank defaults which are not reflected in market capital requirements. In the aftermath of the financial crisis, the regulatory authorities as well as financial intermediaries have put much attention to a reform of the regulation of capital requirements (Hellwig, 2010). In December 2010, the Basel Committee on Banking Supervision published its comprehensive set of reforms in order to strengthen the regulation, supervision and risk management of the banking sector, known as Basel III. In March 2013, the German parliament passed a law to implement Basel III. In Germany, the Basel Committee on Banking Supervision reforms are accompanied by the German restructuring law (Schäfer et al., 2013). Main changes in Basel III are reflected in the fields of capital requirement, risk coverage, leverage ratio, and liquidity. Revised capital requirements focus more on common equity, bringing the total common equity standard to 7% and include a countercyclical buffer within a range of 0 to 2.5% comprising common equity. Also, a non risk-weighted leverage ratio of 3% is currently discussed. This reflects the criticism regarding potentially flawed model-based approaches, referred to as internal ratings based approach.

As a matter of course, this discussion extends also to academic research. In general, risk-based capital requirements can eliminate risk-taking incentives if risk weights are correctly chosen (Rochet, 1992; Kim and Santomero, 1988). However, Hellwig (2010) criticizes the illusion of measurability of risk whereas Blum (2008) emphasizes that the supervisor has to rely on banks' risk reports. Angelini et al. (2011) analyze the impact of Basel III on economic fluctuations and performance,

respectively, by mainly running counterfactual experiments in a dynamic stochastic general equilibrium setting plus some alternative models. They find that the reforms cause a decline in steady state output associated with less output volatility.

Many scholars have been analyzing the role of bank funding and, in particular, the role of leverage and short-term funding. On the one hand, (Admati and Hellwig, 2013; Admati et al., 2011; Pfleiderer, 2010) favor regulatory limits on bank leverage. Their position is also accompanied by the argument that excessive leverage was the primary cause of the financial crisis (Acharya et al., 2012; Adrian and Shin, 2010; Brunnermeier, 2009). On the other hand, DeAngelo and Stulz (2013) emphasize the need of high leverage for banks when liquidity is prized at a premium and banks generate value by producing liquid claims for financially constrained counterparties. However, this argument is not uniformly shared in the literature, van Wincoop (2013) is highly skeptical that the global shock was transmitted through leveraged financial institutions. Lé (2013) finds that between 1986 and 2011 the capital-to-assets ratio of banks has decreased by approximately 15% after the implementation of deposit insurance due to a pick-up in leverage by smaller banks.

In contrast to the role of leverage, there is more general consensus regarding the role of short-term funding. López-Espinosa et al. (2012) find that short-term wholesale funding risk was underestimated prior to the financial crisis. Craig and Dinger (2013) find a positive link between wholesale market conditions and bank risk which they theoretically justify by the moral hazard view, that suggests increasing bank competition to increase banks' incentive to invest in risky projects due to higher funding costs. Dewally and Yingying (2014) examine the impact of the liquidity shock in the wholesale funding market on the supply of bank credit during the peak of the financial crisis. They find that the dry-up in liquidity reduced lending relatively more in case of banks which relied more heavily on wholesale funding. Ivashina and Scharfstein (2010) find that banks which had better access to deposit funding or were less reliant on short-term debt, respectively, cut less lending activity after the collapse of Lehman Brothers.

3 Literature Review

3.1 Bank Lending

Banks, as financial intermediaries, provide liquidity and credit to firms and households. Moreover, they screen credit risks and extend loans to financially constrained borrowers (DeAngelo and Stulz, 2013). They are especially important when the collateral value of assets is low and specific collection skills are important (Diamond and Rajan, 2000).

We argue that the marginal costs of banks' debt increase in debt. The more risky a firm's project is the higher the lending rate banks require. Hence, an increase in banks' debt facilitates the access to capital for relatively more risky projects as banks have to cover increasing lending costs (Craig and Dinger, 2013). Moreover, the banks have more capital which can be used for lending of projects which otherwise would not be financed. Alternatively, we could argue that the marginal revenues of loans has to equal its marginal costs. Finally, this approach is in line with what Acharya et al. (2012) describe as lending "down the quality curve".

Modigliani and Miller (1958) argue that the cut-off point for investment is completely unaffected by the type of security used to finance the investment. Translating this into maturity transformation means that from a theoretical perspective bank lending is unaffected by the maturity composition of bank liabilities.

Consider a market with a continuum of different firms, $i = 1, 2, ..., N$, where the return to firm i's project is a random variable $0 \leq \tilde{Y} \leq \bar{Y}$ and

$$E(\tilde{Y}_i) = E(\tilde{Y}_{j \neq i}) \tag{1}$$

holds.[1] However, the dispersion of expected project returns, $F(Y)$, increases in i so that

$$\int_0^x [F_{i+1}(Y) - F_i(Y)]dY \geq 0 \quad \forall x \geq 0 \tag{2}$$

[1] The modeling approach here and following is related to Bester (1985).

reflects that firms' projects differ in risk. For a given loan (L_i) the loan contract (Ω) is described by the interest paid by firm i (r_i) and the corresponding collateral (c_i). The lending rate increases in the dispersion of expected project returns and collateralization is costless. Firm i is bankrupt if $\tilde{Y}_i + c_i < (1 + r_i)L_i$. A probability of default (p_i) is attached to the event of bankruptcy of firm i. The probability of default increases in the dispersion of expected project returns, $\partial p / \partial F(Y) > 0$. Thus, the lending rate which compensates for risk increases in the probability of default, $\partial r / \partial p > 0$. If a firm goes bankrupt the bank becomes the owner of the respective project plus posted collateral. Hence, the bank has an expected return for a project of

$$\pi_i(\Omega) = E\left\{ min[(1 - p_i)(1 + r_i)L_i,\ \tilde{Y}_i + c_i] - L_i \right\} / L_i \tag{3}$$

which does not differ across different firms if the lending rate sufficiently compensates for the dispersion of expected project returns or risk, respectively. Depending on the amount of funds available to the bank, a risk-averse bank allocates funds from firm 1 to firm N depending on the amount of funds available. Thus, we assume that banks are able to observe the dispersion of expected project returns whereby self-selection by contracts or credit rationing becomes redundant. Even though projects have the same expected returns, the allocation of funds to more risky projects depends on the amount of funds available to the banker. Finally, we assume that the marginal costs of debt (CD) increase in debt (D), $\partial CD / \partial D > 0$. Equation (4) illustrates that a risk-averse banker lends until his marginal cost of debt equals expected return from equation (3).

$$\pi_i(\Omega) = \frac{\partial CD}{\partial D} \tag{4}$$

3.2 Buffer Theory and Pecking Order Theory

The way how banks adjust their balance sheets is crucial regarding the real economy (IMF, 2013). The buffer theory implies that if banks approach the minimum capital requirements, they will have an incentive to increase capital and reduce risk

in order to avoid a punishment by the regulatory authority (Milne and Whalley, 2001; Marcus, 1984). Some authors (Angelini et al., 2011; Cosimano and Hakura, 2011; Kashyap et al., 2010; Rime, 2001) argue that banks will address higher capital requirements by raising equity. However, banks may address higher capital requirements also by deleveraging. Economic reasoning for this scenario is twofold: First, deleveraging is easier to implement in the short-run. Second, asymmetric information has yet to be reduced by completed stress-tests and a common European banking supervisory body. The lack of information to the potential investors makes equity raising costly. Since financing costs determine risk taking this is a clear distinction from previous works. Raising equity would increase cost of capital on average, whereas deleveraging would work in the opposite direction.

Alternatively, the deleveraging scenario is supported also by the pecking order theory (Myers and Majluf, 1984). Using a survey aiming to identify the impact of the Basel Accord, Jackson et al. (1999) find that banks are likely to reduce lending if economic conditions are weak or issuing equity is costly. Hyun and Rhee (2011) analyze the effect of shareholder dilution on banks' decisions to meet capital requirements and show that banks prefer loan reduction over the issuance of new equity. Nonetheless, the possibility that banks may respond to tighter capital requirements not solely by deleveraging represents a natural limitation of our approach. However, if banks address higher capital ratios by raising equity which in turn increases their lending spread (Kashyap et al., 2010), the same industries could lose access to bank loans due to higher costs and due to the disappearance of banks' willingness to lend. Thus, a different approach does not necessarily cause different results.

4 Data

4.1 Dafne Databank

The Dafne databank, provided by the Bureau van Dijk, includes information on balance sheets, profit and loss accounts and the legal form for German firms. Although some of the data is available from 1999, the coverage is limited and therefore

only the three years period before the financial crisis, 2005 to 2007 are used. These three years are characterized by a sound economic environment and no regalutory changes. In total, the amount of firms varies between $23,000$ and $31,000$. This accounts for approximately $82,000$ observations from 2005 to 2007. To obtain a measure for corporates' lending costs, we define an implicit lending rate associated with interest rate payments on bank loans using the reported balance sheet data. However, it is necessary to keep in mind that the data is not detailed enough to calculate bank or loan specific implicit lending rates. Thus, only an average implicit lending rate that firm i pays in period t on its entire bank debt can be calculated. Specifically, for each firm i in period t we calculate the implicit lending rate as

$$ILR_{it} = \frac{I_{it}}{L_{it}}, \tag{5}$$

where I_{it} denotes the total interest payments of firm $i = 1, ..., N$ in period t and L_{it} are total bank loans reported by firm i in period t. ILR_{it} does not only include interest payment but also comprises fees, commissions, penalties for late payment, expensive trade credit, and other costs associated with bank loans. Since the implicit lending rate, ILR_{it}, may be subject to errors, due to e.g. new loans, loan repayment, and received interest payments, large outliers which are defined as an implicit lending rate above 30% are excluded. Implicit lending rates for firms are for example used by Benito and Whitley (2003) or Fidrmuc et al. (2010). Figure **??** graphs the distribution of the ILR. On average an ILR of 9.13% is obtained. The 25% and 75% percentile equal 5.34% and 11.28%, respectively. The distribution of the ILR is similar to the distribution of interest rates used in previous studies, for example, Harhoff and Körting (1998) use data originating from a survey of small and medium-sized German firms and obtain interest rates on average, where mean equals 9.2%, 25% percentile equals 7.5%, and 75% percentile equals 10.5%, almost equal to implicit lending rates calculated here. Using data from the National Survey of Small Business Finances in which trade credit constitutes a considerable fraction,

Petersen and Rajan (1995) report interest rates of 11.3% on average with standard deviation of 2.2%. In addition to the implicit lending rate the profit margin, the EBIT margin, and cashflow/turnover are employed. Figure **??** also illustrates the distribution of the additional firm specific variables.

Finally, sectoral classification (Nace, Rev. 2) is available for each firm. This classification is organized with increasing granularity from sections, divisions, groups, to classes. We take sections, divisions, and classes into account to attach an industry to each firm. We include sectoral effects at different classification levels in our analysis (including robustness analysis).

4.2 Bankscope Databank

For each firm we draw data of all respective bank relations from Bankscope. Thereby, banks' debt ratio and short-term funding ratio are of interest. The debt ratio of bank b in period t (DR_{bt}) is defined as 1 minus equity ratio (ER_{bt}),

$$DR_{bt} = 1 - ER_{bt} = 1 - \frac{E_{bt}}{TA_{bt}}, \tag{6}$$

where equity ratio equals equity (E_{bt}) divided by total assets (TA_{bt}). Similarly, the short-term funding ratio of bank b in period t (ST_{bt}) the balance sheet item "other deposits and short-term borrowings" ($ODSTB_{bt}$) is divided by total assets,

$$ST_{bt} = \frac{ODSTB_{bt}}{TA_{bt}}. \tag{7}$$

Thus, all bank variables are standardized by total assets.

In total, relevant bank relations comprise up to $2,216$ different bank units or branches which are identified according to the bank routing code. They account for $6,197$ observations from 2005 to 2007. Table 1 illustrates both bank funding measures from 2005 to 2007. Whereas the average debt ratio is relatively constant across years under consideration, the short-term funding ratio slightly declines from 2005 to 2007.

[Table 1 about here.]

Table 2 presents pairwise correlation coefficients for all variables specific to firm i that runs a bank relation with bank b in period t. As expected, proxies for firms' collateral (profit margin, EBIT margin and cashflow/turnover) are positively correlated and each of them is negatively correlated with the implicit lending rate. Short-term funding ratio is positively correlated with the implicit lending rate, whereas debt ratio is not statistically significantly correlated with the implicit lending rate. Both bank funding measure are positively correlated since short-term funding constitutes to bank debt.

[Table 2 about here.]

5 Estimation and Results

5.1 Estimation Strategy

The estimation strategy relies on the assumptions drawn in Diamond and Rajan (2000) and Holmstrom and Tirole (1997) where banks first tap capital markets before granting loans to projects. In simple terms, a positive coefficient of banks' debt ratio with respect to the lending rate means that higher bank debt makes relatively more risky projects more likely to be financed and vice versa. In line with Harhoff and Körting (1998), it is assumed that collateral and lending rate conditions are determined sequentially, in a way that the lending rate setting follows the collateral decision. Higher collateral by firms facilitates access to bank loans.

We estimate the impact of banks' debt ratio and short-term funding ratio on implicit lending rates,

$$ILR_{ibt} = \beta_0 + \beta_1 DR_{ibt} + \beta_2 ST_{ibt} + \beta_3 C_{ibt} + \psi_s + \theta_t + u_{ibt}. \tag{8}$$

Variables are specific to firm i and bank b. DR_{ibt} represents banks' debt ratio and ST_{ibt} represents banks' short-term funding ratio. To account for the important role of collateral regarding loan decisions (Diamond and Rajan, 2000; Holmstrom and

Tirole, 1997; Bester, 1985; Stiglitz and Weiss, 1981), C_{ibt} represents a proxy for collateral. ψ_s reflects firm size dummies including quartile 1 to 3, θ_t stands for time fixed effects, and u_{ibt} denotes the residual. A specific feature of our data set is that observations are nested. Two dimensions are specified in order to apply a multilevel model (Kayo and Kimura, 2011): sectors (Nace, Rev. 2), s, and regions (federal states), r. In such a three-level model, the clusters themselves are nested in superclusters, forming a hierarchical structure. It is known that business conditions and infrastructure differ for different industries with respect to the federal state where they are located. In addition, competition in the German banking market differs across regions. The residual, u_{ibt}, is decomposed into random effects and an error term:

$$u_{ibt} = u_{ibtsr} = \lambda_{sr} + \lambda_r + \varepsilon_{ibtsr} \tag{9}$$

where λ_{sr} is the random intercept for sector s and region r and λ_r is the random intercept for region r. The random effect for sector is nested within regions in the sense that it does not take on the same value for a given sector across all regions but takes on different values for each combination of both dimensions. The between-region heterogeneity is modeled by the region-level random intercept.[2]

Coefficient β_1 reflects a change in bank debt relative to total assets keeping the short-term funding ratio and collateral constant. We hypothesize that the marginal costs of banks' debt increase in debt and higher funding costs make banks more willing to grant riskier loans. Correspondingly, we expect β_1 to be positive. Coefficient β_2 reflects a change in a bank's liability composition which means that bank debt relative to total assets remains unchanged but bank debt consists of more short-term funding. In case of the short-term funding ratio, theory and recent empirical analysis provide opposing hypotheses (see e.g. Modigliani and Miller, 1958; Dewally and Yingying, 2014; Craig and Dinger, 2013; López-Espinosa et al., 2012;

[2] We test the null hypothesis that the variance component for regions is zero using a likelihood ratio test. The test suggests that the random effect for regions is required and, thus, supports the hierarchy applied here.

Ivashina and Scharfstein, 2010). However, including ST_{ibt} allows to control for the maturity composition of banks' liabilities. The coefficient for the collateral proxy (β_3) is hypothesized to decrease the implicit lending rate. Higher collateral reduces monitoring costs and in turn the risk premium. Collateral is proxied by profit margin, the EBIT margin, and cashflow/turnover. All collateral proxies employed are comparable across industries.

5.2 Baseline Regressions

In order to assess the transmission of bank funding into corporate loans, equation (8) is estimated. Regarding random effects for sectors, the dimension used for sectors is set at class-level. Given the partially very low amount of observations, these random effects are virtually close to random effects for firms and regions. Table 3 presents estimation results. The coefficient the debt ratio enters the regressions statistically significantly at a 5%-level, with a positive sign. Also, its size is similar for all three different proxies for collateral (column I to III). Hence, the coefficient of debt ratio is line with our hypothesis that more indebted banks allocate more capital to more risky projects.

The coefficient of the short-term funding ratio, however, contradicts the theoretical hypothesis that the maturity of funding does not matter with respect to the allotment of capital to risky projects (Modigliani and Miller, 1958). The short-term funding coefficient is always significant at least at a 10%-level. However, it is line with the recent empirical literature arguing that short-term funding matters with respect to lending. As expected, all proxies for collateral significantly reduce the implicit lending rate.

[Table 3 about here.]

Next, we run equation (8) only for firms which are engaged in relationship banking (Rajan, 1992) and for those which have multiple bank relations. Table 4 illustrates the corresponding results which are that the implicit lending rate of firms engaged in relationship banking is uncorrelated with the respective bank's financing. On the

other hand, the results for firms with multiple bank relations are similar to those obtained for the whole sample.

[Table 4 about here.]

5.3 Robustness Analysis - Industry Specific Regressions

In order to analyze the effect of deleveraging on an industry level, we run industry-specific regressions. Regression equation (8) is estimated for each industry separately.[3]

Thereby, industries are defined at section level according to the Nace Classification (Rev. 2). Because this analysis requires a sufficiently large number of observations at sectoral level, only sections of about one thousand observations are taken into consideration (results for the remaining sectors are available upon request from authors). Moreover, as the manufacturing is the largest sector, we look at the largest divisions. This reduces our sample of 19 different sections to 13 sections. Table 5 summarizes the sections and manufacturing divisions analyzed in the analysis. Similar to the baseline analysis three different proxies for collateral are used (profit margin, cashflow to turnover ratio, and ebit margin).

[Table 5 about here.]

For a given industry, a strong impact of the bank debt ratio on the implicit lending rate implies that the industry is highly sensitive to bank deleveraging. Such an industry would experience deteriorating access loans if regulatory changes cause banks to reduce debt since firms facing a high implicit lending rate run more risky projects and represent the worst credit assets (Hyun and Rhee, 2011) in banks' balance sheets.[4] Moreover, we look at sectors with the highest impact of collateral

[3] Likewise, this analysis is repeated with always one particular industry excluded in order to identify the most influential industries. The results are available upon request from authors.

[4] In response to capital requirements, Rime (2001) finds for example that Swiss banks tend to improve their capital adequacy by increasing their capital (retained earnings, equity issues) not by decreasing risk-taking. Considering large US institutions, Kashyap et al. (2010) find an increase in banks' lending spread if banks raise equity in order to comply with Basel III. As explained in section on estimation strategy our approach relies on the assumption that banks address tougher capital requirements by deleveraging.

variables because tighter financing conditions are likely to influence especially sectors where collateral is important.

Table 6 reports results for main industries regressions. Since results are not sensitive to the use of different proxies for collateral, only results for firms ebit margin are reported.[5] Manufacturing (section C), financial and insurance activities (K) and real estate activities (L) are identified as the industries which are mostly dependent on the bank debt ratio. Moreover, the collateral variable is also mostly important for these sectors. For almost all other industries the effect of banks debt ratio and collateral variables (with the exception of Section F and Section G) on the implicit lending rate is insignificant.

[Table 6 about here.]

Banks debt ratio has a highly significant and strong effect on the implicit lending rate significant on the 1% level in financial services and in manufacturing and insurance activities at 5% level. Results suggest that the access to loans for firms in these sections depends more on the banks' ability to lever compared to other industries. That financing of financial services and insurance activities depend on the overall leverage is rather supportive to our approach than surprising. However, the interaction of the financial industry with other industries like manufacturing is of core interest. A possible explanation could be for example that on average firms in manufacturing have higher capital expenditures than firms in other industries. In Germany, for example, the majority of capital expenditure is assigned to the manufacturing industry. The investment in these long term assets is mostly financed by bank loans. Therefore, deleveraging strongly affects the manufacturing sector.

Moreover, the impact is surprisingly homogenous within the manufacturing sector (results are available upon request). Since manufacturing represents a large industry with many companies, there is considerable amount of observations in some divisions

[5] Results for the remaining regressions are available upon request.

which enables us to estimate the regressions also for these sub-samples.

Characteristics of the sections financial services, manufacturing, and insurance activities are illustrated in Table 7. Manufacturing reveals the expected characteristics: the implicit lending rate is on average statistically higher compared to the remaining sections and excluding profit margin, firms in manufacturing face on average statistically lower collateral proxies. In addition, firms in manufacturing have on average more bank relations. The share of firms with only one bank relation is 8 percentage points lower for manufacturing if compared with the remaining sectors. Finally, firms from manufacturing operate with larger banks. The mean of total assets of banks which operate with manufacturing firms is statistically higher than the mean of total assets of banks operating with all other sectors. Thus, that we identify manufacturing as the sector to suffer most from a regulatory caused bank deleveraging sums up to a consistent overall picture. That firms involved in financial and insurance activities and real estate activities face very different characteristics which simply reflects their very different business model.

[Table 7 about here.]

6 Conclusion

Using a unique dataset for banks and their corporate lenders in Germany between 2005 and 2007, we analyze the transmission of bank funds to corporate lending in Germany. We show that the financial health of the banks determines the access to finance for the corporate sector. We find that bank funding translates into the allocation of capital especially to relatively risky projects.

In order to identify industries which are supposed to face tighter access to bank loans if banks have to delever, we analyze sector-specific multilevel regressions. Thereby, the financial industry, real estates, and manufacturing are supposed to be particularly vulnerable to changes in banks' debt. That access to loans for the former two sectors depends on the overall leverage is no surprise. The extent of

transmission of bank funding to corporate loans of manufacturing is the main finding of this study. The analysis reveals that the access to loans for firms in manufacturing depends heavily on the debt ratio of their bank relations. At the same time, the lending conditions in manufacturing are already determined strongly by the available collateral. Firms in manufacturing face on average a higher implicit lending rate, have lower collateral, are less engaged in relationship banking, and operate with larger banks. We find surprisingly low differences in determinants of lending conditions between individual manufacturing industries, which means that the worsening of access to finance could have a broad and widespread impact on German manufacturing.

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List of Tables

Table 1: Descriptive Statistics

			Mean	Std. Dev.	Min	Max
Bank	2005	Debt Ratio	0.937	0.038	0.271	0.998
		ST Funding Ratio	0.002	0.008	0.000	0.136
	2006	Debt Ratio	0.935	0.035	0.248	0.996
		ST Funding Ratio	0.002	0.009	0.000	0.153
	2007	Debt Ratio	0.935	0.039	0.141	0.988
		ST Funding Ratio	0.002	0.011	0.000	0.148
Firm	2005	IR	9.174	5.675	0.002	30.000
		EBIT	5.824	11.419	-59.610	60.000
		Profit	3.359	10.057	-59.840	59.990
		Cashflow	7.347	11.141	-59.770	59.970
	2006	IR	9.005	5.619	0.003	30.000
		EBIT	6.318	11.762	-59.930	59.910
		Profit	3.997	10.486	-59.990	59.920
		Cashflow	7.880	11.539	-59.940	59.990
	2007	IR	8.994	5.626	0.004	30.000
		EBIT	6.655	12.002	-59.310	59.780
		Profit	4.315	10.557	-59.880	59.930
		Cashflow	8.307	11.713	-59.460	60.000

Source: Bankscope; Dafne.

Table 2: Correlation Analysis

		Bank		Firm			
		DR	ST	IR	Profit	EBIT	CF
Bank	DR	1.000					
	ST	0.499*	1.000				
Firm	IR	0.003	0.019*	1.000			
	Profit	-0.001	0.037*	-0.040*	1.000		
	EBIT	0.009*	0.021*	-0.108*	0.713*	1.000	
	CF	0.019*	0.030*	-0.160*	0.595*	0.651*	1.000

* denotes significance at 5%-level.

Table 3: Bank Funding, Basic Specification, 2005 - 2007

	(I)	(II)	(III)
rand. eff.	region, sector (class)	region, sector (class)	region, sector (class)
fixed eff.	time	time	time
collateral	profit margin	cashflow/turnover	ebit margin
Debt Ratio	2.762**	2.858**	2.919**
[*Bank*]	(1.359)	(1.364)	(1.361)
ST Funding Ratio	2.198*	2.576**	2.317*
[*Bank*]	(1.232)	(1.237)	(1.231)
Collateral	-0.008***	-0.039***	-0.017***
[*Firm*]	(0.002)	(0.002)	(0.002)
Size Dummies	yes	yes	yes
[*Firm*]			
Constant	7.099***	7.253***	7.036***
	(1.290)	(1.294)	(1.292)
No of sectors	450	451	449
No of regions	16	16	16
No of groups	3642	3642	3645
No of obs	62424	61939	62637
LRL	-193300	-191761	-194128

Notes:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Standard errors are reported in parentheses.
(3) *LRL* - Log restricted-likelihood.
(4) Label in brackets distinguishes between firm and bank specific variables.

Table 4: Bank Funding, Basic Specification, 2005 - 2007, Firms with one Bank relation (BR) vs. Firms with more than one Bank relation

one BR	(I)	(II)	(III)
rand. eff.	region, sector (class)	region, sector (class)	region, sector (class)
fixed eff.	time	time	time
collateral	profit margin	cashflow/turnover	ebit margin
Debt Ratio	-2.585	-2.165	-1.715
[*Bank*]	(3.508)	(3.553)	(3.548)
ST Funding Ratio	-0.316	0.728	-0.584
[*Bank*]	(3.004)	(3.040)	(3.023)
Collateral	-0.005	-0.023***	-0.015***
[*Firm*]	(0.004)	(0.004)	(0.004)
Size Dummies	yes	yes	yes
[*Firm*]			
Constant	11.881***	11.651***	11.161***
	(3.319)	(3.361)	(3.357)
No of sectors	370	371	370
No of regions	16	16	16
No of groups	2011	2013	2014
No of obs	10392	10246	10361
LRL	-32437	-32013	-32426

more than one BR	(I)	(II)	(III)
rand. eff.	region, sector (class)	region, sector (class)	region, sector (class)
fixed eff.	time	time	time
collateral	profit margin	cashflow/turnover	ebit margin
Debt Ratio	3.076**	3.133**	3.140**
[*Bank*]	(1.465)	(1.468)	(1.465)
ST Funding Ratio	2.236*	2.611*	2.481*
[*Bank*]	(1.346)	(1.349)	(1.343)
Collateral	-0.009***	-0.047***	-0.020***
[*Firm*]	(0.003)	(0.003)	(0.003)
Size Dummies	yes	yes	yes
[*Firm*]			
Constant	6.879***	7.112***	6.906***
	(1.390)	(1.393)	(1.390)
No of sectors	441	442	442
No of regions	16	16	16
No of groups	3264	3266	3276
No of obs	52032	51693	52276
LRL	-160658	-159527	-161496

Notes:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Standard errors are reported in parentheses.
(3) *LRL* - Log restricted-likelihood.
(4) Label in brackets distinguishes between firm and bank specific variables.

Table 5: Sections at around 1,000 Observations

	Section
A	Agriculture, forestry and fishing
C	Manufacturing
D	Electricity, gas, steam and air conditioning supply
E	Water supply; sewerage, waste management and remediation activities
F	Construction
G	Wholesale and retail trade; repair of motor vehicles and motorcycles
H	Transportation and storage
J	Infomation and communication
K	Financial and insurance activities
L	Real estate activities
M	Professional, scientific and technical activities
N	Administrative and support service activities
Q	Human health and social work activities

Table 6: Bank Funding, Basic Specification, 2005 - 2007, Industry Specific Regressions

	Sample only consisting of					
	Section A	Section C	Section D	Section E	Section F	Section G
rand. eff.	region, sector (class)					
fixed eff.	time					
colletaral	profit margin					
Debt Ratio	-11.161	6.802**	9.763	4.556	-7.169	3.603
[*Bank*]	(9.054)	(2.703)	(6.786)	(9.010)	(4.508)	(2.672)
ST Funding Ratio	27.31***	-1.264	-5.028	10.084	7.982**	-2.560
[*Bank*]	(8.784)	(2.393)	(5.739)	(7.840)	(4.005)	(2.587)
Collateral	0.019	-0.031***	-0.001	0.007	-0.043***	-0.024***
[*Firm*]	(0.019)	(0.006)	(0.013)	(0.015)	(0.009)	(0.008)
Size Dummies	yes	yes	yes	yes	yes	yes
[*Firm*]						
Constant	18.863**	3.950	-0.509	3.489	17.656***	7.032***
	(8.546)	(2.564)	(6.435)	(8.539)	(4.271)	(2.531)
No of sectors	14	203	6	6	16	74
No of regions	16	16	16	16	16	16
No of groups	79	1417	74	66	211	766
No of obs	984	17173	1770	1156	7216	15167
LRL	-2887	-53334	-5135	-3422	-22901	-47427

	Sample only consisting of						
	Section H	Section J	Section K	Section L	Section M	Section N	Section Q
rand. eff.	region, sector (class)						
fixed eff.	time						
colletaral	profit margin						
Debt Ratio	-11.038*	-12.599	21.496***	8.288**	9.976	-3.765	7.670
[*Bank*]	(6.019)	(11.802)	(8.279)	(3.979)	(8.363)	(7.295)	(6.117)
ST Funding Ratio	9.126*	2.586	-4.025	5.730*	5.624	-0.970	24.634***
[*Bank*]	(5.503)	(10.543)	(6.478)	(3.399)	(7.506)	(6.149)	(6.500)
Collateral	-0.013*	0.007	-0.021***	-0.012***	-0.016	-0.012	0.000
[*Firm*]	(0.008)	(0.017)	(0.006)	(0.004)	(0.012)	(0.008)	(0.014)
Size Dummies	yes	yes	yes	yes	yes	yes	yes
[*Firm*]							
Constant	18.706***	21.507*	-12.477	-0.840	0.144	12.418*	-0.697
	(5.723)	(11.193)	(7.906)	(3.772)	(7.915)	(6.902)	(5.817)
No of sectors	18	16	9	4	11	17	5
No of regions	16	16	16	16	16	16	16
No of groups	153	111	70	63	108	149	62
No of obs	2972	1086	2194	4459	2080	2429	2146
LRL	-8961	-3490	-6915	-12774	-6659	-7624	-6221

Notes:
(1) * (**) [***] denotes significance at the 10% (5%) [1%] level.
(2) Standard errors are reported in parentheses.
(3) *LRL* - Log restricted-likelihood.
(4) Label in brackets distinguishes between firm and bank specific variables.

Table 7: Characteristics of manufacturing (section C), financial and insurance activities (K) and real estate activities (L)

Year	Mean	All sections	Section C	Section K	Section L
2005	ILR	9.174	9.938	8.935	6.262
	t-statistic		(-12.973)	(1.299)	(27.059)
	Ebit Margin	5.824	4.490	8.868	19.093
	t-statistic		(9.857)	(-7.147)	(-61.092)
	Profit Margin	3.359	3.435	7.514	6.518
	t-statistic		(-0.635)	(-10.417)	(-15.650)
	Cashflow/Turnover	7.347	5.718	12.456	18.751
	t-statistic		(12.358)	(-11.303)	(-52.591)
2006	ILR	9.005	9.801	8.843	6.223
	t-statistic		(-14.633)	(0.989)	(27.178)
	Ebit Margin	6.318	4.836	9.046	19.743
	t-statistic		(10.541)	(-6.819)	(-60.737)
	Profit Margin	3.997	3.835	8.132	7.736
	t-statistic		(1.287)	(-10.919)	(-18.238)
	Cashflow/Turnover	7.880	6.059	13.262	19.487
	t-statistic		(13.221)	(-12.572)	(-52.509)
2007	ILR	8.994	9.968	9.012	6.207
	t-statistic		(-15.798)	(-0.095)	(22.941)
	Ebit Margin	6.655	5.424	6.664	20.897
	t-statistic		(7.022)	(-0.019)	(-54.078)
	Profit Margin	4.315	4.554	6.604	8.133
	t-statistic		(1.546)	(-5.113)	(-15.562)
	Cashflow/Turnover	8.307	6.147	12.520	20.030
	t-statistic		(12.668)	(-8.3123)	(-44.3843)

Notes: *t*-test shows whether the mean of the reported section is equal to the mean of the remaining sections. *t*-statistics are reported in parentheses.