Got rejected? Real effects of *not* getting a loan

Tobias Berg[†]

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Abstract

Using a lender cut-off rule that generates plausibly exogenous variation in credit supply, I analyze real effects of loan rejections in a sample of small and medium-sized enterprises. I find that loan rejections reduce asset growth, investments, and employment, and these effects are concentrated among low liquidity firms. Precautionary savings motives aggravate real effects: firms whose loan applications got rejected increase cash holdings and cut non-cash assets in excess of the requested loan amount. These results point to the amplifying effect of precautionary savings motives in the transmission of credit supply shocks.

JEL: G21, G32, J23

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[†] Bonn University, Email: tobias.berg@uni-bonn.de. Tel: +49 228 73 6103

1. Introduction

Considerable attention has been devoted to the role of firm's cash holdings. One theory postulates that firms hold cash for precautionary motives, because cash protects them against adverse funding shocks. However, little is known about the role of cash holdings in the transmission of funding shocks. Do firms draw down their cash holdings after a funding shock, thereby cushioning any real effects on asset growth, investment, and employment? Or do precautionary savings motives lead firms to increase cash holdings after a funding shock, thus amplifying real effects? This paper tries to fill this gap by analyzing plausibly exogenous variation in credit supply induced by a lender cut-off rule.

As is the case with many banks, the bank I look at (a major European lending institution) uses a cut-of rule when lending to small and medium-sized enterprises. The data set consists of almost 17,000 loan applications from small and medium-sized enterprises (SMEs) between 2009 and 2012. Each firm is assigned a continuous hard-information rating. Loan applications with a rating better than the cut-off are accepted, while loan applications with a rating worse than the cut-off are subject to an additional review, leading to a sharp drop in the loan acceptance rate at the threshold.

This set-up provides three key advantages: First, and most importantly, the set-up provides a plausibly exogenous variation in credit supply: firms *just* below and *just* above the cut-off are very similar in terms of credit quality, yet one group of

firms has access to credit while the other group of firms does not. Second, the sample consists of firms that have all applied for a loan, i.e., the set-up allows to clearly distinguish between credit supply and credit demand. Third, the lender cut-off rule imposes a credit *quantity* constraint on firms whose loan applications have been rejected. Financial constraints can translate into either higher cost of funds or into credit quantity constraints, but in practice, credit quantity constraints are more prevalent (Almeida and Campello, 2001).

Using a regression discontinuity design, I document the following effects: first, while larger firms (total assets above EUR 3mn) are able to substitute the loss in funding from the sample bank, small firms (total assets below or equal to EUR 3mn) are not. Consequently, small firms whose loan applications have been rejected lose approximately 10 percent of their debt funding and need to cut their assets by 8 percent relative to small firms whose loan applications have been accepted.

Second, the effect crucially depends on the firms' liquidity: firms with high liquidity – measured as the ratio of current assets to current liabilities – decrease their cash holdings after a credit supply shock. As a result, these firms are able to absorb the credit supply shock without a significant effect on asset growth, investments, and employment. In contrast, firms with low liquidity *increase* their cash holdings after a loan rejection. As a consequence, these firms need to cut non-cash assets in excess of the quantity implied by the credit supply shock and thus, investment and employment decline significantly at these firms. These results point

to the amplifying role of precautionary savings motives in the transmission of credit supply shocks.

The regression discontinuity design relies on a no-manipulation assumption of the running variable, i.e., the continuous internal rating. If ratings of firms with a positive outlook would be revised by the loan officer to a rating slightly above the cut-off, then firms slightly below and slightly above the cut-off are no longer comparable. Loan officers are not compensated based on loan volume but on ex-post loan performance and the rating does not include soft information. Thus, there are no incentives to manipulate the rating (as, for example, in Berg, Puri, and Rocholl, 2014) and there is no (conscious or unconscious) influence of soft information. A formal McCrary density test confirms the no-manipulation assumption.

The paper lies at the intersection of the literature on the corporate demand for liquidity and the literature on credit supply shocks. Liquidity helps financially constrained firms to pursue profitable investment opportunities when they occur (Keynes (1936)). This precautionary savings motive for holding cash is formally modeled in Almeida et al. (2004) who show that financially constrained firms save a positive fraction of their cash flows, while unconstrained firms do not. Extensions of this idea include Han and Qiu (2007) who show that cash flow volatility is positively related to firms' precautionary savings demands; and Acharya et al. (2007) who model the trade-off between saving and reducing short-term debt to show that constrained firms save cash instead of reducing short-term debt whenever their

hedging needs are high. Using a large sample from 1980-2006, Bates et al. (2009) confirm that precautionary savings motives play an important role in explaining cash ratios at U.S. industrial firms. Riddick and Whited (2009) caution against using a simple correlation between savings and cash-flows to gauge precautionary savings motives. These simple correlations might be misleading if productivity shocks are serially correlated and firms thus tend to invest more and save less after a positive productivity and cash flow shock. This paper adds to the literature by identifying a plausibly exogenous shock to credit supply and identifying the subsequent change in firms' cash holdings. I find that firms with low liquidity increase their cash holdings after the credit supply shock, thus pointing to the crucial role of precautionary savings motives for financially constrained firms.

The literature on credit supply shocks, or more generally, on real effects of financial constraints (Fazzari, Hubbard, and Petersen, 1988; Lamont, 1997; Rauh, 2006; Campello, Graham, and Harvey, 2010; Faulklender and Petersen, 2012, Banerjee and Duflo, 2014) has seen an increasing awareness since the financial crisis. Supply of credit via banks can have significant real effects (Bernanke, 1983). Prior literature has analyzed real effects of a change in bank loan supply either due to changes in monetary policy (Gertler and Gilchrist, 1994; Kashyap and Stein, 2000; Jiminez, Ongena, Peydro, and Saurina, 2012), due to dispersion in lender health (Gan, 2007; Duchin et al., 2010; Chodorow-Reich, 2014, Acharya, Eisert, Eufinger, and Hirsch, 2014; Balduzzi, Brancati, and Schiantarelli, 2014; Cingano, Manaresi,

and Sette, 2013, Bentolila, Jansen, Jiminez, and Ruano, 2014; Popov and Rocholl, 2014), or due to debt maturity effects (Almeida et al., 2012). A significant part of the decline in employment in the great recession has been attributed to impaired credit supply (Chodorow-Reich, 2014). This paper adds to the literature by highlighting the importance of liquidity holdings in the transmission of credit supply shocks. In particular, my results point to the amplifying effect of precautionary savings motives in the transmission of credit supply shocks.

The rest of the paper is organized as follows. Section 2 describes the loan origination process and the cut-off rule used for accept/reject decisions. Section 3 provides descriptive statistics. Section 4 explains the empirical strategy and provides the empirical results. Section 5 concludes.

2. Institutional set-up and data

2.1 Loan granting process

I access data on 16,855 SME loan applications from 13,484 firms between 2009 and 2012 from a major German bank. The size of the loan applications ranges from EUR 10,000 to EUR 1mn. For loan applications up to EUR 1mn, loan-granting decisions are governed by a cut-off regime that creates plausibly exogenous variation

in the likelihood of receiving a loan.[1] All loan applications are from limited liability firms outside the financial sector.[2] I apply two filters to the original data: first, subsidiaries of larger firms are excluded from the sample because the existence of a parent company is likely to impair the effect of any credit supply shock. Second, I exclude firms with total assets of less than EUR 350,000 as these are only subject to very rudimentary disclosure requirements (this filter will be described in more detail below). Both filters together exclude less than 5% of the original sample.

In the first step, the bank aggregates hard information from various sources (account activity, balance sheet and profit and loss data, firm type/age/location, and information from a private credit registry) into a continuous internal rating. This continuous internal rating ranges from 0.5 (best) to 11.5 (worst) and is mapped into rating grades ranging from 1 (best) to 11 (worst). A distribution of rating grades for all loan applications is depicted in Figure 1.

[Figure 1]

[1] For loan applications above EUR 1mn, there is no cut-off rule and an additional review is required for each application independent of the rating. Dropping loan applications with a loan volume of exactly EUR 1mn – which might be strategically chosen as to avoid the additional review –does not significantly alter any of the following results.

[2] Firms with unlimited liability of the owners (typically sole-proprietorships such as self-employed consultants, architects, or physicians) are handled in a different segment (private customers) by the bank. Financial firms (banks, insurance companies) are handled in a separate segment as well.

In the second step, loan applications are grouped into three distinct buckets. The loan officer can grant loan applications with a rating grade of 1-7 without consent from the risk management department. Loan applications with a rating grade of 8-9 are subject to further review by the risk management department, which then takes the final accept/reject decision.[3] The risk management department bases their decisions on an analysis of the available data sources and can also request further details or clarification on some of the inputs. Such cut-off rules are widely used when granting loans; in particular because a more precise signal about an applicant's credit quality is most valuable for applicants in the middle of the creditworthiness spectrum.[4] This set-up induces a discontinuity in the likelihood of loan application acceptance. As can be seen from Figure 2, the likelihood of an accept-decision is over 80% for rating grades between 1 and 7, and it precipitously drops to 50% for rating grades 8 and 9.[5]

[3] See Udell (1989) and Berg (2015) for a detailed description of the loan review function of risk management.

[4] Ruckes (2004) and Bubb and Kaufmann (2014) provide a theoretical motivation for the use of such cut-off rules in the loan application. The key argument in both papers is that the lender must bear a fixed cost per applicant for the additional screening process by the risk management department. This fixed-cost assumption implies that only for loan applicants below a particular threshold of the hard-information rating, the additional information outweighs the fixed costs.

[5] Loan officers can reject loan applications for ratings 1-7. Discussions with loan officers suggest that these rejections are mainly due to technical reasons: After entering the applicant's data into the system, a loan officer would communicate the terms and conditions of the loan offer to the client if the rating is in the 1-7-range. If an applicant directly decides *not* to take up the loan offer, most loan officers hit the "reject"-button in the loan application system instead of formally making a loan offer.

[Figure 2]

Finally, loan applications with a rating grade of 10-11 are subject to a separate "red-light-process" and lending criteria are akin to debtor-in-possession financing rules. Thus, there is another discontinuity in the likelihood of acceptance between rating grades 9 and 10. However, as the number of loan applications with a rating of 10-11 is very low (see Figure 1), the following analysis focuses on the discontinuity between rating grades 7 and 8.

2.2 Measuring real effects after the accept/reject decision

Measuring real effects *after* the accept/reject decision requires company information in the year(s) after the loan application has been made. This information is not entirely available at the bank, in particular for firms whose loan applications have been rejected. I thus rely on annual reports that need to be filed according to mandatory disclosure requirements. Bureau van Dijk's DAFNE data base provides access to this data in a computer-accessible form. Matching of bank data to Bureau van Dijk's DAFNE data base is straightforward, as both share a common identifier.[6]

The identification strategy is unaffected by this fact as I only use a Below-CutOff-Dummy, but not the accept/reject decision itself, in the empirical section.

[6] The common identifier is the Creditreform-ID. Creditreform is the dominant private credit registry for firms in Germany and therefore both the bank as well as Bureau van Dijk have this item available.

Mandatory disclosure requirements

In Germany, all limited-liability firms are required to disclose their financial statements within 12 months after the end of the fiscal year. These disclosure requirements are mandated by commercial law and are akin to Regulation S-X ("Form and content of and requirements for financial statements") by the SEC in the U.S. However, the scope of firms covered by the disclosure requirements is significantly broader compared to the U.S.: all firms with limited liability need to disclose financial statements – independent of whether they are publicly listed or not and independent of the number of owners of the firm.

There are three exemptions from these disclosure requirements: First, as implied above by the term "limited liability", the rule does not apply to firm types where owners have full personal liability for all obligations of the firm (e.g., sole proprietorships). Second, subsidiaries do not have to separately disclose their annual reports. The disclosure of the parent company's financial statements has an exempting effect for subsidiaries. Third, different disclosure requirements apply to financial firms (banks and insurance companies). The sample at hand only includes non-financial firms with limited liability, and I exclude subsidiaries as per the discussion above.

Granularity of disclosure requirements

The disclosure requirements explicitly specify the items that need to be disclosed. These rules are akin to §210.5 of Regulation S-X in the U.S. that lists and defines balance sheet items to be disclosed to the SEC. The granularity of the disclosure requirement varies by size of the corporation with size being measured via total assets, revenues, and the number of employees. I summarize the disclosure requirements in Table 2.

[Table 2]

All firms that are subject to the disclosure requirements – independent of their size – need to disclose basic balance sheet items, consisting of two main items on the asset side and two main items on the liability side.[7] The two main items on the asset side are current assets (i.e., short-term assets) and investment assets. The two main items on the liability side are equity and debt. The debt item combines both bank debt and trade payables.

Firms that exceed two of three size criteria (1. EUR 350,000 in assets, 2. EUR 700,000 in revenues, 3. more than 10 employees) are subject to further disclosure requirements. These firms are required to further decompose the balance sheet items

[7] In addition to these main items, firms need to disclose deferred tax assets and liabilities as well as accruals.

discussed above. In particular, current assets have to be decomposed into inventory, trade receivables, securities, and cash holdings; and investment assets have to be decomposed into intangible assets; property, plant, and equipment; and financial investments. As some of the following analyses require these items to be available, I exclude firms that are too small to be required to file these items (less than 5% of the original sample).

Larger firms – those exceeding two of the following three criteria: 1. EUR 4.84 million in assets, 2. EUR 9.68 million in revenues, 3. more than 50 employees – need to provide a further breakdown of asset and liability positions and disclose a profit and loss statement. These firms constitute only 25% of the firms in the sample and I thus do not use these items in the following analyses.

Time line for collection of data items

I collect the data items for the year preceding the loan application, the year of the loan application and the year following the loan application. For example, for a loan application from May 2010 I collect data from the annual reports 2009, 2010, and 2011. In some cases, data is not available in the DAFNE database. This can be due to one of the following reasons: first, the firm is not active any more, either due to insolvency or because it was discontinued for different reasons. These firms can be clearly identified as any discontinuation and the respective cause has to be reported to the public register of corporations. Second, in a few cases, data is not available

even though companies are legally required to file the data. I thoroughly check that any of these instances of missing data are not systematically related to a reject/accept decision in Appendix Table 2.

3. Descriptive statistics

Table 3 presents descriptive statistics on the loan application level. All variables are explained in detail in Table 1. The average rating is 5.80 (median: 5.64), i.e., below the cut-off rating of 7.5 that defines risk management involvement. A rating distribution is provided in Figure 1. The proportion of loan applications with a rating above the cut-off rating of is 81%, with 19% being below the cut-off rating. The average loan volume is EUR 527,000 (median: EUR 500,000) with 56% of the loans being collateralized. The mean loan volume corresponds to about 10% of the mean balance sheet size (EUR 5.2mn, median: EUR 2.6mn).

The bank collects firm characteristics during the application process so that firm characteristics in the year *prior* to the loan application are available on a more granular level than mandated by the disclosure requirements discussed above. I thus make use of the firm characteristics collected by the bank for the following descriptive statistics.[8] The average firm is 21 years old (median: 17 years) and has a relationship with the bank for 9.1 years (median: 5 years). It has EUR 9.7mn in

[8] The correlation between the data collected by the bank and Bureau van Dijk's data exceeds 95% for all characteristics in the sample of firms where both characteristics are available.

revenues (median: EUR 5.4mn) and 55 employees (median: 30 employees). According to the German Federal Statistical Office, the average revenue of all German firms in 2012 (excluding self-employed workers) was EUR 5.0mn. Thus, the average firm size is largely representative of the average German firm and significantly smaller than samples of listed firms or firms active in the syndicated loan market.

The average equity-to-asset ratio is 29% (median: 26%), the average liquidity ratio (current assets divided by current liabilities) is 2.10 (median: 1.46). The average profitability, measured as the EBIT-margin (EBIT divided by revenues), is 6% (median: 5%). Table 3 provides descriptive statistics on changes in firm characteristics from the year prior to the year after the loan application as well. These will be discussed in more detail below.

[Table 3]

4. Empirical strategy and results

4.1 Empirical strategy

The lender cut-off rule provides a plausibly exogenous variation in loan supply. Thus, the cut-off rating can be used in a (fuzzy) regression discontinuity design

(Thistlewaite and Campbell, 1960, Lee and Lemieux, 2009) to estimate the treatment effect:

$$y_{i,t} = \beta \cdot BelowCutOff(0/1) + g_1(DifferenceToCutOff) + g_2(DifferenceToCutOff) \cdot BelowCutOff(0/1) + \gamma \cdot Controls + \varepsilon, \quad (1)$$

where $y_{i,t}$ is the variable of interest (e.g., change in loan volume, investments, employment), *BelowCutOff(0/1)* is a dummy equal to one if the rating is below the cut-off rating (i.e., a rating of 7.5 or worse), *DifferenceToCutOff* is the difference between the continuous internal rating and the cut-off rating and *g1* and *g2* are polynomials fitted to the right and left-hand side of the cut-off rating. The coefficient of interest, β, identifies the impact of the exogenous change in loan supply on the outcome variable of interest (e.g., loan volume, investment, employment).

Throughout the paper, I use a local linear regression, i.e., the functions g_1 and g_2 are linear functions and I restrict the sample to a local bandwidth of +/- 2 notches around the threshold. The bandwidth has been determined using the rule-of-thumb bandwidth selector by Fan and Gijbels (1996). The same bandwidth is chosen consistently across all tables to allow for a meaningful comparison.[9]

[9] The rule-of-thumb bandwidth selector trades off bias vs. precision. Ceteris paribus, it therefore calls for a larger bandwidth if precision is low and lower bandwidth if precision is high. Compared to the fixed bandwidth that I use, regression-specific bandwidths are therefore more "socialistic": strong results – where the precision of the estimate is high and the bandwidth selector therefore suggests a

Controls is a set of loan and firm characteristics as well as fixed effects. Loan controls include the loan amount and a collateral dummy, which is equal to one if the loan is collateralized. Firm characteristics include the logarithm of firm age (in years), the logarithm of 1 plus the length of the lending relationship (number of years that the firm has had an account at the bank without interruption), the logarithm of firm revenues (in EUR mn), the logarithm of the number of employees, the equity-to-asset ratio, the EBIT margin (earnings before interest and taxes, depreciation and amortization divided by firm revenues), and the liquidity ratio (current liabilities divided by current assets). All firm characteristics are determined as of the fiscal year prior to the date of the loan application. Fixed effects include industry fixed effects[10], and one-digit zip code times year fixed effects. Equation (1) is estimated using a linear model and all standard errors are clustered at the branch level.[11]

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low bandwidth – will get weaker and weak results – where the precision of the estimate is low and the selector therefore suggests a wider bandwidth – will get stronger.

[10] Firms are grouped into 14 different industries (agriculture, building and construction, consulting, retail sales, wholesale trade, health care, hotels/restaurants/travel, IT, manufacturing, median/publishing/education, services, utilities, chemical and pharmaceutical industry, and other). The three largest industries in the sample are manufacturing (4,622 observations), wholesale trade (3,730 observations), chemical and pharmaceutical industry (1,045 observations), and services (1,028 observations).

[11] The bank has approximately 100 branches. Clustering by branches accounts for both regional correlations among borrowers as well as for branch-specific traits of the banking organization (e.g., culture).

The regression discontinuity design relies on a no-manipulation assumption of the running variable, i.e., the rating. Economically, manipulation is not an issue here, as the rating is purely based on hard information. Furthermore, loan officers are incentivized based on ex-post performance so that any incentives to manipulate hard information as documented in Berg, Puri, and Rocholl (2014) are muted. Furthermore, the no-manipulation assumption might be violated if firms just to the right of the threshold are discouraged from applying for a loan. However, this would require firms to know exactly whether they have a rating just right or just left of the threshold – which is unlikely given that firms do not have access to the exact formula behind the bank's internal rating. A formal McCrary density test (McCrary, 2008) does not reject the no-manipulation assumption (see Appendix Table 1).

4.2 The impact of the lender cut-off rule on firm's financing

Loan acceptance rates

In the first step, I estimate equation (1) using the acceptance dummy as the dependent variable. The acceptance dummy is equal to 1 if the bank accepts a loan application. The test thus fulfills a simple purpose, i.e., to confirm that the cut-off rule as described in Section 2.1 is indeed reflected in the data. Results are presented in column (1) of Table 4.

[Table 4]

Reassuringly, the cut-off rule is indeed borne out in the data: the coefficient on the cut-off dummy is equal to -0.31 (t-stat < -10), suggesting that the likelihood of an accept-decision drops by 31 percentage points at the cut-off rating. The following columns analyze how this drop in loan acceptance rates feeds through the firms' financing structure (loan volume with the bank, total debt, equity).

Loan volume with the bank

How does the cut-off rating affect a firm's loan volume at the bank? Column (2) of Table 3 looks at the change in loan volume from one month prior to three months after the loan application. The loan volume constitutes the total loan volume with the sample bank, i.e., including loans granted prior to the sample period that are still outstanding at the time of interest (here: three months after the loan application) and including loans larger than EUR 1mn.

Here and in the following, the change is measured relative to the firm's total assets in the fiscal year prior to the loan application. Therefore, the results directly shed light on the economic importance, that is, on the loss in funding relative to the size of the firm's balance sheet.

The coefficient on the cut-off dummy is -0.073 and highly statistically significant. The coefficient is also economically significant: firms below the cut-off end up with a lower amount of funding from the sample bank equal to 7.3% of their total balance sheet size. This effect stems both from loan rejections (see column (1) of Table 4) as well as from the fact that risk management might accept a loan application, but only with a loan amount which is lower than that demanded by the firm. With an average balance sheet size of EUR 5.2mn, a credit supply shock equal to 7.3% of total assets amounts to approximately EUR 380,000.

The prior analyses looked at a rather short time window, i.e., one month prior to three months after the loan application. It is important to analyze whether the same results carry over to longer time horizons, for example one or two years after loan application. It is conceivable that a firm just below the cut-off rating migrates to a rating above the cut-off rating after a while; and is thus able to successfully reapply for a loan. For the identification of real effects, which are measured using annual report data, it is important that the discontinuity in the loan supply is non-transient.

I thus repeat the regression using the change in loan volume from one month prior to 12 months (column (3) of Table 4) and 24 months (column (4) of Table 4) after the loan application. Results are very similar to column (2), with the coefficient on the cut-off dummy ranging from -7.0% to -8.8% (significant at the 1 percent level in all specifications). I conclude that being below the cut-off rating at the time of a

loan application has indeed a longer-lasting effect on loan supply from the sample bank.

Substitution effect 1: Total debt

The loan volume analyzed in columns (2)-(4) of Table 4 only constitute the loan volume with the sample bank, i.e., the results are uninformative as to whether the firm is able to substitute any funding shortfall by applying for a loan at another bank.

Are firms able to substitute funding from the sample bank via other funding sources such as loans from other banks or equity capital? Column (5) of Table 4 sheds light on this question. The dependent variable is the change in total debt from the fiscal year prior to loan application to the fiscal year in the year following the loan application (i.e., the change is measured over two years). Total debt includes bank debt as well as trade payables, i.e., the results shed light on substitution effects via other banks as well as via trade credit from suppliers. Again, the change is measured relative to the firm's balance sheet size in the fiscal year prior to the loan application. The coefficient on the cut-off dummy is -8.0%, suggesting that firms are not fully able to substitute from other banks or via trade credit.

Substitution effect 2: Equity

As an alternative to debt funding, firms might also choose to increase equity capital. Column (6) of Table 4 shows that this is not the case. Using the change in equity capital as the dependent variable gives a marginal significant, but negative, coefficient. If at all, firms that saw their loan applications rejected decrease equity capital, but they certainly do not substitute the loss in debt funding by an increase in equity funding. Please note that the disclosure requirements are too coarse to allow distinguishing whether changes in equity capital are a result of lower earnings, lower retention rates, or lower external equity financing.

Taken together, these results imply that loan rejections have a non-transient effect on loan volumes with the bank. The loss in funding from the bank is not substituted by other funding sources (loans from other banks, trade credit, equity financing).

Results by size class

Table 5 reproduces the regressions from Table 4 by size class. Firms are split into four quantiles by total assets in the year prior to the loan application. Table 5 only reports the key coefficient of interest – i.e., the coefficient for the *BelowCutOff*-Dummy. Consistent with prior literature (Gertler and Gilchrist, 1994), the effects are more pronounced for smaller firms. While acceptance rates drop significantly at the

cut-off rating for all size classes, the change in loan volume with the bank and the change in total debt are only consistently significant for the first two quantiles.

These results suggest that larger firms are able to cushion the effects of loan rejections, either because they have a more granular financing structure so that a single loan application constitutes a smaller amount of their total financing volume, or by reapplying for a loan at this or another bank. The existence of a credit supply shock is a necessary requirement for the following analysis and I will thus focus firms in the smallest two quantiles (firms with total assets ≤ EUR 3mn) in the following subsections.

[Table 5]

4.3 The impact of the lender cut-off rule on firm's cash holdings

The prior analysis has demonstrated that the lender cut-off rule restricts firms' overall availability of funding, in particular for small firms. How does the loss in funding transmit to the asset side, that is, which assets are reduced as a response to funding shock?

As a first item, I look at the impact on cash holdings. The theory on precautionary savings postulates that firms hold cash as a buffer against adverse cash flow shocks. One possible prediction of this theory is thus that firms use their cash

holdings to cushion the credit supply shock induced by the lender cut-off rule. However, firms might as well *increase* their cash holdings as a result of the loan rejection: the loan rejection is likely to impact firms' belief about the future availability of financing. The credit supply shock might therefore increase precautionary savings motives, as the value of cash is higher for credit-constrained firms than for unconstrained firms.

I test these hypotheses in Panel A of Table 6. Again, the regressions follow the regression discontinuity design as formulated in equation (1). The dependent variable is the sum of cash and marketable securities, which I label *cash and cash equivalents* following the common practice in the literature. Column (1) in Table 6 reports results for the total sample of small firms. Effects of loan rejections on cash holdings are insignificant. The results are, however, strikingly different when splitting the sample by the current ratio (current assets divided by current liabilities) of the firms in the year prior to the loan application. Column (2) reports results for firms with a low current ratio prior to the year of the loan application. These firms *increase* cash holdings by 2.6% of their total assets. In contrast, firms with a high current ratio *decrease* their cash holdings by 3.1% of their total assets. The difference between these two coefficients is highly significant at the 1 percent level. With mean cash holdings in the year prior to the loan application equal to 12% of total assets, these changes in cash holdings are also economically significant.

[Table 6]

An increase in cash holdings after a credit supply shock implies that non-cash assets need to be cut by more than the amount of the credit supply shock. The increase in cash holdings acts like an additional shock to the supply of funding for these firms. Firms have two primary options how to absorb this funding shock: first, firms can cut their other (non-cash) current assets, for example by collecting bills earlier and thereby decreasing trade receivables. Second, firms can cut down on investments, a strategy which has likely more severe consequences for employment at the firm.

Panel B of Table 6 tests the first conjecture. The dependent variable is the change in current assets excluding cash and cash equivalents. The dependent variable is therefore equal to the sum of inventories and account receivables. Differences between high and low liquidity firms are small and insignificant, suggesting that it is not the management of other current assets that distinguishes low and high liquidity firms. Rather, the credit supply shock and the increase in precautionary savings for low liquidity firms manifests itself in a decrease in investments, as I will discuss in more detail in the next subsection.

4.4 The impact of the lender cut-off rule on asset growth, investment and employment

In the next step, I analyze variable that are usually summarized under "real effects". In particular, these variables include asset growth, investments, and employment. Table 7 reports the results.

[Table 7]

Panel A of Table 7 looks at asset growth. Firms whose loan applications were rejected decrease their assets by an average of 8.9% relative to firms whose loan applications were accepted. The effect is similar for firms with low liquidity and firms with high liquidity (column (2) and (3) in Panel A). Panel B focuses on non-cash assets only, i.e., at total assets minus cash and cash equivalents. Firms with low liquidity cut their non-cash assets by 11.2% (significant at the 1 percent level), while firms with high liquidity only cut their non-cash assets by an insignificant 3.4%. These results suggest that precautionary savings motives amplify the credit supply shock for low liquidity firms as these firms cut their non-cash assets by more than their total assets.

This narrative is supported in Panel C of Table 7 which looks at changes in investment. While low liquidity firms whose loan applications were rejected cut their investment by 5.6% (significant at the 1 percent level) relative to low liquidity firms

whose loan applications were accepted, the respective coefficient for high liquidity firms is small (-1.3%) and insignificant.

Results for employment are similar, with a negative and significant effect for low liquidity firms (-7.2%, significant at the 1 percent level) and an insignificant effect for high liquidity firms. These results suggest that employment losses after a credit supply shock are concentrated at firms with low liquidity holdings, and are amplified by precautionary savings motives of these firms.

Overall, the results suggest that pooling firms together provides an incomplete picture of the adjustment process after a credit supply shock. This adjustment process crucially depends on the liquidity of the firm: while firms with high liquidity are able to cushion credit supply shocks, firms with low liquidity need to cut their investment and see a significant decrease in employment. These real effects are amplified by precautionary savings motives: low liquidity firms increase their cash holdings after a credit supply shock and cut their non-cash assets by more than what the direct impact of the credit supply shock would imply.

The prior analysis has highlighted differences between firms whose loan application got accepted versus those whose loan application has been rejected. These differences, while economically and statistically highly significant, do not necessarily imply inefficient outcomes. The bank at hand tries to distinguish between creditworthy and non-creditworthy firms, and it might well be that the rating threshold corresponds to the threshold where firm growth would be inefficient.

Panel A of Table 9 provides some evidence in this regards. It plots measures of profitability (EBIT margin, Return on Assets) and leverage (equity-to-asset ratio) as a function of the rating in the year prior to the loan application. The table focusses on firms with total assets smaller than EUR 3 million below the median in terms of liquidity, i.e., those firms where real effects are strongest. Profitability is clearly a declining function of the credit rating. If profitability in the year prior to the loan application is a proxy for expected profitability of new investments, then granting loans to high-rating firms is consistent with granting loans to high-profitability firms as well. However, the profitability numbers for firms just below the threshold (5.3% EBIT margin, 14.4% return on assets) clearly do not allow to label these firms as inefficient or unprofitable. However, the equity-to-asset ratio of firms directly below the threshold is below 20%, potentially implying that agency conflicts (Jensen and Meckling, 1976) between equity holders and debtholders might be too high for the bank to consider supporting these projects. This narrative should, though plausible, be interpreted with care as the set-up at hand does not allow to precisely measure agency conflicts.

[Table 9]

Panel B of Table 9 looks at the macro implications of these findings. Do firms that got rejected invest less, or do they simply not expand as much as those

firms whose loan applications were accepted. Panel B provides asset growth, non-cash asset growth, change in investments, and change in employment from the year prior to the loan application to the year after loan application. All numbers are cumulative numbers over two years, e.g., for a loan application in 2010, changes are from the annual report 2009 to the annual report 2011. Furthermore, growth rates are shown in nominal terms.

Panel B of Table 9 clearly shows that firms below the threshold grow less than firms above the threshold. However, firms below the threshold do still see positive growth both in terms of assets, as well as in terms of investments and employment. For the interpretation of these results, two pieces of information are important: first, these results are certainly affected by the period under consideration (2009-2012), where the German economy grew significantly. Results from a boom period followed by a bust might certainly look different. Second, the sample of firms is restricted to firms that did apply for a loan during the sample period. These firms themselves are likely to be different from the average firm in the economy, for example, firms with high growth prospects might be more likely to raise additional funding, both internally or externally via bank credit.

Overall, for the period under study, the results support the narrative that firms whose loan applications were rejected were not particularly unprofitable or inefficient. These firms observed positive growth despite the loan rejections, albeit at a significantly lower level than firms whose loan applications were accepted.

5. Conclusion

Using exogenous variation induced by a lender cut-off rule, I analyze the real effects of loan rejections. Loan applications with a rating better than the cut-off are accepted, while loan applications with a rating worse than the cut-off are subject to an additional review, leading to a sharp drop in the acceptance rate at the threshold. Using almost 17,000 loan applications by small and medium-sized enterprises at a major German bank, I compare the development of firms *just* above the cut-off rating to those firms that are just *below* the cut-off rating using a fuzzy regression discontinuity design.

The results convey the importance of liquidity in the transmission of credit supply shocks. Real effects such as a reduction in asset growth, investments, and employment are concentrated among low liquidity firms. Crucially, firms with low liquidity actually *increase* cash holdings after a credit supply shock. The results thus point to the amplifying effect of precautionary savings motives in the transmission of credit supply shocks.

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Figure 1: Distribution of ratings

This figure provides a distribution of rating grades for the sample of all loan applications between January 2009 and December 2012. For variable definitions see Table 1.

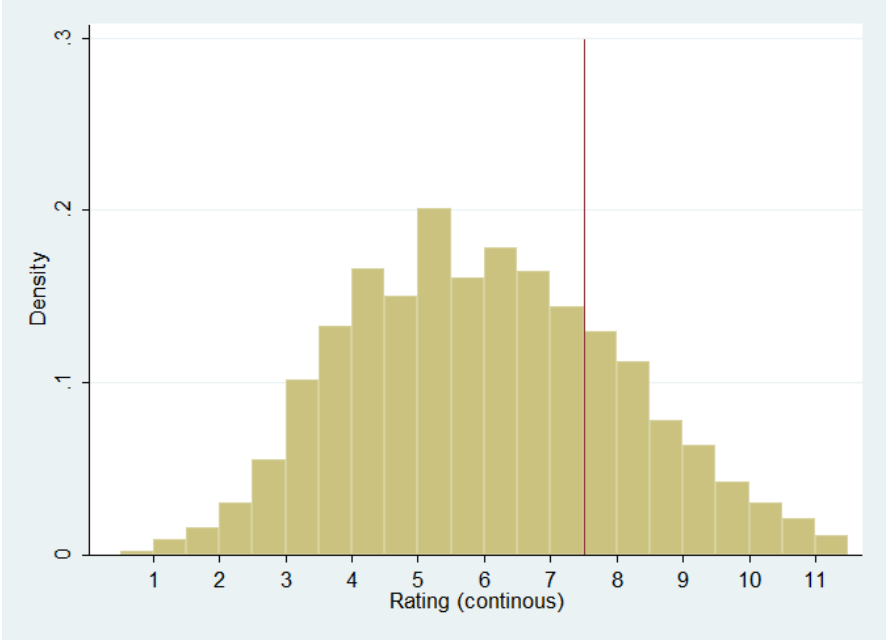

Figure 2: Loan acceptance rates by rating

This figure depicts the likelihood of loan application acceptance as a function of the continuous rating for the sample of all loan applications between January 2009 and December 2012. For variable definitions see Table 1.

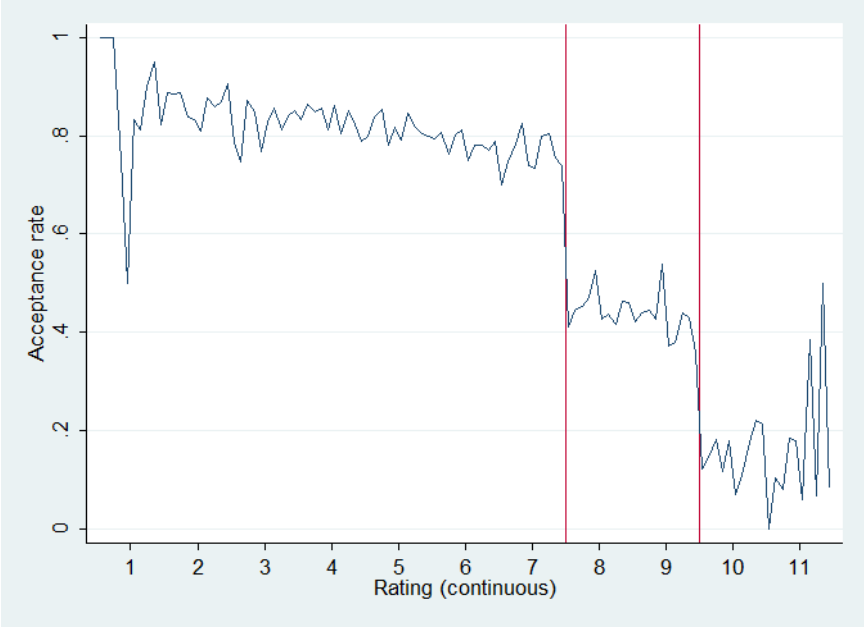

Table 1: Explanation of variables

This table provides a description of variables. The column *Name* provides the name of the variable. The column *Source* provides the source, with "Bank" denoting that the variables comes from bank-internal data, and "Dafne" denoting that the variable comes from Bureau van Dijk's Dafne database.

Name	Source	Description
Ratings, cut-off, and loan acceptance		
Rating	Bank	Internal continuous rating ranging from 0.5 (best) to 11.5 (worst).
Rating grade	Bank	Mapping of the continuous rating to rating grades, ranging from 1 (continuous rating from 0.5 to 1.5) to 11 (continuous rating from 10.5 to 11.5).
Cut-off (0/1)	Bank	Dummy variable equal to one if a loan application has a rating grade of 8 or worse, i.e., cannot be directly accepted by the loan officer.
Accepted (0/1)	Bank	Dummy equal to one if a loan offer is made to the client
Loan characteristics		
Loan amount		Notional amount of the loan application in EUR '000.
Collateralized (0/1)	Bank	Dummy equal to one if a loan is collateralized (either by a physical collateral or a third party guarantee).
Firm characteristics at the time of the loan application		
Firm age	Bank	Age of the firm in years since incorporation.
Relationship age	Bank	Number of years that the firm has had an account at the bank without interruption.
Revenues	Bank	Revenues of the firm in EUR mn according to its financial statement in the fiscal year prior to the loan application (based on German accounting standards).
Total assets	Bank	Total assets of the firm EUR mn according to its financial statement in the fiscal year prior to the loan application (based on German accounting standards).
Number of employees	Bank	Number of employees of the firm in the fiscal year prior to the loan application.
Equity-to-assets	Bank	Equity-to-asset ratio of the firm according to its financial statement in the fiscal year prior to the loan application.
EBIT-Margin	Bank	Ratio of EBIT (earnings before interest and taxes) to revenues of the firm according to its financial statement in the fiscal year prior to the loan application.
Liquidity	Bank	Ratio of current assets to current liabilities of the firm according to its financial statement in the fiscal year prior to the loan application.

Table continued on next page

Table continued from prior page

Changes in firm characteristics after the time of the loan application

Change in loan volume with the bank	Bank	Percentage change in loan volume with the bank from 1 month prior to 3 months / 12 months / 24 months after the loan application, scaled by total assets of the firm in the fiscal year preceding the loan application.
Change in assets	DAFNE	Percentage change in total assets from the fiscal year preceding the loan application to fiscal year following the loan application.
Change in current assets	DAFNE	Percentage change in current assets (i.e., short-term assets) from the fiscal year preceding the loan application to fiscal year following the loan application, scaled by total assets of the firm in the fiscal year preceding the loan application. For the constituents of current assets, see Table 2.
Change in cash and cash equivalents	DAFNE	Percentage change in cash and cash equivalents from the fiscal year preceding the loan application to fiscal year following the loan application, scaled by total assets of the firm in the fiscal year preceding the loan application. Cash and cash equivalents are defined as the sum of cash and marketable securities.
Change in noncurrent assets	DAFNE	Percentage change in noncurrent assets (i.e., long-term assets) from the fiscal year preceding the loan application to fiscal year following the loan application, scaled by total assets of the firm in the fiscal year preceding the loan application. For the constituents of noncurrent assets, see Table 2.
Change in debt	DAFNE	Percentage change in debt from the fiscal year preceding the loan application to fiscal year following the loan application (e.g., year-end 2009 and year-end 2011 for a loan application in 2010), scaled by total assets of the firm in the fiscal year preceding the loan application. Debt includes bonds, bank debt, and trade payable, see Table 2.
Change in equity	DAFNE	Percentage change in equity from the fiscal year preceding the loan application to fiscal year following the loan application, scaled by total assets of the firm in the fiscal year preceding the loan application.
Change in employment	DAFNE	Percentage change in employment from the fiscal year preceding the loan application to fiscal year following the loan application.

Table 2: Disclosure requirements by size class

This table provides disclosure requirements by size class. An "x" denotes that the respective item needs to be disclosed by the firm in its annual report, while an empty field denotes that the respective items does not need to be disclosed by the firm in its annual report. Rules according to § 266 of Germany's Commercial Code ("HGB").

	Size class 1 (Assets ≤ EUR 350,000)[1]	Size class 2 (EUR 350,000 < Assets <= EUR 4.84mn)[2]	Size class 3 (Assets > EUR 4.84 mn)[1]
Assets			
A. Current assets	x	x	x
I. Inventory		x	x
II. Trade receivables		x	x
III. Marketable Securities		x	x
IV. Cash		x	x
B. Investments	x	x	x
I. Intangible assets		x	x
II. Property, Plant, and Equipment		x	x
III. Financial investments		x	x
C. Other assets (e.g., accruals, deferred tax assets)	x	x	x
Total assets	x	x	x
Liabilities			
A. Equity	x	x	x
B. Debt	x	x	x
1. Bonds			x
2. Bank loans			x
3. Trade payables			x
4. Other debt			x
C. Other liabilities (e.g., provisions, accruals, deferred tax liabilities)	x	x	x
Total liabilities	x	x	x

[1] Precise definition: Two out of the following criteria fulfilled: 1) Total assets ≤ EUR 350,000, 2) Revenues ≤ EUR 700,000, 3) Number of employees ≤ 10.

[2] Precise definition: Not in size class 1 and two out of the following criteria fulfilled: 1) Total assets ≤ EUR 4.84 million, 2) Revenues ≤ EUR 9.68 million, 3) Number of employees ≤ 50.

Table 3: Descriptive statistics

This table presents summary statistics for the sample of all loan applications between January 2009 and December 2012. For variable definitions see Table 1.

	Unit	N	Mean	Median	Std.Dev.
Ratings and cut-off					
Rating grade	Number (1=Best, 11=Worst)	16,855	5.78	6.00	2.00
Rating (continuous)	Number (0.5=Best, 11.5=Worst)	16,855	5.80	5.65	1.98
Cut-off	Dummy (0/1)	16,855	0.81	1.00	0.39
Accepted	Dummy (0/1)	16,855	0.72	1.00	0.45
Loan characteristics					
Loan amount	EUR '000	16,855	526.80	500.00	345.2
Collateralized	Dummy (0/1)	16,855	0.56	1.00	0.50
Firm characteristics					
Firm age	Years	16,855	20.98	17.00	17.79
Relationship age	Years	16,855	9.05	5.00	10.86
Revenues	EUR mn	16,855	9.70	5.37	13.70
Total assets	EUR mn	16,855	5.18	2.58	8.46
Number of employees	Number	16,855	54.73	30.00	81.59
Equity-to-asset ratio	Number	16,855	0.29	0.26	0.22
EBIT-Margin	Number	16,855	0.06	0.05	0.08
Liquidity	Number	16,855	2.10	1.46	2.04
Changes in firm characteristics					
Change in loan volume (1 months prior to 3 months after loan appl.)	Percent of total assets	16,855	0.07	0.00	0.20
Change in total assets	Percent	16,855	0.13	0.10	0.30
Change in current assets	Percent of total assets	16,855	0.14	0.07	0.31
Change in investment assets	Percent of total assets	16,855	0.05	0.00	0.13
Change in debt	Percent of total assets	16,855	0.12	0.04	0.32
Change in equity	Percent of total assets	16,855	0.07	0.04	0.14
Change in employment	Number	12,866	0.10	0.00	0.25

Table 4: The impact of the lender cut-off rule on firms' financing

This table estimates the effect of the lender cut-off rule on credit supply using a regression discontinuity design. Column (1) uses the acceptance dummy as the dependent variable to test whether the lender cut-off rule is confirmed in the data. The acceptance dummy is equal to 1 if the bank makes a loan offer to the firm and equals 0 if the bank does not make a loan offer to the firm. Columns (2)-(4) provide results using the subsequent change in loan volume with the bank as the dependent variable. The subsequent change in the loan volume is measured as the logarithm of the ratio of the loan volume of the firm at the bank 3/12/24 months after the loan application date divided by the loan volume of the firm at the bank 1 month prior to the loan application. Column (5) uses the change in debt (column (6): change in equity) as reported in the annual reports from the fiscal year prior to the loan application date to the fiscal year after the loan application date. All models are estimated using a linear model. For variable definitions see Table 1. T-values, based on standard errors clustered at the branch level, are reported in parentheses. ***, **, * denote significance at the 1, 5 and 10 % level respectively.

	Loan acceptance		Change in loan volume with the bank						Change in total debt (all banks and non-banks)		Change in equity	
	(1)		(2)		(3)		(4)		(5)		(6)	
Dependent	Acceptance dummy (0/1)		Time horizon: 3 months		Time horizon: 12 months		Time horizon: 24 months		Fiscal year prior to loan application to fiscal year after loan application		Fiscal year prior to loan application to fiscal year after loan application	
Model	Linear		Linear		Linear		Linear		Linear		Linear	
Methodology	Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off	
Parameter	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
INFERENCE												
BelowCutOff (0/1)	-0.310***	(-13.56)	-0.073***	(-7.80)	-0.070***	(-6.36)	-0.088***	(-5.73)	-0.080***	(-3.37)	-0.012*	(-1.95)
TRENDS BELOW/ABOVE CUT OFF												
(Rating-CutOff) x BelowCutOff (0/1)	-0.001	(-0.09)	0.026***	(4.33)	0.012*	(1.74)	0.005	(0.54)	0.002	(0.12)	-0.007*	(-1.74)
(Rating-CutOff) x (1- BelowCutOff (0/1))	-0.035**	(-2.26)	-0.015**	(-2.45)	-0.017*	(-1.95)	-0.021**	(-2.28)	0.030*	(1.92)	-0.008*	(-1.69)
Firm controls	Yes		Yes		Yes		Yes		Yes		Yes	
Loan controls	Yes		Yes		Yes		Yes		Yes		Yes	
Industry fixed-effects	Yes		Yes		Yes		Yes		Yes		Yes	
Region x Time fixed-effects	Yes		Yes		Yes		Yes		Yes		Yes	
Diagnostics												
Adj. R^2	12.49%		6.87%		5.25%		6.94%		4.04%		5.61%	
N	8,807		8,807		8,807		8,807		8,807		8,807	

Table 5: The impact of the lender cut-off rule on firms' financing – Split by size classes

This table estimates the effect of the lender cut-off rule on credit supply using a regression discontinuity design. Results are split by quantile of total assets in the fiscal year prior to the loan application date. Columns and models are as in Table 4, but only the coefficient on the BelowCutOff-Dummy is reported. For variable definitions see Table 1. T-values, based on standard errors clustered at the branch level, are reported in parentheses. ***, **, * denote significance at the 1, 5 and 10 % level respectively.

	Loan acceptance		Change in loan volume with the bank						Change in total debt (all banks and non-banks)		Change in equity	
	(1)		(2)		(3)		(4)		(5)		(6)	
Dependent	Acceptance dummy (0/1)		Time horizon: 3 months		Time horizon: 12 months		Time horizon: 24 months		Fiscal year prior to loan application to fiscal year after loan application		Fiscal year prior to loan application to fiscal year after loan application	
Model	Linear		Linear		Linear		Linear		Linear		Linear	
Methodology	Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off	
Parameter	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Q1: Total assets ≤ EUR 1.5mn												
BelowCutOff (0/1)	-0.370***	(-10.26)	-0.160***	(-6.02)	-0.158***	(-5.50)	-0.203***	(-4.75)	-0.162**	(-2.51)	-0.036**	(-2.13)
Controls and fixed effects as in Table 4	Yes		Yes		Yes		Yes		Yes		Yes	
Q2: EUR 1.5mn < Total assets ≤ EUR 3mn												
BelowCutOff (0/1)	-0.283***	(-7.01)	-0.061***	(-3.64)	-0.068***	(-3.49)	-0.078***	(3.17)	-0.069**	(-2.59)	-0.009	(-0.56)
Controls and fixed effects as in Table 4	Yes		Yes		Yes		Yes		Yes		Yes	
Q3: EUR 3mn < Total assets ≤ EUR 5mn												
BelowCutOff (0/1)	-0.305***	(-6.83)	-0.043***	(-3.84)	-0.024*	(-1.96)	-0.016	(-0.87)	-0.037	(-1.34)	-0.007	(-0.72)
Controls and fixed effects as in Table 4	Yes		Yes		Yes		Yes		Yes		Yes	
Q4: EUR 5mn < Total assets												
BelowCutOff (0/1)	-0.264***	(-6.21)	-0.008	(-1.42)	0.006	(0.76)	-0.006	(-0.63)	-0.017	(-0.58)	-0.000	(-0.02)
Controls and fixed effects as in Table 4	Yes		Yes		Yes		Yes		Yes			
Test for difference in coefficients (Q1-Q4)	Δ Coeff.	X^2	Δ Coeff.	X^2	Δ Coeff.	X^2	Δ Coeff.	X^2	Δ Coeff.	X^2	Δ Coeff.	X^2
Difference in coefficients	-0.106**	(4.83)	-0.152***	(31.68)	-0.164***	(29.61)	-0.197***	(20.05)	-0.145**	(4.02)	-0.036	(2.18)

Table 6: The impact of the lender cut-off rule on firms' cash holdings

This table estimates the effect of the lender cut-off rule on cash holdings. Columns (1)-(3) provide results using cash and cash equivalents as the dependent variable. Column (1) reports results for all small firms, column (2) reports results for low liquidity firms (current-asset-to-current-liability ratio in the fiscal year prior to the loan application ≤ 1.4), and column (3) reports results for high liquidity firms (current-asset-to-current-liability ratio in the fiscal year prior to the loan application > 1.4). Columns (4)-(6) provide results using current assets excluding cash and cash equivalents as the dependent variable. Column (4) reports results for all small firms, column (5) reports results for low liquidity firms (current-asset-to-current-liability ratio in the fiscal year prior to the loan application ≤ 1.4), and column (6) reports results for high liquidity firms (current-asset-to-current-liability ratio in the fiscal year prior to the loan application > 1.4). All models are estimated using a linear model. For variable definitions see Table 1. T-values, based on standard errors clustered at the branch level, are reported in parentheses. ***, **, * denote significance at the 1, 5 and 10 % level respectively.

	Panel A: Change in cash and cash equivalents						Panel B: Change in current assets (excluding cash and cash equivalents)					
	(1)		(2)		(3)		(4)		(5)		(6)	
Dependent	All firms		Low liquidity (CA/CL ≤ 1.4)		High liquidity (CA/CL > 1.4)		All firms		Low liquidity (CA/CL ≤ 1.4)		High liquidity (CA/CL > 1.4)	
Model	Linear		Linear		Linear		Linear		Linear		Linear	
Methodology	Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off	
Parameter	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
INFERENCE												
BelowCutOff (0/1)	0.006	(0.60)	0.026**	(2.23)	-0.031**	(-2.26)	-0.057**	(-2.19)	-0.052*	(-1.82)	-0.055	(-1.20)
TRENDS BELOW/ABOVE CUT OFF												
(Rating-CutOff) x BelowCutOff (0/1)	-0.002	(-0.29)	-0.007	(-0.88)	0.019**	(2.06)	0.007	(0.39)	0.002	(0.09)	0.010	(0.42)
(Rating-CutOff) x (1- BelowCutOff (0/1))	0.000	(0.02)	-0.005	(-0.69)	0.007	(0.68)	0.018	(0.93)	0.018	(0.84)	0.035	(0.90)
Firm controls	Yes		Yes		Yes		Yes		Yes		Yes	
Loan controls	Yes		Yes		Yes		Yes		Yes		Yes	
Industry fixed-effects	Yes		Yes		Yes		Yes		Yes		Yes	
Region x Time fixed-effects	Yes		Yes		Yes		Yes		Yes		Yes	
Diagnostics												
Adj. R^2	1.15%		1.53%		3.19%		7.92%		6.37%		9.54%	
N	4,714		2,279		2,435		4,714		2,279		2,435	
				ΔCoeff.	X^2					ΔCoeff.	X^2	
Difference between *BelowCutoOff(01/1)* - Low minus High Liquidity				0.057***	(11.13)					0.003	(0.04)	

Table 7: The impact of the lender cut-off rule on firms' asset growth, investments, and employment

This table estimates the effect of the lender cut-off rule on real effects using a regression discontinuity design. Results are reported for the sample of all small firms (first column in each Panel) as well as split by the median of liquidity (measured as the ratio of current assets to current liabilities in the fiscal year prior to the loan application date). Panel A provides results for asset growth, Panel B provides results for non-cash asset growth (non-cash assets are defined as total asset minus cash and cash equivalents), Panel C provides results for investment, and Panel D provides results for employment. All models are estimated using a linear model. For variable definitions see Table 1. T-values, based on standard errors clustered at the branch level, are reported in parentheses. ***, **, * denote significance at the 1, 5 and 10 % level respectively.

	Panel A: Asset growth						Panel B: Non-cash asset growth					
	(1)		(2)		(3)		(4)		(5)		(6)	
Dependent	All firms		Low liquidity (CA/CL ≤ 1.4)		High liquidity (CA/CL > 1.4)		All firms		Low liquidity (CA/CL ≤ 1.4)		High liquidity (CA/CL > 1.4)	
Model	Linear		Linear		Linear		Linear		Linear		Linear	
Methodology	Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off	
Parameter	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
INFERENCE												
BelowCutOff (0/1)	-0.089***	(-4.24)	-0.080***	(-3.29)	-0.077**	(-2.00)	-0.071***	(-3.03)	-0.112***	(-4.54)	-0.034	(-0.81)
TRENDS BELOW/ABOVE CUT OFF												
(Rating-CutOff) x BelowCutOff (0/1)	0.002	(0.21)	0.004	(0.22)	0.008	(0.48)	-0.008	(-0.52)	0.014	(0.70)	-0.019	(-0.95)
(Rating-CutOff) x (1- BelowCutOff (0/1))	0.021	(1.60)	0.026	(1.60)	0.029	(1.10)	0.027**	(2.04)	0.030**	(2.03)	0.030	(1.08)
Firm controls	Yes		Yes		Yes		Yes		Yes		Yes	
Loan controls	Yes		Yes		Yes		Yes		Yes		Yes	
Industry fixed-effects	Yes		Yes		Yes		Yes		Yes		Yes	
Region x Time fixed-effects	Yes		Yes		Yes		Yes		Yes		Yes	
Diagnostics												
Adj. R^2	7.74%		5.62%		9.82%		4.71%		6.09%		5.78%	
N	4,714		2,279		2,435		4,714		2,279		2,435	
				ΔCoeff.	X^2					ΔCoeff.	X^2	
Difference between *BelowCutoOff(01/1)* - Low minus High Liquidity				-0.003	(0.02)					-0.078*	(3.01)	

(Table continued from prior page)

	Panel C: Change in investment						Panel D: Change in employment					
	(7)		(8)		(9)		(10)		(11)		(12)	
Dependent	All firms		Low liquidity (CA/CL ≤ 1.4)		High liquidity (CA/CL > 1.4)		All firms		Low liquidity (CA/CL ≤ 1.4)		High liquidity (CA/CL > 1.4)	
Model	Linear		Linear		Linear		Linear		Linear		Linear	
Methodology	Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off	
Parameter	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
INFERENCE												
BelowCutOff (0/1)	-0.035***	(-3.67)	-0.056***	(-3.20)	-0.013	(-0.93)	-0.007	(-0.25)	-0.072**	(-2.00)	0.038	(0.86)
TRENDS BELOW/ABOVE CUT OFF												
(Rating-CutOff) x BelowCutOff (0/1)	0.006	(0.88)	0.005	(0.41)	0.006	(0.55)	-0.018	(-1.17)	0.015	(0.58)	-0.032*	(-1.97)
(Rating-CutOff) x (1- BelowCutOff (0/1))	-0.004	(-0.46)	0.004	(0.33)	-0.014	(-1.13)	-0.015	(-0.80)	0.026	(1.06)	-0.054*	(-1.88)
Firm controls	Yes		Yes		Yes		Yes		Yes		Yes	
Loan controls	Yes		Yes		Yes		Yes		Yes		Yes	
Industry fixed-effects	Yes		Yes		Yes		Yes		Yes		Yes	
Region x Time fixed-effects	Yes		Yes		Yes		Yes		Yes		Yes	
Diagnostics												
Adj. R^2	4.16%		3.42%		6.33%		5.96%		5.51%		8.19%	
N	4,714		2,279		2,435		3,295		1,718		1,577	
				ΔCoeff.	X^2					ΔCoeff.	X^2	
Difference between *BelowCutoOff(01/1)* - Low minus High Liquidity				-0.044*	(2.99)					-0.110*	(3.54)	

Table 9: Firm profitability, leverage, and growth by rating grade

This table provides descriptive statistics by rating grade. The sample consists of firms with total assets less than EUR 3mn and liquidity (measured as the ratio of current assets to current liabilities) below the median. Panel A provides information on firm profitability (EBIT margin, Return on assets) and firm leverage (equity/assets) at the fiscal year end prior to the loan application. Panel B provides real effects (asset growth, non-cash asset growth, change in investments, change in employment) from the fiscal year end prior to the loan application to the fiscal year end in the year after the loan application (for example, for a loan application in 2010 changes in Panel B are from year end 2009 to year end 2011). Changes in investment are relative to total assets in the year prior to the loan application. All other changes are relative to their own baseline values in the year prior to the loan application. For variable definitions see Table 1.

	Panel A: Firm characteristics at the fiscal year end prior to the loan application			**Panel B: Real effects from the year prior to the year after the loan application (numbers are cumulative over two years)**			
Rating	**EBIT margin**	**Return on Assets**	**Leverage (Equity/Assets)**	**Asset growth**	**Non-cash asset growth**	**Change in investments**	**Change in employment**
1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2	0.084	0.235	0.422	0.058	0.092	0.073	0.057
3	0.075	0.220	0.415	0.137	0.120	0.073	0.060
4	0.063	0.187	0.345	0.092	0.082	0.048	0.056
5	0.058	0.169	0.297	0.153	0.112	0.085	0.077
6	0.057	0.171	0.291	0.178	0.155	0.071	0.106
7	0.057	0.161	0.251	0.197	0.187	0.092	0.166
8	0.053	0.144	0.196	0.174	0.140	0.064	0.115
9	0.041	0.120	0.163	0.179	0.151	0.062	0.154
10	0.025	0.094	0.114	0.163	0.136	0.066	0.188
11	0.017	0.058	0.093	0.061	0.015	0.034	0.026

Appendix Table 1: McCrary density test

This table provides results of a McCrary density test for the internal rating at the cut-off rating of 7.5. Panel I provides results for the sample of all loan applications. Panel II provides results for the sample of all loan applications with available balance sheet data. ***, **, * denote significance at the 1, 5 and 10 % level respectively.

	Bandwidth	Bin size	Jump estimate	(SE)
Panel I: Density at rating of 7.5				
Standard bandwidth	1.132	0.026	-0.019	(0.0551)
Undersmoothing	0.566	0.026	-0.041	(0.0783)
Panel II: Density at rating of 7.5, firms with available balance sheet data only				
Standard bandwidth	1.008	0.028	-0.015	(0.0631)
Undersmoothing	0.504	0.028	0.003	(0.0906)

Appendix Table 2: Availability of data items – Test for discontinuity at the cut-off rating

This table estimates the effect of the cut-off on the availability of annual report data. Annual report data is culled from the DAFNE data base from Bureau van Dijk in the fiscal year prior to the loan application and the fiscal year following the year of the loan application. The dependent variables is equal to one if any of these two annual reports are missing or if the respective data item in any these two annual reports is missing. Column (1) provides results for firms' balance sheet items (dependent variable is equal to one if any of the balance sheet items is missing), column (2) provides results for the number of employees (dependent variable is equal to one of the number of employees is missing). All models are estimated using a linear model. For variable definitions see Table 1. T-values based on standard errors clustered at the branch level are reported in parentheses. ***, **, * denote significance at the 1, 5 and 10 % level respectively.

	(1)		(2)	
Dependent	Change in firm balance sheet items is missing (0/1)		Change in the number of employees is missing (0/1)	
Model	Linear		Linear	
Methodology	Local regression +/- 2 notches around cut-off		Local regression +/- 2 notches around cut-off	
Parameter	Coeff.	t-stat	Coeff.	t-stat
INFERENCE				
BelowCutOff (0/1)	0.015	(0.90)	0.006	(0.23)
TRENDS BELOW/ABOVE CUT OFF				
(Rating-CutOff) x BelowCutOff (0/1)	-0.008	(-0.96)	0.046*	(1.69)
(Rating-CutOff) x (1- BelowCutOff (0/1))	0.009	(0.95)	0.051	(1.34)
Firm controls	Yes		Yes	
Loan controls	Yes		Yes	
Industry fixed-effects	Yes		Yes	
Region x Time fixed-effects	Yes		Yes	
Diagnostics				
Pseudo. R^2 / Adj. R^2	1.23%		3.61%	
N	10,127		10,127	