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Bank Lines of Credit in Liquidity Management - The Impact of Recall Risk for German SMEs

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Abstract

We use a unique sample of self-employed and corporate clients provided by a universal bank in Germany to investigate how recall risk of recallable bank lines of credit impact cash holdings and line usage. While the bank does not require an upfront fee for providing a line of credit, which may make these lines an effective tool in liquidity management, the bank has the right to recall the line upon short notice. Based on theoretical considerations, we postulate that clients with low recall risks have lower cash holdings and higher line usages than clients with moderate recall risks. In turn, the latter have higher cash holdings and lower line usage than clients with high recall risks, whose recall risk comes along with financial distress. Our findings indicate that the recall risk has a non-linear and non-monotonic effect on cash holdings and line usages and that this effect is not driven by other line characteristics.

1 Introduction

Bank lines of credit insure firms against deterioration of their own credit quality (e.g. Campbell (1978) and Hawkins (1982)) and against liquidity shortages (Gatev and Strahan (2006)). By holding a bank line of credit firms have access to funding on short notice (Martin and Santomero (1997)) and can reduce their cash holdings while still being prepared to handle liquidity needs stemming from the financing of upcoming investment projects or inventories (Sufi (2009) and Lins *et al.* (2007)). Thus, bank lines of credit are beneficial because they complement financial tools available to firms.

The recent literature has already studied several facets of lines of credit and their use. For instance, Sufi (2009) investigates the substitution between lines of credit and cash holdings for listed firms and documents that the firms' cash flows are central for determining the usage of lines of credit. Jiménez *et al.* (2009) investigate determinants of line usage for Spanish firms and document that the firms' expected default probabilities are the main drivers of line usage. In their sample, firms with a higher expected default probability increase their line usage substantially.

Our analysis contributes to this literature by providing additional and new insights on how lines of credit are used by self-employed clients and small and medium-sized corporate clients which hold a business account at a German universal bank. Our database covers more than one million monthly business account observations from about than 15,000 clients over the period October 2002 to December 2008. The bank lines of credit we focus at have a particular design, which may make them most effective in liquidity management for self-employed and corporate clients. After obtaining a line of credit, which is attached to the account, the client can flexibly keep its account in debit or credit without further permission or consultation of the bank. Quite contrary to common banking practice, the bank does not request an upfront fee for providing a line of credit but requests an interest rate for line usage which typically is higher than the interest rate on other bank funding with fixed

repayment plans. The terms and conditions of the lines of credit are agreed upon until further notice. Therefore, the bank can renegotiate or even recall the line in case of a material adverse change.

There exists some empirical literature on line usage (e.g. Ham and Melnik (1987), Berger and Udell (1995), Shockley and Thakor (1997), Agarwal *et al.* (2004), and Jiménez *et al.* (2009)) and on cash holdings (e.g. Opler *et al.* (1999), Dittmar *et al.* (2003), Almeida *et al.* (2004), Faulkender and Wang (2006), Bates *et al.* (2009), Yun (2009), and Denis and Sibilkov (2010)). Our main contribution to this body of work is to show that the lines' recall risk has a non-linear, and in fact even non-monotonic, effect on both cash holdings and line usage.

We follow Opler *et al.* (1999) and argue that if it is costly for firms to raise outside debt, the firms hold cash to be prepared to finance upcoming investment projects and inventories. When a firm holds a line of credit and when recall risk is absent, the optimal amount of cash holdings is lower because the line can be drawn to fulfill liquidity needs. The firm will repay the borrowed funds from the line shortly, either by using current cash inflows, if the liquidity gap is not permanent, or by requesting a bank loan with fixed repayment plan, if the liquidity gap is permanent. Thus, the lack of loans with very short maturities or very low volumes determines the use of the line of credit. This beneficial effect is likely most pronounced for the clients in our sample since they have limited access to public capital markets. It may, however, diminish when the bank can recall the line of credit and the recall risk increases. Firms with moderate recall risks may therefore hold more cash than firms with low recall risks. Clients with rather high recall risk may not care about the risk that the bank recalls the line since they most likely have to use the line as a permanent funding tool due to their worse financial conditions (cf. Denis and Sibilkov (2010)). This line of argument implies that the lines' recall risk has a non-linear and non-monotonic effect on cash holdings and line usage: Clients with low recall risks have lower cash holdings and higher line usages than clients with moderate recall risks.

In turn, the latter have higher cash holdings and lower line usage than clients with high recall risks, whose recall risk comes along with financial distress.

Our empirical findings for cash holdings and line usage, both are normalized by net total assets, support this line of argument. Clients with moderate recall risks have higher cash holdings and higher line usage than clients with low or high recall risks. To trace out whether the differences in cash holdings and line usages of clients with low, moderate and high recall risks are driven by the size of the line limit, we also check the clients' total liquidity, defined as cash holdings plus the remaining line, normalized by net total assets. We find that clients with low recall risks have lower total liquidity than clients with moderate recall risks, who have higher total liquidity than clients with high recall risks. These last findings indicate that clients with moderate recall risks do not use their bank lines of credit as efficiently as the clients with low recall risks. While the latter substitute costly cash holdings by bank lines of credit, the former have further cash holdings due to recall risk although their limit size is not a binding constraint.

Our data set enables one further contribution to the recent literature. Monthly account data provide us with the basis to calculate liquidity-at-risk based on a historical simulation. The liquidity-at-risk measure allows us to control for expected liquidity needs a client faces more precisely than the recent literature was able to do, which often applies the standard deviation of annual cash flows. We find that liquidity-at-risk is positively correlated with the line usage measured in terms of the clients' net total assets, but negatively with the line usage measured in terms of the line limit. In addition, liquidity-at-risk is positively correlated with cash holdings and total liquidity measured in terms of the clients' net total assets. These findings indicate that clients with high liquidity-at-risk, which proxies expected short-term liquidity needs, use their bank lines of credit more heavily. We expect them to do so because holding cash over a long horizon without using it is more costly than fulfilling liquidity needs by drawing the line over a short horizon.

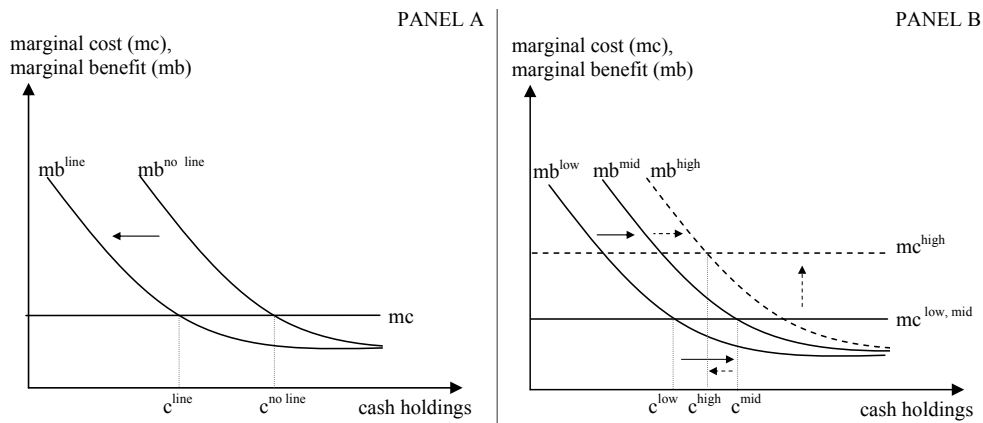
The remainder of the paper is organized as follows. Section 2 discusses theoretical approaches and our empirical hypotheses. Section 3 describes our data set. Section 4 contains our estimation of the probability of recalling the bank line of credit on which we base our recall risk measure. Section 5 presents estimation results for cash holdings and line usage, while Section 6 provides results from some model extensions. Section 7 concludes.

2 Theory and empirical hypotheses

In a world of perfect capital markets, the amount of cash (and cash equivalents) that a firm holds has no impact on its value. On the one hand, there are no benefits of cash holdings since the firm can raise funds at zero transaction cost whenever it will face liquidity needs in the future. On the other hand, there are no opportunity costs of cash holdings since the firm would not receive a liquidity premium if it invested its funds into means other than cash.

In a world of imperfect capital markets, however, the firm faces benefits and costs of cash holdings and will therefore, as the *trade-off theory of cash* (e.g. Miller and Orr (1966)) suggests, hold an optimal level of cash. Benefits of cash holdings arise since the firm avoids expected future cost of liquidity shortages. The *transaction motive* of cash holdings (cf. Keynes (1936)) postulates that sufficient cash holdings today avoid (frequently) future needs of converting cash substitutes into cash as well as (frequently) future needs of accessing capital markets to raise external funds. Moreover, the *precautionary motive* of cash holdings postulates that sufficient cash holdings today avoid the need to cut back valuable investments as well as to raise funds when the firm is undervalued (cf. Myers and Majluf (1984)). The marginal benefit of holding cash is supposed to decrease in the amount of cash that the firm holds (cf. Figure 1).

Figure 1: Optimal cash holdings by callable bank lines of credit.



Concerning the costs of cash holding, we concentrate first on the firm's investment decision and therefore assume equity and debt as given. For a fixed level of funds, a marginal increase in cash holdings comes along with a marginal decrease of alternative assets. The difference between the (zero) return of cash holdings and the presumably higher return on alternative assets constitutes the costs of cash holdings. As in Opler *et al.* (1999), we start with constant marginal costs as shown in Figure 1, Panel A.¹

Beyond holding cash, the firm has other instruments at its disposal to avoid future costs of liquidity shortages. Boot *et al.* (1987), among others, have motivated the existence of bank lines of credit by such market frictions. If a bank offers a line of credit without requiring any upfront fee, every rational firm should demand a line of credit as soon as it would have to debit its account. Neglecting a possible recall of the line for the moment, holding such a bank line of credit reduces the marginal benefits of cash holdings. Since the line provides liquidity on demand, the costs of future liquidity shortages are lower and the marginal benefits of cash holdings shift down and to the left in Figure 1, Panel A. So far, a bank line of credit reduces the optimal level of cash.

Contracts for such bank lines of credit usually include material adverse change clauses. These clauses give the bank the right to recall the line upon short notice. To illustrate the effects of the recall risk on the optimal level of cash holdings, we distinguish between clients facing low, moderate, or high recall risks. The recall risk directly impacts on the marginal benefit of cash holdings. Firms with low recall risks can strongly rely on their line and have low marginal benefits of further cash holdings. Firms with moderate recall risks face the danger to lose the line when they experience liquidity needs in the future. Due to this danger, the marginal benefit curve of cash holdings shifts up and to the right in Figure 1, Panel B. Firms

¹ Another part of the costs of cash holdings are the *agency costs of cash* which arise when a manager does not maximize shareholder value but safeguards own interests. Cash holdings provides the opportunity to engage in wasteful capital spending which may reduce shareholder's value. The implications of these costs on the choice between cash holdings or relying on bank lines of credit are discussed by Dittmar *et al.* (2003) and Yun (2009).

facing high recall risks cannot rely on their lines at all. Therefore, their benefits of cash holdings are almost identical to those of firms without any bank line of credit.

Our (partial) line of argument so far implies that the optimal level of cash increases in the recall risk. Next, we have to discuss whether the recall risk, and the factors determining the recall risk, influences the marginal costs of holding cash, too. For firms with low and moderate recall risks, the (opportunity) costs of cash holdings are related to the return on other assets and can be assumed to be rather similar. Firms with a high recall risks, however, are most likely in a worse financial situation. They may not be able to turn other assets into cash but would have to increase expensive debt to obtain more cash. Therefore, firms with high recall risks have considerably higher marginal costs leading to lower optimal cash holdings as shown in Figure 1, Panel B.² Our first hypothesis summarizes the effects of the recall risk on the optimal cash holdings.

Hypothesis 1. *Firms with moderate recall risks have higher cash holdings than firms with low or high recall risks.*

Which implications follow from the reduction in cash holdings for the line usage? For all firms alike, using the line permanently is not efficient since line rates are higher than the interest rates on alternative bank loans. Therefore, whenever a liquidity gap is persistent and sufficiently large, the firm reduces its line usage by raising a regular bank loan. A permanent use of the line is only reasonable when the incompleteness of bank products calls for such a use. There are two dimensions which may require a permanent use of the line. First, the persistence in the liquidity gap might not be long enough to demand a bank loan with fixed repayment plan. For example, if the firm has a liquidity gap of 20,000 Euros for the next four weeks, a suitable short-term bank loan might not be available. Second, the size of the liquidity gap might not be large enough. For example, if the firm has a liquidity gap of 5,000

² If there were no jump in marginal costs but some more or less continuous upward move, than the optimal cash holdings of firms with moderate and high recall risks may be undistinguishable.

Euros for one year, the additional cost of using the line instead of another bank loan with fixed repayment plan is considerably moderate. If the line rate is about 5 percentage points higher than the interest rate on a bank loan, the additional interest costs amount to just 250 Euros per year (which should be compared to transactional costs of the alternative bank loan.)

Thus, the reduction in cash holdings does not imply a permanent usage of the line. Nevertheless the reduction of cash holdings will be reflected in particular months, in which the firm use the line to compensate brief liquidity gaps. As a reflection of the reduction in cash holdings, we expect that firms with low recall risks will more intensively use their lines (in absolute terms) to fulfill their liquidity needs than firms with moderate recall risks.³ For both types of firms, using the line permanently is not efficient. Firms facing high recall risks, however, will have to draw heavily on their lines since it may already be their last funding source. Thus, firms with high recall risks may even use their line permanently. This leads to the following hypothesis.

Hypothesis 2. *Firms with moderate recall risks use their lines less intensively than firms with low or high recall risks.*

So far, we postulate that the reason why firms facing moderate recall risks hold more cash and use their lines (in absolute terms) less intensive than than firms facing low recall risk, is that the former use further cash holdings to *insure against losing the line*. Next, we introduce an alternative reason by relaxing the implicit assumption that both types of firms have sufficiently large line limits to fulfill their expected liquidity needs. Most presumably, the bank provides firms facing low recall risks with sufficiently large line limits. However, the bank may, due to its own risk exposure, restrict the line limits of firms facing moderate (or high) recall risks since those firms exhibit some signs of financial distress. In this case, the size of the line

³ ‘Absolute terms’ means that ‘line usage’ does not refer to the drawn amount scaled to the size of the line but refers to the absolute drawn amount in monetary unit (possibly scaled to client’s size to filter out size effects).

would be a binding constraint for those firms. In the same manner as the line's recall risk, an insufficient size of the line may also enhance the benefits of further cash holdings since the line on its own will not suffice to fulfill expected liquidity needs. Thus, the alternative reason why firms facing moderate recall risks hold more cash and use their lines (in absolute terms) less intensive than than firms facing low recall risks, is that the former use further cash holdings to *complement an insufficient size of the line*.

To eliminate the alternative reason, we observe a firm's total liquidity. Following Sufi (2009), we define this as cash holdings plus the undrawn amount of the line of credit. If the alternative reason is true and the bank provides only firms facing low recall risks with sufficiently large line limits, both firms will have identical total liquidity available. The former will have large line limits and low cash holdings and the latter will have small line limits and high cash holdings. Otherwise, our original reason is true, and we should find that firms facing moderate recall risks will have higher total liquidity than firms facing low recall risks. In that case, only recall risks and not the size of the line drives cash holdings (respectively, absolute line usage).

In any case, firms facing high recall risks have the lowest total liquidity available. As mentioned above, holding cash is too expensive for those firms and their financial distress causes permanent line usage. Presumably, a limit reduction by the bank enhances the effect. These considerations are summarized in our third and last hypothesis which is only true if the bank provides firms facing low and moderate recall risks with sufficiently large line limits.

Hypothesis 3. *Firms with moderate recall risks have more total liquidity than firms with low or high recall risks.*

3 Data

We use a unique data set provided by a German universal bank, which consists of more than one million monthly business account observations from October 2002 through December 2008. To focus on SMEs, we do not consider private costumers and financial or public sector companies. Moreover, we neglect all clients with a maximum (minimum) account balance exceeding 1 million Euro (deceeding -1 million Euro) and those with incomplete information about their industry classification or their legal form. Clients with legal form ‘e.V.’ (association) or ‘e.G.’ (cooperative) are neglected, too. Furthermore, we delete all clients for which less than three observations are available, and for which the amount in the business account does not change over three consecutive months because in these cases the clients are not sufficiently active with this bank. Finally, we delete a client from the data base one month after the first event of default. The final data set still consists of 13,683 clients for which we have business account data (hereafter the full sample). For approximately 12% of this full sample, we also have annual reporting data which are particular important when dealing with the amount of cash holdings (hereafter the subsample).

The design of bank lines of credit in our sample deserves particular attention since it differs from other bank lines of credit on which the recent literature has focused. In our sample, a line of credit is usually offered together with the main transactional business account. After obtaining a line of credit, the client can withdraw money or repay the outstanding debt at any time without further permission or consultation of the bank. For a debt balance within the contracted line of credit, which is an authorized overdraft, the account holder has to pay a debt interest rate. This rate is usually considerably higher than the interest rate required for alternative bank funding, such as bank loans with fixed repayment plans. In turn, all lines of credit in our sample are free of any upfront fee. In most cases, the bank and client negotiate a variable interest rate or a fixed markup on a variable basis such as EURIBOR. Beyond the authorized overdraft, the bank may tolerate an overdraft which exceeds

the agreed limit on a case-by-case basis. The same holds for an account overdraft if no line is contracted at all. The bank penalizes such an unauthorized overdraft with up to about 5 percentage points of additional interest on top of the line of credit rate. Moreover, nearly all lines of credit are agreed upon until further notice. Therefore the bank is allowed to renegotiate or even can recall the line in case of a material adverse change (MAC). Explicit covenants as in the sample of S&P firms analyzed by Sufi (2009) are quite unusual in our sample. Instead, it is common to renegotiate the credit terms in regular intervals against the backdrop of a client's creditworthiness and behavior.

Because of the particular design of lines of credit, most of the clients in our sample hold a bank line of credit as shown in Table 1, Panel A. In the subsample, only 103 out of a total of 1,532 clients never had a line in the considered time period. We refer to this group of clients as Group A. In the group of clients who hold a line at anytime in the period (Group B), 1,203 out of 1,429 clients hold the line during the whole sample period, i.e., in every month between October 2002 and December 2008 (Group B1). 91 clients had no line at the beginning of our sample period but obtained a line later on (Group B2), and 62 clients hold a line which was recalled later on by the bank (Group B3). Finally, we have 73 clients who switch their line status more than once (Group B4).

In Table 1, Panel B, we compare the client-year-observations (1) with bank line of credit and (2) without bank line of credit for the subsample ((S1) and (S2)) and the full sample ((F1) and (F2)). Clients holding a line of credit have substantially lower amounts in their business accounts than clients without a line. On average, clients with line have negative amounts whereas clients not holding a line credit their accounts. In order to capture clients who have considerable negative amounts in their business accounts throughout a full year, we create the variable $FLOOR_y$. It is set to zero if we observe any non-negative amount in the monthly business account observations within year y . If we observe negative amounts only, it is the highest (or, in absolute terms, the smallest negative) amount in the corresponding

year y (hereafter the ‘negative floor’). In other words, it is the maximum within-year account balance if the account is debited throughout the whole year, and zero otherwise. From an ex post perspective, such a negative floor (and thus a permanent use of the line) of sufficient size should have been financed by alternative funding sources, if available, which are cheaper than negative amounts in business accounts even if a line of credit is attached to the account. However, a negative floor is not irrational per se because alternative funding products might be not available.

Table 1: Availability and usage of bank lines of credit.

PANEL A		Subsample (S)		Full sample (F)	
clients in the years 2002-2008		1,532		13,683	
thereof those who never had a line (Group A)		103		4,118	
thereof those with line in any year (Group B)		1,429		9,565	
clients from Group B who...					
...had a line in each of the years (Group B1)		1,203		7,278	
...once switched from no line to line (Group B2)		91		1,267	
...once switched from line to no line (Group B3)		62		636	
...switched their status at least twice (Group B4)		73		384	

	Subsample		Full sample	
	Yes (S1)	No (S2)	Yes (F1)	No (F2)
client-year observations with line of credit?	7,953	1,205	49,989	28,956
client-year observations (over 7 years)	7,953	1,205	49,989	28,956
average account balance in Euro	-16,733	11,191	-5,528	9,454
average account balance to net total assets	-3.65%	3.49%	-1.17%	3.91%
observations with negative <i>FLOOR</i>	1,769	73	4,937	283
average negative <i>FLOOR</i> to net total assets	16%	15%	14%	31%
Liquidity-at-Risk to net total assets (LaR^{TA})	6.76%	5.34%	3.83%	4.70%
Share of clients with $PD < 1\%$	61.2%	56.8%	60.9%	56.6%
Relationship’s <i>DURATION</i> in years	18	13	17	11
Share of self-employed clients (D^{SELF})	39%	26%	77%	65%

PANEL C		(based on client-year observations in Subsample S1)				
endogenous variables:	observations	mean	std	p25	p50	p75
$CASH^{TA}$	7,953	10.45	21.06	0.48	2.21	9.92
$MAXUSE^{TA}$	7,953	13.92	15.80	1.93	9.11	19.98
$MAXUSE^{LIMIT}$	7,953	95.09	87.56	27.52	91.13	128.14
$LIQUID^{TA}$	7,953	20.78	29.58	2.82	10.20	26.34
exogenous variables:	observations	mean	std	p25	p50	p75
$CASHFLOW^{TA}$	7,953	13.29	15.58	4.50	10.10	18.50
$TRADE^{TA}$	7,953	13.58	14.83	3.04	8.52	18.78
$LIABILITY^{TA}$	7,953	77.28	26.31	60.85	83.03	96.74
$COST^{DEBT}$	7,921	4.56	2.53	2.88	4.48	5.83
TA (in Mio. Euro)	7,953	1.69	12.02	0.21	0.44	1.01

Note: The ‘Subsample’ contains all client-year observations for which financial statements are available. ‘With line’ means that the client holds a line throughout the full corresponding year. TA is net total assets, i.e. total assets minus cash. All variables are measured in percentage of the denominator.

More specifically, the negative floor might be too small for a bank loan (either in absolute terms or in percentage of total assets). To control for this and to really focus on considerable negative amounts, the variable $FLOOR_y$ is also set to zero if the highest amount is above -5,000 Euro or above -5% of the client's total assets.⁴ In the subsample, we observe a negative floor for 22% (1,769) of the client-year observations with line and 6% (73) of the ones without line. The negative floor accounts, on average, for 16% and 15% of total assets for clients with and without line.

For our main analyses of cash holdings and line usage (Section 5), we rely on observations from clients who hold a bank line of credit in the subsample (S1). Only in selected model extensions (Section 6), we use either the whole subsample including clients with and without lines of credit (S1 and S2) or, alternatively, clients holding a line in the full sample (F1). Therefore, we compare the different samples in the lower part of Table 1, Panel B, using the following four variables available for the full sample. First, we use a liquidity-at-risk (LaR^{TA}) measure from a historical simulation to capture that the clients likely face quite different liquidity shocks. We derive the liquidity-at-risk from the transaction business accounts and calculate the monthly changes in the account for the past two years (neglecting the last quarter) before we observe cash holdings and line usage. From these 21 observations we use the second smallest value whenever it is negative, multiply it by minus one, and normalize it by total assets minus cash holdings (hereafter net total assets as in Opler *et al.* (1999) and Sufi (2009)). A higher liquidity-at-risk indicates higher liquidity shocks. Second, we use the probability of default (PD) which is the risk assessment of the bank. Third, we use the length of the relationship ($DURATION$) which is the time since the first contact between the client and the bank in years. Berger

⁴ For those client-year-observation in the full sample that lack of reporting data, we have to predict the total assets using a pooled OLS regression models calibrated on subsample data. We use the limit and the interest rate of the bank line of credit, industry and year dummies, as well as dummies concerning the strategic business unit of the bank as explanatory variables. We estimate the model for self-employed and corporate clients separately and yield and adjusted R^2 of respectively, 60% and 38%. We neglect predicted total assets below 2,000 Euros, which is the lowest value in the subsample. We only rely on these prediction in the descriptive statistics shown in Table 1 and do not use it in any regression models.

and Udell (1995) have already shown that firms with longer banking relationships pay lower interest rates and have to pledge lower collateral. Finally, the client's legal form is a time-invariant dummy variable, which is equal to one if the client is self-employed and zero if it is a corporate client (D^{SELF}).⁵ Noteworthy, in our sample all bank lines of credit are collateralized, although collateral differs in quality and quantity, which we can, unfortunately, not measure. Therefore, we do not take into account collateral as a further characteristic.

The subsample of clients holding a line (S1) does not differ too much from the full sample of clients holding a line (F1) with respect to the liquidity-at-risk, the probability of default and the duration of the client-bank relationship. However, the percentage of self-employed clients is substantially lower in S1 (39%) than in F1 (71%). Thus, the subsample that we use in our main analyses contains relatively more corporate clients than we observe in the bank's total clients basis. The obvious reason is that the self-employees are less likely to have to submit full financial reports. The subsample of clients holding a line differs in certain ways from the subsample of clients without line. On average, clients with a line have higher liquidity-at-risk, which likely increases the benefits of using lines of credit as a liquidity management tool, they are perceived as a little less risky, suggesting that the bank considers the creditworthiness of clients when it provides a line of credit, and they have longer relationships to the bank.

In Table 1, Panel C, we finally introduce our endogenous and exogenous variables which will later be used in several regressions. As well as the regressions, the Panel include only client-year-observations with bank line of credit in the subsample (S1). As endogenous variables, we use cash holdings ($CASH^{TA}$) defined as cash and cash-equivalent items relative to net total assets (total assets minus cash), and line usage ($MAXUSE^{TA}$), which is the maximum debt (in absolute values) on the account to which a line is attached during each year normalized by net total assets. Since

⁵ Self-employed business clients differs from (the neglected) private customers in that the former hold business accounts at the bank (which we use in our data set) and are classified as self-employees the corresponding strategic business unit of the bank.

the limit may determine how clients use their line of credit, we use in addition the maximum line usage normalized by the clients' limit of the line ($MAXUSE^{LIMIT}$). The variable $LIQUID^{TA}$ represents the client's total liquidity, which we define as cash holdings plus the remaining amount of the line not used, normalized by net total assets.

The exogenous variables in our analyses are believed to have an impact on the marginal benefits and costs of cash holdings, which have been put forward in the literature. We use cash flow to total assets ($CASHFLOW^{TA}$) since clients with higher cash flows have a higher inside financing potential. $TRADE^{TA}$ denotes trade loans which have been proven to be an alternative funding source for small private businesses without access to bank lines of credit (Petersen and Rajan (1997)). Unfortunately, the data does not allow us to distinguish between short-term and long-term debt financing. Therefore, we use the leverage ratio defined as debt financing over total assets ($LIABILITY^{TA}$). Since this leverage ratio depends on the line usage, we use the ratio of the previous year and also test whether excluding the leverage ratio changes our main insights. Finally we also calculate the funding costs ($COST^{DEBT}$) defined as interest payments over total debt. We use this variable in addition to the leverage ratio in order to control for different funding conditions. We do not consider other determinants put forward in the literature on cash holdings and line usage, such as dividend payments and the tangibility of assets, since the variation in these variables is too low in our sample. All variables described above are measures in percentage of the denominator. Further descriptions on the variables (Table 8) and a table of correlation coefficients (Table 9) are given in the Appendix.

4 Recall Risk

To determine the recall risk of the bank line of credit, we estimate the probability of retaining the line of credit by using the dummy variable (D_y^{LINE}), which equals one if the client holds a line of credit through out the full year y , and zero otherwise. Since the sample consists of different types of clients (see Table 1, Panel A), we consider only clients who permanently hold a line (over the full sample period), and clients whose line is at least once recalled by the bank during the sample period. Thus, clients to whom the bank never provides a line (Group A) and clients to whom the bank likely provides a line for the first time (Group B2) are not included in the estimation sample. Since many clients hold a line of credit in all years (and months) of our sample period, we employ a probit model without fixed effects and cluster the error terms on the level of the client.

The bank may have different reasons to recall a line of credit from a particular client. First, the bank may recall the line with a higher probability when the client's creditworthiness decreases because a poorer creditworthiness implies that the client less likely meets its obligations. Therefore, we include the probability of default (PD) as an explanatory variable and expect that a higher PD calls for the bank's attention and therefore decreases the probability of retaining the line. Second, the bank may recall the line with a higher probability when the client behaves adversely. An adverse behavior is, for example, an unauthorized overdraft. Thus, we use the dummy D^{OVER} , which equals one if a client holding a line exceeds its limit or if a client who does not hold a line unauthorizedly debts its business account.

Since the clients in our sample are relatively small and do not have access to public capital markets, problems arising from informational asymmetries between the bank and the clients may be particularly pronounced and this may also impact the probability of retaining the line. The bank has several instruments at its disposal to mitigate problems arising from information asymmetries ,e.g. the duration of the bank-client relationship. We therefore include $DURATION$ as our third explana-

tory variable and expect that it positively impacts on the probability of retaining the line since the bank will likely care more about its reputation and therefore recall the line less easily. In addition, we include year and industry dummies to filter out time-varying and industry-specific unobservable effects.

To trace out what role the clients' legal status play, we present several specifications of the probit model. First and second, we estimate the model described above for self-employees and corporate clients, separately. Third, we estimate a joint model for both groups and include a dummy variable equal to one for self-employed clients (D^{SELF}). Furthermore, we add financial reporting variables, such as $CASHFLOW^{TA}$, $TRADE^{TA}$, $LIABILITY^{TA}$, and $COST^{DEBT}$ to the latter model.

Table 2 presents the marginal effects on the probability of retaining the line of credit based on the subsample. Marginal effects are evaluated at the sample means except for dummy variables for which they are calculated by changing the variable from 0 to 1. The average probability of retaining the line is 94% which results in an average recall risk of 6%. In each of the four specification, the bank's assessment of the clients' creditworthiness (PD) has, as expected, a considerable negative effect on retaining the line of credit. A marginal increase in the probability of default evaluated at the sample mean decreases the probability of retaining the line by about 0.25%. Clients that overdraw their line limit ($D^{OVER} = 1$) have a significantly lower probability of retaining their line. Overdrawing the line limit comes along with a reduction in the probability of retaining the line of about 5%.

We also find some, albeit small, differences between self-employed and corporate clients. An increase in the duration of the bank-client relationship has a significant positive effect on the probability of retaining the line for corporate clients (2), but not for self-employees (1). Moreover, the dummy variable D^{SELF} is significantly positive in (3) (and in (4) as well). The probability of retaining the line is about 1.6% higher for self-employed clients than for corporate clients. This difference between self-employed clients and corporate clients may have several reasons, e.g. different

variations of the firms' income conditions. Moreover, the vast majority of the corporate clients are limited companies while every self-employee has unlimited liability due to German Law. Thus, the bank's trust in the clients meeting their future repayment obligation might be higher for self-employees. Corporate clients, in turn, can obviously dissipate doubt by holding longer relationships to the bank.

Table 2: Probability of retaining a bank line of credit.

sample selection	self-employees (1)	corporates (2)	all (3)	all (4)
endogenous variable	D_y^{LINE}	D_y^{LINE}	D_y^{LINE}	D_y^{LINE}
<i>exogenous variables:</i>				
PD_y	-0.0026*** (0.0008)	-0.0019** (0.0008)	-0.0027*** (0.0007)	-0.0025*** (0.0007)
D_{y-1}^{OVER}	-0.0424*** (0.0148)	-0.0497*** (0.0138)	-0.0501*** (0.0109)	-0.0471*** (0.0112)
$DURATION_y$	0.0003 (0.0004)	0.0007* (0.0004)	0.0004 (0.0003)	0.0005 (0.0003)
D^{SELF}			0.0159** (0.0075)	0.0145* (0.0082)
$CASHFLOW_y^{TA}$				0.0004* (0.0002)
$TRADE_{y-1}^{TA}$				0.0002 (0.0002)
$LIABILITY_{y-1}^{TA}$				-0.0002 (0.0001)
$COST_{y-1}^{DEBT}$				0.0001 (0.0014)
Industry dummies	Yes	Yes	Yes	Yes
Annual dummies	Yes	Yes	Yes	Yes
Clients	545	799	1,344	1,344
Observations	2,475	3,784	6,259	6,259
Pseudo- R^2	0.164	0.099	0.099	0.103
AUC-value	0.815	0.743	0.751	0.756

Note: We use a probit model to estimate the probability of retaining a bank line of credit for German SMEs during 2002-2008 (annual observations) in order to estimate the risk that the bank recalls the client's bank line of credit. We exclude subsample groups A and B2 (cf. Table 1, Panel A). The functional form of the model in the first column is as follows: $P(D^{LINE} = 1)_{c,y} = \alpha + \beta_1 \cdot PD_{c,y} + \beta_2 \cdot OVER_{c,y-1} + \beta_3 \cdot DURATION_{c,y} + \delta \cdot CONTROL$. The table contains the marginal effects evaluated at the means. Marginal effect of dummy is the discrete change from 0 to 1. Marginal effect of continuous variable is first order partial derivative. *, **, and*** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered by clients (given in brackets). The AUC value is the fraction under the *receiver operating characteristic* (ROC) curve. Cf. Table 8 for variable description.

The financial reporting variables (only included in (4)) are not very helpful in explaining the probability of retaining the line except cash flow, which increases the probability. The insignificance of the financial reporting variables is not surprising because the bank considers all these variables in its risk assessment condensed in the probability of default.

In the following, we use the linear prediction of the probability of retaining a line of credit according to the specifications (1) and (2) to measure a client's recall risk. To gain higher values for higher recall risks we use a monotone linear transformation of the predicted value. We will use this recall risk measure to investigate the coherence between recall risk, cash holdings, and line usage as postulated in Section 2. Since the linear prediction contains the impact of D^{OVER} , which basically describes one facet of how clients use their lines of credit, this measure would be endogenous with respect to line usage. Therefore, we adjust the linear prediction by the effect of D^{OVER} . Doing so, we ensure that our recall risk measure is not endogenous, so that we can investigate the impact of the recall risk on the clients' cash holdings and line usage.

5 Cash holdings and line usage

5.1 Univariate results

To gain descriptive insights into the clients' cash holdings and line usage, we classify the subsample of clients who hold a line of credit (S1 in Table 1, Panel B) into three groups according to their recall risks. Clients with low recall risks are those clients whose predicted recall risk is below the 25th percentile, while clients with high recall risks are those whose predicted recall risk of the line of credit is above the 75th percentile. All remaining clients are referred to as clients with moderate recall risks.

Table 3 delivers descriptive statistics for clients' cash holdings and line usage. Clients with moderate recall risks have higher cash holdings ($CASH^{TA}$) than clients with low or high recall risks. These descriptive statistics give preliminary support for our first hypothesis stating that the recall risk non-linearly and non-monotonically affects cash holdings. The t-test allows us to reject the hypothesis of mean equality between the subsamples of (i) clients with moderate recall risks and (ii) clients with low or high recall risks. The line usage, measured with $MAXUSE^{TA}$, which is the maximum amount within each year (based on monthly observations) normalized by net total assets, reflects the clients' cash holdings. Clients with moderate recall risks use the line less intensively than clients with low or high recall risks. Again confirmed by the t-test, these findings lend preliminary support to our second hypothesis dealing with the non-linear and non-monotonic effect of the recall risk on line usage.

The limit of the line ($LIMIT^{TA}$) varies systematically with the recall risk as well. A higher recall risk comes along with a reduction in the size of the line limit (compared to firm's size). Therefore, the differences in cash holdings and line usage of clients with low, moderate, and high recall risks might be also driven by the size of the line limit, as outlined in detail in Section 2. To check whether an insufficient limit size for clients with moderate recall risks causes the non-linear and non-monotonic effect of the recall risk, we consider two further variables: The firm's total liquidity

Table 3: Descriptive statistics of cash holdings and line usage.

Recall Risk	$CASH^{TA}$	$MAXUSE^{TA}$	$LIMIT^{TA}$	$LIQUID^{TA}$	$MAXUSE^{LIMIT}$
Low	8.63	16.22	19.02	20.65	94.14
Moderate	11.93	13.61	16.42	22.42	94.68
High	8.96	14.44	14.54	16.99	109.51
Total	10.37	14.50	16.70	20.73	97.85
t-test	-5.98***	4.46***	1.47	-4.64***	2.95***
p-value	0.000	0.000	0.141	0.000	0.003

Note: Based on the subsample of clients holding a bank line of credit (S1), the table shows the means (annual observations) of our key variables on cash holdings and line usage for different groups of recall risk. All figures are given in percentage of the denominator. The t-test refers to the groups of (i) clients with moderate recall risk and (ii) clients with low or high recall risk. The p-value represents the probability that the difference between the group means of the column variable is zero. Cf. Table 8 for variable description and Section 4 for the estimation procedure of the recall risk.

($LIQUID^{TA}$), defined as cash holdings plus the remaining bank line normalized by net total assets, and $MAXUSE^{LIMIT}$, which is the maximum within year line usage normalized by the line limit. Clients with moderate recall risks have more total liquidity available than clients with low or high recall risks. Confirmed by the t-test, these findings lend preliminary support to our third hypothesis.

The results of the very right column indicate that clients with low recall risks do not use their lines normalized by the line limit more intensively than clients with moderate recall risks. One might argue that this is not in line with our line of argument and that it may indicate that firms facing moderate recall risks are indeed constrained by limit size. However, the (little) lower relative line usage of firms with low recall risk is more presumably a consequence of unnecessarily high line limits. The bank obviously provides firms facing low recall risks with limits exceeding their expected liquidity needs. That firms facing low recall risk have higher line limits (and consequently lower relative line usage) than firms facing moderate recall risks does not prove that the latter firms are constrained by their line's size. To trace out this, one has to consider the impact of total liquidity available, as discussed above.

5.2 Multivariate results

Our multivariate results on the impact of recall risks on cash holdings and line usage come from dynamic panel estimations proposed by Blundell and Bond (1998) and a finite sample correction proposed by Windmeijer (2005). The inclusion of the lagged endogenous variable is useful to control further for unobserved client-specific effects. The estimation results will be consistent if we use appropriate instruments for the lagged endogenous variables, and if there is no second-order autocorrelation. Therefore, we use the Hansen test of overidentifying restrictions Arellano and Bond (1991), Blundell and Bond (1998)). Since the Hansen test of overidentifying restrictions can be weakened by many instruments (Roodman (2009)), we specify only a very limited number of instruments and use the same lag structure of instruments in all the model specifications. The tests for overidentifying restrictions and second-order autocorrelation for the estimation presented in Tables 4 and 5 indicate that the instruments used are valid instruments in most models and that second-order autocorrelation is absent.

Our first set of estimations presented in Table 4 considers cash holdings ($CASH^{TA}$) and line usage ($MAXUSE^{TA}$) both normalized by net total assets as the endogenous variables. Since our first and second hypotheses postulate that the effect of recall risk on cash holdings and line usage is non-linear and non-monotonic, we present one specification in which we include the recall risk linearly, and one specification in which we include recall risk as well as recall risk squared to allow for non-linear effects. Moreover, we control for liquidity-at-risk measure (LaR^{TA}) and the same financial reporting variables as used in the former section concerning the recall risk. In addition, we again include year and industry dummies to filter out time-varying and industry-specific unobservable effects and a dummy variable equal to one for self-employed clients (D^{SELF}).

We find that cash holdings do not depend on the recall risk, when it is included linearly, while the line usage depends positively on the recall risk. Moreover, we

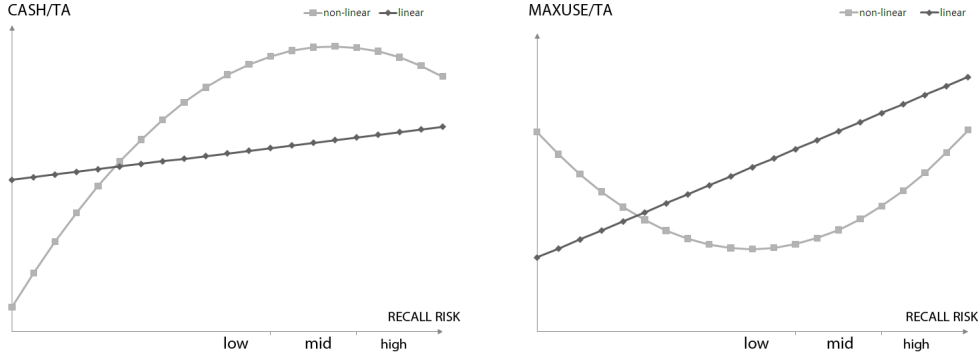
find non-linear effects of the recall risk in both the cash holdings and line usage equation. The recall risk has a positive impact whereas recall risk squared has a negative impact on cash holdings, and the opposite holds for line usage. Since these findings do not necessarily imply that cash holdings increase in the recall risk for moderate risk levels, while they decrease in the recall risk for high risk levels, we

Table 4: Cash holdings and use of bank line of credit

endogenous variable	$CASH^{TA}$	$CASH^{TA}$	$MAXUSE^{TA}$	$MAXUSE^{TA}$
<i>exogenous variables:</i>				
$RECALL_y$	0.6139 (0.648)	17.8627** (7.547)	2.4429*** (0.601)	-17.8651*** (5.427)
$RECALL_y^2$		-1.0851** (0.477)		1.2778*** (0.356)
LaR_y^{TA}	0.7668*** (0.099)	0.7667*** (0.099)	0.6841*** (0.067)	0.6851*** (0.066)
$CASHFLOW_y^{TA}$	0.0795*** (0.021)	0.0787*** (0.021)	-0.0604*** (0.015)	-0.0596*** (0.015)
$TRADE_{y-1}^{TA}$	-0.0680** (0.029)	-0.0680** (0.029)	-0.0320** (0.016)	-0.0321** (0.016)
$LIABILITY_{y-1}^{TA}$	-0.1038*** (0.020)	-0.1033*** (0.020)	0.0410*** (0.011)	0.0403*** (0.011)
$COST_{y-1}^{DEBT}$	-0.6299*** (0.164)	-0.6298*** (0.164)	0.0870 (0.165)	0.0851 (0.165)
D^{SELF}	-3.6313*** (0.885)	-3.6759*** (0.889)	3.4291*** (0.490)	3.4735*** (0.485)
Lagged	0.4933*** (0.069)	0.4926*** (0.069)	0.4232*** (0.060)	0.4234*** (0.060)
endogeneous				
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Clients	1386	1386	1386	1386
Observations	5310	5310	5310	5310
Instruments	28	29	28	29
AR1 (p-value)	0.000	0.000	0.000	0.000
AR2 (p-value)	0.767	0.773	0.373	0.367
Hansen (p-value)	0.177	0.183	0.001	0.001

Note: We use a dynamic generalized method of moments estimation technique following Blundell and Bond (1998) with Windmeijer (2005) correction to examine the impact of recall risk on cash holdings and usage of bank lines of credit of German SMEs during 2002-2008 (annual observations). We only include clients holding a bank line of credit from the subsample (S1). $CASH$ represents the sum of cash and cash equivalents according the financial statements whereas $MAXUSE$ is the maximum drawn amount of the bank line of credit in the corresponding year. Both are scaled to net total assets. The functional form of the model in the first column is as follows: $CASH_{c,y}^{TA} = \beta_0 + \beta_1 \cdot CASH_{c,y-1}^{TA} + \beta_2 \cdot RECALL_{c,y} + \beta_3 \cdot RECALL_{c,y}^2 + \beta_4 \cdot LaR_{c,y} + \beta_5 \cdot CASHFLOW_{c,y} + \delta \cdot CONTROL_{c,y-1} + \varepsilon_{c,y}$. *, **, and*** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered by clients (given in brackets). Cf. Table 8 for variable description and Section 4 for the estimation procedure of the recall risk.

Figure 2: Cash holdings and line usage by recall risk.



plot cash holdings and line usage for different reasonable levels of the recall risks in Figure 2. We find, that cash holdings reach indeed a maximum for clients with moderate recall risks, while line usage reaches a minimum for clients with moderate recall risks. These findings strongly support our first and second hypotheses.

The estimation results shown in Table 4 with respect to the impact of the recall risk on cash holdings and line usage raise the question on whether the effect is driven by the line limit and not (only) by the recall risk of the line. Therefore, we present estimation results for the firms' total liquidity ($LIQUID^{TA}$) and the line usage normalized by the line limit ($MAXUSE^{LIMIT}$) in Table 5. We find that $LIQUID^{TA}$ does not depend on the recall risk, when it is included linearly, while $MAXUSE^{LIMIT}$ depends positively on the recall risk. This latter finding corresponds to the results by Jiménez *et al.* (2009), although they use the firms' probability of default instead of the lines' recall risk. We find non-linear effects of the recall risk in both $LIQUID^{TA}$ and $MAXUSE^{LIMIT}$. In Figure 3, we show that the firms' total liquidity reaches a maximum for clients with moderate recall risks. These finding indicates that the non-linear and non-monotonic effect of the recall risk on cash holdings and line usage (in absolute terms) is not driven by differences in the size of the line limit and, therefore, support our third hypothesis.

Figure 3 also exhibits, that line usage in relative terms, normalized by the limit, ($MAXUSE^{LIMIT}$) reaches its minimum already for clients with low recall risks and

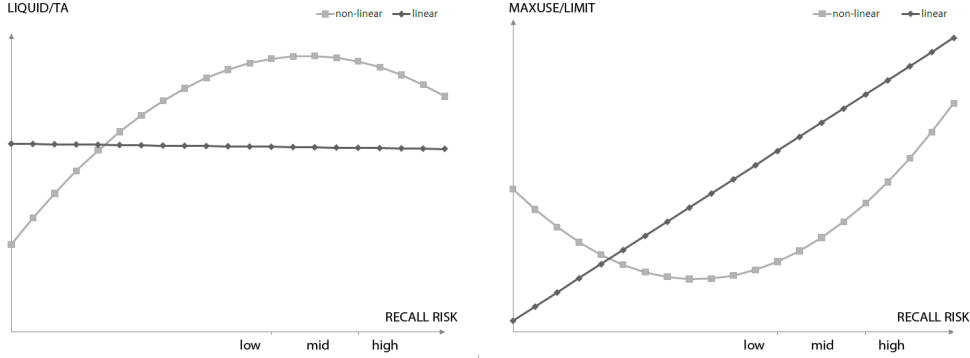
is monotonically increasing with recall risk above this value. This result (which we have already discussed on the descriptive statistics shown in Table 3 in the former subsection) reflects, that clients facing low recall risks have higher line limits than those with moderate (or high) recall risk. Nevertheless, the size of the limit of firms facing moderate recall risks may be insufficiently large to fulfill expected liquidity needs. Thus, it is in line with our hypothesis.

Table 5: The Role of line limit

endogeneous variable	$LIQUID^{TA}$	$LIQUID^{TA}$	$MAXUSE^{LIMIT}$	$MAXUSE^{LIMIT}$
<i>exogenous variables:</i>				
$RECALL_y$	-0.0856 (0.849)	21.2926** (8.419)	0.2323*** (0.039)	-1.1193*** (0.401)
$RECALL_y^2$		-1.3448** (0.540)		0.0850*** (0.026)
LaR_y^{TA}	1.6925*** (0.133)	1.6921*** (0.133)	-0.0042** (0.002)	-0.0041** (0.002)
$CASHFLOW_y^{TA}$	0.1128*** (0.027)	0.1119*** (0.027)	-0.0034*** (0.001)	-0.0033*** (0.001)
$TRADE_{y-1}^{TA}$	-0.1329*** (0.035)	-0.1329*** (0.035)	0.0008 (0.001)	0.0008 (0.001)
$LIABILITY_{y-1}^{TA}$	-0.0993*** (0.021)	-0.0987*** (0.021)	0.0023*** (0.001)	0.0023*** (0.001)
$COST_{y-1}^{DEBT}$	-0.9373*** (0.185)	-0.9361*** (0.185)	0.0035 (0.005)	0.0034 (0.005)
D^{SELF}	-4.6197*** (1.014)	-4.6695*** (1.019)	0.2320*** (0.029)	0.2347*** (0.028)
Lagged endogeneous	0.4483*** (0.059)	0.4480*** (0.059)	0.3576*** (0.041)	0.3577*** (0.041)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Clients	1386	1386	1386	1386
Observations	5310	5310	5305	5305
Instruments	28	29	28	29
AR1 (p-value)	0.000	0.000	0.000	0.000
AR2 (p-value)	0.739	0.744	0.174	0.180
Hansen (p-value)	0.279	0.285	0.756	0.776

Note: We use a dynamic generalized method of moments estimation technique following Blundell and Bond (1998) with Windmeijer (2005) correction to examine the impact of recall risk on cash holdings and usage of bank lines of credit of German SMEs during 2002-2008 (annual observations). We only include clients holding a bank line of credit from the subsample (S1). $CASH$ represents the sum of cash and cash equivalents according the financial statements whereas $LIQUID$ is $CASH$ plus the undrawn part of the bank line of credit. Both variables are scaled to net total assets. The functional form of the model in the first column is as follows: $LIQUID_{c,y}^{TA} = \beta_0 + \beta_1 \cdot LIQUID_{c,y-1}^{TA} + \beta_2 \cdot RECALL_{c,y} + \beta_3 \cdot RECALL_{c,y}^2 + \beta_4 \cdot LaR_{c,y} + \beta_5 \cdot CASHFLOW_{c,y} + \delta \cdot CONTROL_{c,y-1} + \varepsilon_{c,y}$. *, **, and*** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered by clients (given in brackets). Cf. Table 8 for variable description and Section 4 for the estimation procedure of the recall risk.

Figure 3: Available liquidity and line usage by recall risk.



Our liquidity-at-risk measure (LaR^{TA}) has a bearing positive effect on cash holdings and line usage. Based on the short-run coefficients, a client has about 0.8 units in $CASH^{TA}$ and about 1.7 units in $LIQUID^{TA}$ for each unit of LaR^{TA} . Thus, clients with higher discrepancies in cash inflows and outflows have higher cash holdings and, at the same time, are better protected against liquidity shortages since they have more total liquidity available for each unit of LaR^{TA} . In addition, clients with higher LaR^{TA} use their lines normalized by net total assets more intensively, while they use their lines normalized by the line limit less intensively. These findings suggest that clients with higher LaR^{TA} have disproportionately high line limits.

In line with recent literature, we find that clients with higher cash flows have higher cash holdings and higher total liquidity available, but use their lines of credit (irrespective of the normalization procedure used) less intensively. These findings underpin the higher inside financing potential of clients with high cash flows. Trade loans, an alternative and important short-term funding source of the clients in our sample, impact on cash holdings, total liquidity, and line usage negatively. This indicates that when the clients use more trade loans, they are less required to hold cash and they are less dependent on bank lines of credit. Clients with higher leverage have lower cash holdings and lower total liquidity, and they use their lines (irrespective of the normalization procedure used) more intensively. This may indicate that they have limit access to alternative sources of funding. Finally, self-employed clients

have lower cash holdings and lower total liquidity and they use their lines more intensively than corporate clients.

6 Model extensions

6.1 Line usage in the full sample

While we cannot investigate the effect of the recall risk on cash holdings in the full sample due to the lack of financial reporting data, we can assess its impact on line usage, although we cannot control for the multitude of client-specific characteristics which we considered in the last section. Our model set up and methodology is similar to the one used in the last section. However, we solely focus on $MAXUSE^{LIMIT}$, which is the maximum within year line usage normalized by the line limit, since total assets are not available for the full sample. Moreover, we only include recall risk and liquidity-at-risk normalized by the line limit (LaR^{LIMIT}) as well as the usual industry and year dummy variables, and a dummy variable equal to one for self-employed clients (D^{SELF}). Table 6 delivers estimation results for the full sample as well as for samples of self-employed and incorporated clients. The test results for overidentifying restrictions and second-order autocorrelation indicate that the instruments used in these estimations are not valid instruments and that second-order autocorrelation is present in 4 out of the 6 model specifications. Nevertheless, we will interpret the estimation results since they are similar to those which we gain by using a non-dynamic estimation approach, i.e., fixed effect estimations without considering lagged endogenous variables.

The effects of the recall risk on the line usage normalized by the line limit are quite similar to the results we found for the subsample of clients described in the last section. We find that line usage depends positively on the recall risk, when it is included linearly. This effect holds when we include all clients in the estimation, as well as when we include either only self-employed or corporate clients. We find the expected non-linear effect of the recall risk on the line usage for both types of clients, although the non-linear effect of the recall risk on line usage are statistically insignificant in the sample of self-employed clients. The reason for these different findings for self-employed and corporate clients might be that self-employed clients

Table 6: Line usage in the full sample.

sample selection	all clients in full sample		only corporates		only self-employees	
endogenous variable	$\frac{MAXUSE}{LIMIT}$	$\frac{MAXUSE}{LIMIT}$	$\frac{MAXUSE}{LIMIT}$	$\frac{MAXUSE}{LIMIT}$	$\frac{MAXUSE}{LIMIT}$	$\frac{MAXUSE}{LIMIT}$
<i>exogenous variables:</i>						
$RECALL_y$	1.9924*** (0.088)	-13.9269*** (5.229)	3.2249*** (0.330)	-2.2807*** (0.337)	1.9105*** (0.094)	-6.1070 (5.551)
$RECALL_y^2$		1.0642*** (0.351)		0.3062*** (0.045)		0.5364 (0.373)
LaR_y^{LIMIT}	0.0009*** (0.000)	0.0009*** (0.000)	0.0005** (0.000)	0.0004* (0.000)	0.0010*** (0.000)	0.0010*** (0.000)
D^{SELF}	0.4844*** (0.024)	0.4861*** (0.024)				
Lagged endogeneous	0.3512*** (0.025)	0.3515*** (0.025)	0.3060*** (0.049)	0.4181*** (0.049)	0.3606*** (0.028)	0.3608*** (0.028)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Clients	6627	6627	1581	1581	5046	5046
Observations	26676	26676	6866	6866	19810	19810
Instruments	24	25	23	24	23	24
AR1 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
AR2 (p-value)	0.046	0.047	0.025	0.006	0.438	0.438
Hansen (p-value)	0.000	0.000	0.012	0.000	0.009	0.009

Note: We use a dynamic generalized method of moments estimation technique following Blundell and Bond (1998) with Windmeijer (2005) correction to examine the impact of recall risk on usage of bank lines of credit of German SMEs during 2002-2008 (annual observations). We only include clients holding a bank line of credit from the full sample (F1). $MAXUSE$ is the maximum drawn amount of the bank line of credit in the corresponding year. It is scaled to the limit of the bank line of credit. The functional form of the model in the first column is as follows: $MAXUSE_{c,y}^{LIMIT} = \beta_0 + \beta_1 \cdot MAXUSE_{c,y-1}^{LIMIT} + \beta_2 \cdot RECALL_{c,y} + \beta_3 \cdot RECALL_{c,y}^2 + \beta_4 \cdot LaR_{c,y} + \delta \cdot CONTROL_{c,y-1} + \varepsilon_{c,y}$. *, **, and*** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered by clients (given in brackets). Cf. Table 8 for variable description and Section 4 for the estimation procedure of the recall risk.

in the full sample are, on average, smaller and therefore less likely to manage their liquidity than corporate clients in the full sample.

6.2 Cash holdings of clients with and without line

Finally, we use the subsample of clients with and without line to investigate the effects of a line of credit on clients' cash holdings and total liquidity. Our endogenous variables are again $CASH^{TA}$ and $LIQUID^{TA}$, and we estimate the effect of a dummy variable which is equal to one if the client holds a line of credit, and zero otherwise (D^{LINE}). Since this dummy variable is endogenous, we use the $DURATION$ of the client-bank relationship as an instrument. As further exogenous variables, we include the same variables as in Section 5 to control for liquidity-at-risks and the firms' characteristics due to the financial reporting information. Again, we also include

a dummy variable for being self-employed as well as year and industry dummy variables.

Due to the special design of the lines of credit in our sample, the comparison of cash holdings and total liquidity for clients with and without line is less straight

Table 7: Effect of holding a bank line of credit.

sample selection	all	without A and B2	all	without A and B2
endogenous variable	$CASH^{TA}$	$CASH^{TA}$	$LIQUID^{TA}$	$LIQUID^{TA}$
<i>exogenous variables:</i>				
D_y^{LINE-Y}	-4.3863*** (1.088)	-4.0070** (1.662)	-0.1674 (1.230)	0.3777 (2.067)
LaR_y^{TA}	0.9759*** (0.108)	0.8459*** (0.101)	1.7716*** (0.128)	1.7125*** (0.134)
$CASHFLOW_y^{TA}$	0.0901*** (0.020)	0.0889*** (0.024)	0.1129*** (0.025)	0.1111*** (0.031)
$TRADE_{y-1}^{TA}$	-0.0340 (0.028)	-0.0512* (0.029)	-0.0922** (0.036)	-0.1228*** (0.039)
$LIABILITY_{y-1}^{TA}$	-0.1042*** (0.018)	-0.1014*** (0.020)	-0.1095*** (0.019)	-0.1046*** (0.021)
$COST_{y-1}^{DEBT}$	-0.5816*** (0.170)	-0.6771*** (0.168)	-0.8058*** (0.174)	-0.9371*** (0.187)
D^{SELF}	-4.7866*** (0.807)	-4.4571*** (0.833)	-5.1069*** (0.883)	-5.0173*** (0.930)
Lagged endogeneous	0.4131*** (0.060)	0.4717*** (0.064)	0.4048*** (0.053)	0.4451*** (0.059)
Industry dummies	Yes	Yes	Yes	Yes
Annual dummies	Yes	Yes	Yes	Yes
Clients	1532	1342	1532	1342
Observations	6187	5383	6187	5383
Instruments	29	29	29	29
AR1 (p-value)	0.000	0.000	0.000	0.000
AR2 (p-value)	0.854	0.634	0.994	0.962
Hansen (p-value)	0.700	0.299	0.352	0.255

Note: We use a dynamic generalized method of moments estimation technique following Blundell and Bond (1998) with Windmeijer (2005) correction to examine the impact of holding a bank line of credit on cash and available liquidity of German SMEs during 2002-2008 (annual observations). We only include clients from the subsample. Furthermore, the models in the second and fourth column only include clients who hold a line permanently or who once or more often switch from line to no line. $CASH$ represents the sum of cash and cash equivalents according to the financial statements whereas $LIQUID$ is $CASH$ plus the undrawn part of the bank line of credit. Both variables are scaled to net total assets. The functional form of the model in the first column is as follows: $CASH_{c,y}^{TA} = \beta_0 + \beta_1 \cdot CASH_{c,y-1}^{TA} + \beta_2 \cdot D_{c,y}^{LINE} + \beta_3 \cdot LaR_{c,y} + \beta_4 \cdot CASHFLOW_{c,y} + \delta \cdot CONTROL_{c,y-1} + \varepsilon_{c,y}$. *, **, and*** indicate significance at the 10%, 5%, and 1% level, respectively, based on robust standard errors clustered by clients (given in brackets). Cf. Table 8 for variable description, Section 4 for the estimation procedure of the recall risk and Table 1 for the groups of the subsample.

forward than the comparison of clients holding a line who face different recall risks. This is owing to the fact that all clients should hold a line of credit since the bank does not require an upfront fee. Therefore, a large number of clients not holding a line are clients whose line has been recalled by the bank (see Table 1, Panel A). We therefore estimate the models based on two different samples of clients: (i) for all clients with and without a line, and (ii) for all clients who hold a line permanently or who once or more often switch from line to no line. In other words, we exclude those who never hold a line (Group A in Table 1, Panel A) and those who once switch from no line to line (Group B2) from the second group (ii). Noteworthy, the following estimation results might suffer from a survivorship bias since clients whose line has been recalled by the bank might shortly after the recall of the line fill in bankruptcy, after which they are dropped from our sample. However, from the 1,532 clients included in the following estimations, only 15 fill in for bankruptcy.

For holding a bank line of credit the estimation results (Table 7) suggest the following. Based on all clients in our subsample, a bank line of credit leads to lower cash holdings but not to higher total liquidity. The cash holdings of clients with a line of credit are, on average, almost 4.4% lower than the ones of clients without line. We find similar results when we restrict our focus on clients who hold a line permanently or who once or more often switch from line to no line. Here the cash holdings of clients with a line of credit are, on average, about 4% lower than the ones of clients without line. Thus, clients whose line of credit is recalled by the bank and who do not fill in for bankruptcy, rebuild their cash holdings. The results concerning the control variables are in line with the results of the former sections.

7 Conclusions

We have analyzed the role of bank lines of credit in firms' liquidity management. In related papers, Sufi (2009) and Yun (2009) have recently studied several facets of lines of credit and their impact on cash holdings for U.S. listed firms. Our data set contains bank lines of credit of German SMEs, who have limited access to capital markets and therefore heavily rely on bank funding, which is somewhat traditional and typical for the German financial market in general. Since these lines of credit are free of any upfront usage charge, holding such lines is costless and every rational client should apply for one. The data, provided by a German universal bank, contains information on the bank's view of the firms' creditworthiness, which provides insight in how the bank decides the applications. At the same time, we are able to observe the firms' decisions on line usage and cash holdings by combining the monthly account data with the firms' annual reports. Since the bank can recall lines immediately due to material adverse change clauses, each firm holding a line faces the danger to lose it again, which we name recall risk. Since some clients in our sample have already lost their lines, we are able to estimate the recall risk by predicting the firms' probability of (not) retaining the line, using the bank's risk assessment data. Therefore, we contribute to the literature, firstly, by analyzing how this recall risk impacts the firms' cash holdings and line usage. We postulate that the lines' recall risk has a non-linear and even non-monotonic effect on both cash holdings and line usage.

Following theoretical predictions (e.g. Opler *et al.* (1999)), holding a bank line of credit allows firms to reduce their cash holdings since the additional available liquidity from the line reduces the benefit of further cash holdings, which in turn is costly due to cost-of-carry. However, when the line's recall risk increases, the benefit of further cash holdings increases again and so does the optimal level of cash holdings. Therefore, firms with low recall risks are supposed to have lower cash holdings than firms with moderate recall risks. The bank's decision to recall the line strongly depends on the firm's creditworthiness. Firms with high recall risks have

low creditworthiness, which in turn influences their marginal costs of cash holdings because rebuilding cash after a liquidity shock is much more expensive for these firms. Thus, firms facing high recall risks are supposed to have higher costs of cash than firms with moderate or low recall risks. In conclusion, this leads to a non-linear and non-monotonic coherence between cash holdings and the recall risk of the bank line of credit. Since the use of the line reflects the reduction in cash holding, we postulate, that firms holding a bank line of credit and facing moderate recall risks hold higher cash positions and use their lines less intensively than firms with low or high recall risks.

Our empirical findings support this line of argument. Firms with low recall risks have lower cash holdings and higher line usage than clients with moderate recall risks. Moreover, clients with high recall risks have lower cash holdings and higher line usage than clients with moderate recall risks indicating that if the clients' financial conditions worsen, they do not (or cannot) care about the recall risk but rather use the line as long as the bank allows them to do so.

On the one hand, our findings augment the literature on cash holdings. So far, financially constrained firms were found to save cash out of cash flow more heavily when financial conditions worsen. This is in line with our empirical result that firms facing moderate recall risks hold more cash than firms with low recall risks. However, we demonstrate as a novel result that firms facing higher recall risks have lower cash holdings than firms with moderate risks. Even though firms facing high recall risks might have higher benefits from further cash holdings, the very high marginal costs of cash holdings do not allow them to build up cash. Therefore, theoretical and empirical research should consider the non-linear and non-monotonic coherence between the financial conditions of a firm and the firm's optimal cash level as recently done by Denis and Sibilkov (2010).

On the other hand, our findings augment the literature on the use of bank lines of credit. Jiménez *et al.* (2009) have investigated determinants of line usage for Spanish firms and document that the default probability is a main driver of line

usage. In their sample, firms with a high default probability increase their line usage substantially. This finding is in line with our result that firms facing high recall risks hold less cash and use their lines (in absolute terms) more intensively than firms with moderate recall risks. However, we additionally find that firms with low recall risks – associated with a low probability of default – use their lines more intensively than firms with moderate recall risks. This higher line usage is not due to financial distress but a result of the free reduction of costly cash holdings. This finding has an important implication for a bank which consider the line usage as an indicator for the firm's financial conditions. The bank has to distinguish whether the amplified draw down arises from being financially distressed or from reducing costly cash holdings. Since in the latter case high line usages need not be a bad signal, interpreting higher line usage per se as bad may provoke wrong decisions. As we mentioned before, line usage of non-distressed firms should not last for long. Those firms should return to an optimal cash level by cash flows or refund the line with the help of less expensive loans. Therefore, the duration of the line usage as well as the adjustment speed in cash levels may be sufficient indicators for interpreting high line usage in the right manner.

The main focus of our work was to analyze the interrelation between liquidity granted by bank lines of credit and cash holdings in SME business. As with almost any empirical study, some limitations remain. For example, we cannot consider two other sources of short-term funding which may additionally provide liquidity to SMEs: available trade loans and capital contributions from the owner's personal assets. To some extent we can control for the former by making use of the corresponding balance sheet item. However, this item embodies trade loans already taken out in the past and says little about currently available trade loans. By no means, we can control for private capital contributions due to lack of any data. Since our dynamic regression models control for unobservable effects, our results are still valid. Nevertheless, information on other liquidity sources may provide further insights. Another limitation is that our data set is restricted to only one bank providing the bank lines of credit. Even so, this enables us to consider the bank's risk assessment of

the clients and keeps our data free from noise caused by differences in bank behavior. Throughout the whole time period, the bank did not face any solvency problems or liquidity shortages. Further research may analyze how clients' behavior changes when the bank as the liquidity provider itself faces solvency problems or liquidity shortages. Moreover, further research should explore whether or not a reduction in cash holdings causes an increase in shareholder value. Such research may explore the economic consequences of differences in firms' liquidity management. Beside the transaction cost used in our work, one has to take into account the agency costs of cash holdings by analyzing such changes in shareholders' wealth.

A Variable description and correlation table

Table 8: Variable Description.

c	Client index.
y	Year index, which refers to the firm-individual financial year of client c .
$TA_{c,y}$	Total assets minus cash and cash equivalent assets of client c according to financial statement in financial year y . $(\cdot)_{c,y}^{TA}$ means that variable (\cdot) is measured in percentage of $TA_{c,y}$.
$CASH_{c,y}$	Cash and cash equivalent assets of client c according to financial statement in financial year y .
$LIQUID_{c,y}$	Total liquidity available due to cash assets and remaining bank line of credit of client c at the last day of financial year y .
$LIMIT_{c,y}$	Limit of the bank line of credit of client c at the last day of financial year y . If client c holds more than one account at the bank, we use the sum of all limits. If client c has no line, the variable is missing (not zero). $(\cdot)_{c,y}^{LIMIT}$ means that variable (\cdot) is measured in percentage of $LIMIT_{c,y}$.
$MAXUSE_{c,y}$	Maximum drawn part of all bank lines of credit in Euro in corresponding financial year y . If client c has no line, the variable is missing (not zero). Note that although the variable refers to negative account balances it takes positive values.
$CASHFLOW_{c,y}$	Cash flow of client c according to financial statement in financial year y .
$TRADE_{c,y}$	Trade accounts payable of client c according to financial statement in y .
$LIABILITY_{c,y}$	Liabilities of client c according to financial statement in financial year y .
$COST_{c,y}^{DEBT}$	Interest costs of client c according to financial statement in financial year y in percentage of $LIABILITY_{c,y}$.
$FLOOR_{c,y}$	If monthly account balance is always ‘significantly negative’ in y , this variable values (in absolute terms) the smallest negative account balance, and is 0 otherwise. ‘Significantly negative’ means that the account balance is less than -5,000 Euro and the debit amount exceeds 5% of $TA_{c,y}$. The variable takes positive values. For instance, $FLOOR_{c,y} = 5,000$ means that the account of client c was always below -5,000 Euro in y (and that $TA_{c,y}$ is below 100,000 Euro.)
$LaR_{c,y}$	Liquidity at Risk of the past 2 years of client c in y . $LaR_{c,y} = \max(-Q_{c,y}^{10}, 0)$, where $Q_{c,y}^{10}$ is the 10%-quantile of the monthly account balance changes through the last 2 years (neglecting the last quarter due to endogeneity). A high positive value refers to a high negative shock in the past. In other words, $LaR_{c,y}$ is the absolute value of the second highest negative monthly account balance change in the last 2 years (neglecting the last quarter).
$PD_{c,y}$	Client’s probability of default estimated by the bank.
$DURATION_{c,y}$	Duration of the relationship between client c and the bank in years (since day of first contract).
$D_{c,y}^{LINE}$	1 if client c has any bank line of credit in each of the observable month of the corresponding financial year y (and 0 otherwise).
$D_{c,y}^{OVER}$	1 if client c has unauthorizedly overdrawn its bank line of credit at least once in the corresponding financial year y (and 0 otherwise). If client c has no line, the dummy is 1 if client c has at least once unauthorizedly debit its account (and 0 otherwise).
$RECALL_{c,y}$	For self-employed persons and companies separately, we predict the $RECALL$ risk by the use of the following probit model considering only clients which always had a line and those whose line was recalled at least once: $P(D^{LINE} = 1)_{c,y} = \alpha + \beta_1 \cdot PD_{c,y} + \beta_2 \cdot DURATION_{c,y} + \beta_3 \cdot D_{c,y-1}^{OVER} + \beta_4 \cdot INDUSTRY_c + \beta_5 \cdot YEAR_y$. $RECALL$ is a linear monotonic transformation of the linear prediction of this model, so that high values comes a long with high recall risk.
$INDUSTRY_c$	15 time-invariant dummies referring to the industry code of client c following Standard Industrial Classification (SIC-Code).
D_c^{SELF}	Time-invariant dummy: 1 if client c is self-employed and 0 if it is a corporate client).

Table 9: Correlation table based on clients holding a line in the subsample (S1)

	<i>CASH</i>	<i>LIQUID</i>	<i>MAXUSE</i>	<i>LIMIT</i>	<i>CASHFLOW</i>	<i>TRADE</i>	<i>COST^{DEBT}</i>	<i>LIABILITY</i>	<i>LaR</i>	<i>PD</i>
<i>CASH</i>	1.000									
<i>LIQUID</i>	0.856	1.000								
<i>MAXUSE</i>	-0.165	0.007	1.000							
<i>LIMIT</i>	0.118	0.481	0.655	1.000						
<i>CASHFLOW</i>	0.073	0.078	-0.044	0.015	1.000					
<i>TRADE</i>	0.074	0.086	0.049	0.060	-0.256	1.000				
<i>COST^{DEBT}</i>	-0.191	-0.107	0.384	0.228	0.094	-0.259	1.000			
<i>LIABILITY</i>	0.016	-0.025	0.199	0.057	-0.146	0.225	-0.034	1.000		
<i>LaR</i>	0.339	0.542	0.435	0.603	0.056	0.108	0.055	0.013	1.000	
<i>PD</i>	-0.163	-0.215	0.158	-0.065	-0.128	0.089	0.142	0.219	-0.153	1.000
<i>DURATION</i>	-0.047	-0.034	-0.047	-0.017	-0.075	-0.030	-0.005	-0.035	-0.094	-0.076

Note: *CASH, LIQUID, MAXUSE, LIMIT, CASHFLOW, TRADE, LIABILITY*, and *LaR* are scaled to net total assets.

See Table 8 for data description.

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