.

"The response of firms ' investment and financing to adverse cash flow shocks: the role of bank relationships"

Catherine Fuss (National Bank of Belgium) *

Philip Vermeulen (European Central Bank)

Abstract

We test whether firms with a single bank are better shielded from loss of credit and investment cuts in periods of adverse cash flow shocks than firms with multiple bank relationships. Our estimates of the cash flow sensitivity of investment show that both types of firms are equally subject to financing constraints that bind only in the event of adverse cash flow shocks. In these periods, firms incur lower cuts in investment expenditures when they can obtain extra credit. In periods of adverse cash flow shocks, the probability of obtaining extra bank debt becomes more sensitive to the size and leverage of the firm. Having a single bank relationship has no additional effects compared to firms with multiple bank relationships and periods of normal cash flow fluctuations

Keywords: financial constraints, lending relationships, firm investment, firm financing
JEL: D92

* Catherine Fuss, National Bank of Belgium, 14, bd de Berlaimont, 1000 Brussels, Belgium, email: catherine.fuss@nbb.be

** Philip Vermeulen, European Central Bank, Kaiserstrasse 29, D-60311 Frankfurt am Main, Germany, email: Philip.Vermeulen@ecb.int

.

I. Introduction

A large empirical literature investigates the benefits for firms of having strong banking relationships. Economic theory suggests that bank relationships are useful in overcoming asymmetric information problems between lenders and firms. Over time, when a bank has a relationship with a firm, useful information about the creditworthiness of the firm can be collected by the bank. This information can then be used in credit decisions by the bank. Theory suggests that firms with strong banking relationships should have cheaper credit and/or larger credit availability than firms with weaker relationships.

The strength of the relationship between a firm and a bank is not an easy definable object however. A relationship of a firm with a bank has many dimensions. The empirical literature has therefore mainly concentrated on a few dimensions of bank relationships that are measurable: length of the relationship, breath of the relationship (i.e. the type and number of financial services a firm obtains from the same bank) and the number of banks.

The number of bank relationships of a firm has been used as measure of how "close' a firm is to its lenders (Petersen and Rajan, 1994). Firms with a single bank relationship are thought to have a 'closer' relationship in which the single bank obtains more valuable information on the firm. Petersen and Rajan (1994) argue that firms may concentrate their borrowing with only a few lenders (or just one) to reduce overall monitoring costs. This should reduce borrowing costs. On the other hand they acknowledge that firms may borrow from a single bank only, because they could not find any other source of finance, i.e. this would tend to increase the costs. In addition firms with a single bank could be subject to a hold-up problem in which the bank extracts rents from the firm (Rajan, 1992). It is therefore ambiguous if the cost of external finance of a firm should be higher or lower as firms move away from a single to multiple bank relationships. Similarly, it is equally ambiguous if the availability of credit should be higher or lower. Whereas a single (or a few) bank(s) could provide reduced cost of monitoring and hence increased availability of credit, it is possible that multiple bank relationships increase credit availability by the mere fact of having the chance of obtaining credit from multiple banks.

Ultimately, the availability and cost of credit as a function of the number of bank relationships is an empirical question. This paper investigates whether having a single versus multiple bank relationships has an effect on the availability of credit during times of adverse cash flow shocks. Adverse cash flow shocks, are defined as big drops in cash flow (relative to the capital stock of the firm) from previous levels. In this respect the paper deviates from most of the literature that simply investigate the effect of credit availability independent of the liquidity situation of the firm. It is especially in times of adverse cash flow shocks that the role of bank relationships should become important. When firms try to restore their liquid resources during adverse cash flow shocks, they likely need external finance. However if external finance is restricted, they always can choose to reduce spending (or do some combination of both restoring liquidity and reducing spending). More specifically, if firms during adverse cash flow shocks are financially constrained and can therefore

not restore liquidity fully, adverse cash flow shocks should be associated with reduced investment spending and with insufficient external financing.

A large literature beginning with Fazzari et al. (1988) has established that small, opaque and low dividend paying firms have a higher cash flow sensitivity of investment than other firms, suggesting that adverse cash flow shocks are associated with reduced investment spending for those type of firms. To the extent that strong bank relationships alleviate the asymmetric information problem, adverse cash flow shocks could have a different effect depending on whether the firm has a single or multiple bank relationship. The first question we investigate in this paper is therefore whether firms investment reacts differently to adverse cash flow shocks as a function of having a single bank relationship. Secondly we also investigate directly the restoration of liquidity after an adverse cash flow shock. We specifically investigate the financing behaviour of the firm and its borrowing or repayment of bank debt and net trade debt (i.e. trade debt minus trade credit) when faced with an adverse cash flow shock. The reason also to investigate trade debt is that Petersen and Rajan (1994) argue that trade debt should be a (more expensive) substitute of bank debt. If banks do not provide enough financing, firms should increase trade debt. We investigate whether the quantity of net trade debt and bank debt taken up after an adverse cash flow shock is different for single bank versus multiple bank relationships. We also examine whether the probability of obtaining extra bank debt is different for firms with a single bank and firms with multiple bank relationships.

Ultimately, the paper aims at answering whether having more than 1 bank relationship matters in bad times both for the real and financial side of the firm. The rest of the paper is structured as follows. In section 2 we briefly describe the related literature. In section 3 we describe our data. In section 4 we investigate whether firm investment is affected by adverse cash flow shocks and whether having more than 1 bank relationships matter. In section 5 we investigate the behaviour of the firm financing when faced by an adverse cash flow shock. In Section 6 we investigate the probability of obtaining extra bank debt. Section 7 concludes.

II. Related literature

Although our paper does take the number of bank relationships as given and seeks to find if it has effects on financing and investment, it is related to a number of papers that try to explain the determinants of multiple bank relationships. In general, multiple bank relationships should be costly as banks need to somehow charge the firm for the information gathering in the credit process. Multiple banks should increase the screening and monitoring costs. On the other hand, being tied to only 1 bank, firms can be vulnerable to a hold-up problem in which the bank (that has all the important information on the firm) extracts rents from the firm. When going into a relationship with another bank, firms therefore should weigh the extra costs of monitoring with the benefit of competition between banks (Rajan , 1992, Von Thadden 1992). There are also other reasons why firms might prefer multiple bank relationships. Detragiache et al. (2000) develop a model in which firms choose multiple relationships to avoid being denied refinancing of long term

projects when their bank faces liquidity problems. Increasing the number of bank relationships increases the probability that at least one informed bank will refinance the projects. While in our paper we do not investigate the liquidity of the bank, but rather the liquidity of the firm, it could be argued that a firm has more than 1 bank relationship also to increase the probability of obtaining a loan when the firm has a liquidity problem (rather than the bank). Ongena and Smith (2000) investigate empirically the determinants of the number of bank relationships in a set of large firms of 20 European countries. They find that next to size of the firms also country specific reasons such as the efficiency of the judicial system and the enforcement of creditor rights explain cross-country differences in the number of bank relationships.

Our paper is also related to a number of empirical papers that investigate the link between availability and cost of finance as a function of the number of banks a firm has relationships with[1]. A number of empirical papers have found a link between the number of bank relationships a firm has and the availability and cost of bank finance. Berger and Udell (1995) provide evidence that the loan rates are lower the longer the bank relationship. D'Auria et al. (1999) show that the interest rates charged by a bank are lower the larger the share of firm's debt in that bank, all other firm and bank characteristics being equal. Degryse and Van Cayseele (2000) find that long lasting lending relationships increase the loan rate, while wider bank-relationships (i.e. when the firm buys different products and services from the same bank) reduce the loan rate. Chirinko and Elston (2006) show that in the German banking system, bank affiliated firms do not benefit from more long-term bank debt than independent firms, after controlling for a set of firm's characteristics. Petersen and Rajan 's (1994) results indicate that the loan rate increases with the number of banks a firm has on a set of small U.S. firms. They also find that the amount of trade debt paid late is positively related to the number of banks, i.e. the more banks a firms has, the more it pays its trade debt late. This suggests that the availability of bank credit worsens as firms have more bank relationships. Harhoff and Körting (1998) follow Petersen and Rajan (1994) by using trade debt to infer the availability of external finance. They confirm the finding of Petersen and Rajan (1994) that trade debt paid late increases with the number of banks on a set of small German firms. Cole (1998), also using small U.S. firms, finds that the number of banks a firm has, has a negative effect on the probability of being extended a loan. In general therefore the literature has found that more bank relationships are associated with worse credit availability.

An number of papers have explicitly analysed the availability of credit in bad times. Elsas and Krahnen (1998) show that house banks in Germany increase their financing share of firms when these firms face rating downgrades. They interpret this as an insurance service provided by hausbanks in the German banking system. Vickery (2005) investigates the role of banks in Asia during the Asian financial crisis. Firms with close relationships to banks were less likely to be denied credit by banks. Interestingly, he finds that close bank relationships were not leading to greater access to credit prior to the crisis, so that relationships only seems important in bad times. Conigliani et al (1997) show evidence that the probability of an increase in the interest rates

1 See also Elyasiani and Goldberg (2004) for a survey.

charged on bank loans following a monetary tightening is higher for more indebted firms and for firms with a larger number of lending banks.

Our paper is also related to a number of papers that investigate the role of banks in the investment of firms. Firms that have closer ties to their bank should face less asymmetric information problems, therefore access to bank finance should be better. A number of papers have investigated whether firms that have closer ties to their banks have lower sensitivity of investment with respect to cash flow, in the spirit of Fazzari et al. (1988). In a Q model of investment for a sample of Japanese firms, Hoshi et al. (1991) find that firms with close ties to a bank (in a Keiretsu) are less sensitive to cash flow than independent firms. Elston (1998) finds that German firms that are partially owned by banks show less sensitivity to cash flow. Garcia-Macro and Ocafia (1999) show that the Euler equation derived from the neoclassical model without financing constraints, holds for firms which are partly owned by banks, while it fails for the other firms. For US listed firms, Houston and James (2001) find that cash flow sensitivity of investment is significantly greater for firms that rely on one single bank than for firms with multiple bank relationships, contrary to other papers in the literature they argue that information asymmetries might be less severe for firms with multiple bank relationships. On the other hand they also find that for moderate investment levels bank dependent firms (i.e. firms with little public debt) show lower cash flow sensitivity, while for large investment levels bank-dependent firms show larger sensitivity. They interpret this as evidence that banks are unwilling to finance large investment projects.

III. Data

Dataset

We combine two datasets which are collected by the National Bank of Belgium. The first is the annual accounts dataset from the Balance Sheet Office which reports annual balance sheets and profits and losses accounts of firms since 1985. The second is the Credit Register dataset from the Central Credit Office, which collects information on all credit lines and loans (the amount authorised and the amount taken up) at the end of the month from each bank to each firm, from 1997 onwards. The annual accounts dataset is fully representative of Belgian non-financial firms. Indeed, by legal obligation, nearly every firm in Belgium has to report its annual accounts[2]. Further, almost all banks have to report most of their loans and credit lines[3] to the Central Credit

2 In general, except for financial intermediaries, which have to obey special rules, all firms governed by Belgian law have to report their annual accounts. This includes all limited liability companies; all economic joint ventures and European economic joint ventures; all unlimited liability companies if they are regarded as large and if at least one of their partners is a legal person; all foreign companies which have a branch or a place of business in Belgium or wish to establish one there (legal obligation until 1991).

3 Banks do not report to the Credit Register in two cases: (1) when the sum of all credits of a bank to a firm does not exceed 25,000 Euros, (2) branches of foreign banks do not report to the Credit Register, on the contrary to subsidiaries of foreign banks.

Office[4]. We consider all sectors of activities, and do not focus on manufacturing firms. We adopt the following definition of a bank relationship: firm x has a relationship with bank y as soon as bank y reports a loan, credit line or collateral for that firm.

We do not keep all the firms that are matched in the two datasets. First, we do not consider very small firms. The choice of excluding very small firms is simply imposed to us by the fact that the detail of the information provided to the Balance sheet office depends on the size of the firm and that very small firms need to provide much less detail to the annual accounts dataset.[5] Importantly, therefore compared to Petersen and Rajan (1994), Harhoff and Körting (1998) and Cole (1998) the median firm in our dataset is much larger. The medium firm in our sample has 7.5 million euros in total assets. Also, for the Belgian economy, these firms are considered as medium or large. Second, we also require the firms to have at least 7 consecutive annual accounts. Third, we only consider firms with annual accounts that cover the period from January to December[6]. Finally, we remove outliers from the data, trimming on investment-capital ratio, cash flow capital ratio, sales growth, output-capital ratio as well as a set of financial ratios in order to clean our sample from distressed firms (the motivation for this is explained in section 4). The data appendix describes in more details the variables definition and trimming procedure Our final unbalanced panel includes 8415 observations on 1448 firms. The dataset covers the period 1997-2002.

Single versus multiple bank relationships

We report in Table 1 the number of observations according to the number of bank relationships. Most firms in our sample have 4 or less than 4 bank relationships. The average number of bank relationships is 2.6. The 25% percentile is 2 bank relationships and the 75% percentile is 3 bank relationships. These numbers are very comparable (albeit slightly larger) than the numbers for the US or Germany. By comparison, the small German firms in Harhoff and Körting (1998) (that are smaller than ours) have on average 1.8 bank relationships. In their sample the 25% percentile is 1 bank relationship and the 75% percentile is 2 bank relationships. Petersen and Rajan (1994) report that in their sample of small US firms, the smallest firms tend to have just over 1 lender, while the largest firms have about three lenders. So generally, firms either have only 1 bank relationship or when they have more than 1 relationship they have just a few relationships. In the following we will therefore mostly (although not exclusively) concentrate on the differences

4 To our knowledge only Degryse et al (2005) have used this dataset; they analyse the effect of bank mergers on bank relationships for small firms. Degryse and Van Cayseele (2000) have also examined the effects of bank relationships in Belgium, but they made use of a smaller database.

5 Although small firms also have to report their annual account and credits, the information they provide is less precise. For example they do not have to report sales. Further since credits are reported only when total credits from a bank is higher than 25.000 euros, there is a risk of mismeasurement of the lending relationship. Only firms that exceed certain thresholds provide enough information in the annual accounts dataset for our analysis. We consider firms for which yearly average of its workforce is at least 100 or when at least two of the following thresholds were exceeded: (1) yearly average of workforce: 50, (2) turnover (excluding VAT): EUR 6,250,000, (3) balance sheet total: EUR 3,125,000. (the values of the latter two thresholds are altered every four years in order to take account of inflation).

6 This is ensures consistency within the sample and time-consistency with the deflators used.

of firms when they have just one or more than 1 (i.e. multiple) relationships. From the moment a firm has more than 1 relationship, at least 2 banks should have information about the firm so that the firm in principle could use bank competition to obtain favourable borrowing conditions.

Table 1: Number of bank relationships

# bank relationships	N	%
1	1606	19%
2	2879	34%
3	2154	26%
4	1086	13%
5 or more	408	8%

Table 2 reports the median value of asset size, some financial ratios and profitability, distinguishing between firms with a single bank relationship and firms with multiple bank relationships. Differences are tested for using a Chi-squared test of significant differences in the medians. First, the median firm with a single bank relationship is significantly smaller than the median firm with multiple bank relationships. Total assets amounts to 5 millions euros for the median firm with a single bank against 8.4 millions euros for the median firm with multiple bank relationships. Second, compared to the median firm with multiple bank relationships, the median firms with a single bank relationships also has significantly less bank debt (as a fraction of assets) (12% versus 18%), less long term bank debt (4.7% versus 7.3%), less short term bank debt (0%versus 4.7%) and less credit lines (7% versus 13.5%). The lower amount of credit lines for single bank relationship firms implies less liquidity buffer. This may make them more likely to be financially constrained, especially in case of adverse liquidity shocks. Houston and James (2001) argue that the credit lines to asset ratio is a measure of 'slack' in the banking relationship. For large US listed firms they find a median credit lines to asset ratio of 8% for firms with 1 bank relationship versus 11% for firms with multiple bank relationships. So more bank relationships are clearly associated with more bank debt and more 'slack' in the banking relationship. However the stylized fact that single bank relationship firms have less bank credit does not imply by itself that these firms are 'constrained' in any sense. It could simply be that firms that are in less need of external finance choose to have just one bank. Given a fixed cost of setting up a relationship this might just be optimal. Third, there is no significant difference in the ratio of net trade debt (i.e. trade debt minus trade credit) over assets between firms with a single bank and firms with multiple bank relationships. Fourth, the median firm with a single bank relationships is also slightly more profitable (with a profit to asset ratio of 13%) than the median multiple bank relationship firm (with a profit to asset ratio of 12%). This is not simply due to the fact that firms with a single bank have lower interest charges as they have lower bank debt. The last two rows of Table 2 shows that earnings before taxes is higher for firms with a single bank relationship, whether we include interest charges or not

Table 2: Number of bank relationships size, financial ratios and profitability (medians)

	1 bank	> 1 bank	X^2	
assets (millions euros)	5,099	8,447	211,45	***
bank debt/assets	0,121	0,181	69,35	***
LT bank debt/assets	0,047	0,073	32,09	***
ST bank debt/assets	0,006	0,047	106,60	***
unused lines of credit /assets	0,070	0,135	295,99	***
trade debt/assets	-0,078	-0,072	1,94	
profits/assets	0,134	0,124	13,78	***
EBIT/assets	0,052	0,045	15,56	***
EBT/assets	0,042	0,032	19,75	***

EBIT: earnings before interest and taxes, EBT: earnings before taxes

*** differences are significant at the 1% level, ** differences are significant at the 5% level,

* differences are significant at the 10% level,

The role of bank relationships for the availability of bank finance is complicated by the fact that generally size is positively associated with the number of bank relationships. Ceteris paribus, larger firms have more bank relationships. This finding is quite robust and has been found also by Petersen and Rajan (1994) for U.S. firms, Ongena and Smith (2000) for a sample of very large firms in 20 European countries and Harhoff and Körting (1998) and Elsas and Krahnen (1998) for German firms. It can also be found in our dataset.

In the literature there have been suggested a number of explanations for the positive association between firm size and the number of bank relationships. First, the cost of information gathering could be lower for larger firms, so that the advantages of a single bank relationship may be lower for large firms. Second, the gain of multiple banks becomes higher as firms having ties to multiple banks, firms may be better able to solve the hold-up problem, i.e. reduce the monopolistic power of a single bank. Third, given that the nominal amount of lending should increase with firm size, banks themselves may favour syndicated credits for risk reduction purposes. Fourth, larger firms might need more specialized services and have different specialized banks for different services.

However, it should be emphasized that having multiple bank relationships is certainly not a perfect proxy for size. Table 3 shows in more detail the relationship between size and the occurrence of a single bank relationship. For firms with assets below 4 million euros the occurrence of a single bank relationship is 34%. The occurrence of a single bank relationship declines gradually as firms get larger. However still 11% of the firms with assets above 16 million euros have only 1 bank relationship.

Table 3: Size and a single bank relationships

	number of observations	% of firms with 1 bank
assets <= 4	1788	0.34
4 < assets <=8	2593	0.19
8 < assets <=16	1848	0.14
16 < assets	2186	0.11
entire sample	8415	0.19

Firms with a single bank relationship should suffer less from asymmetric information problems, however small firms are generally associated with more asymmetric information problems. It is therefore possible that small firms endogenously choose more often to just have 1 bank relationship, in essence whereas their size makes them more vulnerable to asymmetric information problems, they can try to alleviate this by having one strong bank relationship.

It would be interesting to know from the start if the amount of bank credit firms have is a function of the number of bank relationships and/or the size of the firm. Given the correlation between number of bank relationships and size, the positive relationship between bank debt over asset and bank relationships found in table 1 could potentially be spurious if it is truly size that matters for access to bank finance. To check this, we regress the ratio of bank debt over assets on bank relationship and size dummies. We define 4 bank relationship dummies (D2, D3, D4 and D5P, signifying 2, 3, 4 and 5 or more bank relationships respectively) and 3 size class dummies (DSIZ4_8, DSIZ8_16 and DSIZ16 signifying asset size between 4 and 8 million, between 8 and 16 million euros and more than 16 million euros). Table 4 reports the results of the OLS regression of bank debt over assets on those 7 dummies. The first column presents the results without time and industry dummies, the second column includes time and industry dummies. The constant term of the regression represents the average bank debt over assets ratio for firms with a single bank relationship and the smallest size (below 4 millions euros).

Table 4: Bank debt as a function of bank relationships and size

OLS results Dependant variable:Δbank/assets 8415 observations. All equations include time dummies

	coef.	std err		coef.	std err	
c	0.165	25.53	***	0.126	14.71	***
D2	0.012	2.50	***	0.010	2.15	**
D3	0.026	4.96	***	0.029	5.63	***
D4	0.051	8.03	***	0.055	8.93	***
D5P	0.053	4.86	***	0.064	5.97	***
DSIZ4_8	0.009	1.67	*	0.009	1.87	*
DSIZ8_16	0.027	4.78	***	0.025	4.56	***
DSIZ16	0.000	0.07		-0.001	-0.21	

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level

The regression results in table 4 show that firms will have statistically significantly more bank debt (relative to assets) the more bank relationships they have, *controlling for size*. The difference is also economically significant. Whereas the smallest single bank relationship firms have a ratio of bank debt to assets of 0.17 the same small firms have a bank debt ratio of 0.18 if they have 2 bank relationships, 0.195 if they have three relationships and 0.221 if they have 4 relationships. Note that one should not necessarily interpret this result as if by increasing the number of banks relationships, firms are able to increase the amount of bank debt they carry. Some firms might simply not be able to increase the number of bank relationships they have. It might also simply be the case that firms that want (and have access!) to have more bank debt endogenously choose to have more banks, i.e. want to avoid having only a single relationship when increasing bank debt. So the causality could run the other way. However it remains true that the correlation between bank debt and bank relationships remains positive, controlling for size.

Also size is associated with bank debt, controlling for bank relationships. Firms that have assets lower than 4 million do not have significantly less debt than firms with assets above 4 but below 8 million. The amount of bank debt increases for firms between 8 and 16 million. The ratio of bank debt to assets increase by 0.027. It declines again for firms larger than 16 million euros of assets to the level of the firms below 8 million euros. So only medium sized firms between 8 and 16 million assets have higher bank debt. The regression result implies an inverse U-shaped pattern for bank debt as a function of size. One possible explanation is that the smallest firms are quantity constrained in obtaining bank finance. As firms expand and get larger they are able to obtain more bank debt. The largest firms however, likely have access to other sources of finance besides bank finance, such as equity or bond debt so that they reduce their reliance on bank debt. The finding that the largest firms have less bank debt is consistent with the findings in Houston and James (1996) that bank borrowing decreases in size for large publicly traded US firms.

IV. Adverse cash flow shocks, investment and bank relationships

The results above have shown that firms with a single relationship have on average less bank debt. However this does not imply that they are more likely financially constrained. This section uses a test along the lines of Fazzari et al (1988)[7] to check whether cash flow sensitivity is different for single bank relationship firms versus multiple bank relationship firms. The idea behind Fazzari et al (1988) is that when firms have limited access to external sources of finance, investment depends more extensively on internally generated liquidity (i.e. cash flow). We estimate an error correction model for investment. This type of reduced form equations has been used by Bond et al.(2003) or Mairesse et al.(1999)[8]

$$I_{it}/K_{it-1} = \delta_i+\delta_t+\alpha_1.I_{it-1}/K_{it-2}+\alpha_2.\Delta y_{it}+\alpha_3.\Delta y_{it-1}+\alpha_4.CF_{it}/K_{it-1}+\alpha_5.(y_{it-2}-k_{it-2})+\varepsilon_{it} \quad (1)$$

where I_{it}/K_{it-1} is the investment rate, Δy_{it} is sales growth, CF_{it}/K_{it-1} is the cash flow to capital ratio and $(y_{it-2}-k_{it-2})$ is the log of the output to capital ratio. We first estimate (1) to check whether in our dataset firm investment spending is sensitive to cash flow fluctuations irrespective of whether adverse cash flow shocks have occurred or not and irrespective of whether firms have a single or multiple bank relationships, i.e. . we test whether α_4 is positive.

Interacting the cash flow variable with a dummy D_1, indicating the presence of only 1 bank relationship provides a test whether firms that have 1 bank relationship are more or less sensitive to cash flow than firms with multiple relationships. In the spirit of the interpretation by Fazzari et al (1988), if firms that have multiple bank relationships show higher cash flow sensitivity, this is interpreted as evidence in favour of the existence of more financing constraints for those firms.

If bank relationships are valuable, they should be most valuable in times of adverse cash flow shocks. Adverse cash flow shocks reduce the internal liquidity available for firm investment spending. Firms that are unable to restore liquidity, i.e. are unable to increase external finance should reduce investment spending. By the findings of Petersen and Rajan (1994), Harhoff and Körting (1998) and Cole (1998) one should suspect that a single bank relationship is more valuable and should lead to easier restoring of liquidity. On the other hand however the findings by Houston and James (2001) imply the contrary.

We test therefore first if during times of adverse cash flow shocks, sensitivity to cash flow is higher (irrespective of bank relationships). We define adverse cash flow reductions as the 1st quartile of changes in cash flow over capital. These represent a minimal reduction of the cash flow

---

7 Alternative strategies have been used. One is based on the Q theory of investment, and amounts to estimate the cash flow sensitivity of investment in a Q equation. We do not follow this line of research because financial markets in Continental Europe, and in particular in Belgium, are less developed than in the US They may not give the best description of firms financing; Further, we do not want to restrict our sample to quoted firms alone

An other strand of the literature uses a more structural approach that consists in estimating the Euler equation that would prevail when the firms are financially unconstrained. Rejection of the intertemporal equilibrium is taken as evidence of financial constraints. However, rejection of the Euler equation may not only be due to financial constraints but also to a misspecification of the underlying theoretical model.

8 A more general specification would allow for the lagged cash flow-capital ratio. However, preliminary estimates suggests that due to colinearity this broader specification produces insignificant coefficients.

to capital ratio of 0.05 (i.e. 5% of the capital stock of the firm.) We finally test whether bank relationships matter during times of adverse cash flow shocks.

Evaluating the degree of financial constraints by comparing the cash flow sensitivity of investment across different subsamples has become standard in the literature. However, it has been criticised on several grounds. First, it has been argued that because cash flow may proxy for future profits, finding a positive cash flow sensitivity of investment cannot be taken as evidence of financial constraints. We examine this issue along the lines of Bond et al (2003). In table A.1. in appendix we find no evidence that cash flow helps to forecast future sales growth. Further, there is no a priori reason why cash flow should proxy differently for profit in single versus multiple bank relationship firms, whereas it is the difference in the cash flow sensitivity that is interpreted as evidence in favour of financing constraints. Estimates of forecasting models of sales growth, in the spirit of Bond et al . (2003), suggest that there is weak evidence of cash flow proxying for future profits. Second, Kaplan and Zingales (1997, 2000) and Cleary (1999) show that firms that are classified as the most financially constrained are less sensitive to cash flow. This is consistent with the finding of Allyannis and Mozundar (2004) that financially distressed firms - identified as firms with negative cash flows - become insensitive to cash flow fluctuations. This suggests that the relation between the degree of financial constraints and the cash flow sensitivity of investment may not be monotonic but rather concave. In this case, the relationship would be increasing with the degree of financial constraints but become decreasing in case of financial distress. As explained in section 3, we clean our sample for distressed firms; we are therefore confident that in our sample negative cash flow shocks are not synonymous of financial distress. Rather they capture times of stronger liquidity rationing.

All equations are estimated with fixed effects and time dummies. We consider all variables as endogenous. We use the System GMM estimator of Arellano and Bover (1995) and Blundell and Bond (1998)[9]. Standard errors of the coefficients are corrected for small sample bias using Windmeijer (2004) 's correction[10]. In the investment equation, the instrument set for the difference equation is the Arellano-Bond matrix for I_{it-2}/K_{it-3}, I_{it-3}/K_{it-4}, stacked Δy_{it-2}, Δy_{it-3}, CF_{it-2}/K_{it-3}, CF_{it-3}/K_{it-4}, $(y_{it-2}-k_{it-2})$ and $(y_{it-3}-k_{it-3})$[11]. The instrument set for the level equation are Arellano-Bond matrices for $\Delta(I_{t-1}/K_{t-2})$, $\Delta\Delta y_{t-1}$, $\Delta(CF_{t-1}/K_{t-2})$, $\Delta(y_{it-2}-k_{it-2})$. When the equations are estimated with interactions terms we also include the dummies in the instrument set. Table 5 provides a summary of the variables used in the regression.

9 Blundell and Bond (1998) show that the first-differenced GMM estimator of Arellano and Bond (1991) suffers from small sample biases and low precision, and that exploiting the additional moment conditions of the system-GMM estimator allows to substantially improve the estimators.

10 The second-step estimator of SGMM typically underestimate the true standard errors.

11 We restrict the number of lags in the instrument set to avoid potential overfitting problems.

Table 5 : investment equations variables

	single bank relationship			multiple bank relationships.		
	Mean	Std	median	mean	std	median
I_t/K_{t-1}	0.12	0.19	0.06	0.11	0.15	0.07
$\log(Y_t/Y_{t-1})$	0.03	0.14	0.02	0.03	0.13	0.03
CF_t/K_{t-1}	0.26	0.43	0.16	0.25	0.33	0.16
Y_t/K_{t-1}	6.45	9.56	2.97	5.82	8.58	3.06

Table 6 reports the SGMM estimates of equation (1). The Sargan statistics, m1 and m2 statistics report no misspecification or identifying restriction bias. All coefficients have the expected sign. The error correction term is not significant. First we estimate equation (1) for the full sample. The cash flow coefficient is high and significant at 0.19 indicating that in the full dataset, investment is sensitive to cash flow. In the second column, we test whether cash flow sensitivity is lower for firms with a single bank. The coefficient of the interaction term $D_1.CF_{it}/K_{it-1}$ is negative at -0.10, indicating a lower sensitivity for single bank relationship firms. However it is imprecisely estimated and not statistically significantly different from zero. The results indicate that, irrespective of adverse cash flow period, there is no significant difference in cash flow sensitivity for firms with a single relationship versus firms with multiple bank relationships.

It could be however that financial constraints are stronger in periods of adverse liquidity shocks. Vickery (2005) found for Asian firms that outside the financial crisis period bank finance was not influenced by having a close relationship or not. We first check whether cash flow sensitivity is higher in periods of adverse cash flow shocks. The regression results are in column (3). The interaction term between the dummy for adverse cash flow shocks and the cash flow-capital ratio is high, positive and significant at 0.29. The coefficient in front of CF_{it}/K_{it-1} which now measures cash flow sensitivity outside periods of adverse shocks turns to zero. So the estimates suggest that financial constraints bind mainly in bad times. We therefore introduce an interaction term with both a dummy for adverse cash flow shocks and a dummy for a single bank relationship. The results indicate that the number of bank relationships is irrelevant for the degree of financial constraints, both in periods of normal cash flow fluctuations and in periods of adverse liquidity shocks. So our results indicate that firms with a single bank relationship do not face stronger financial constraints than firms with multiple bank relationships, both in periods of normal cash flow fluctuations and in periods of adverse cash flow shocks[12]. On the contrary, both firms with a

12 The interaction term between D_1 and D_{bad} may be insignficant for two reasons. First, only 4% of the observations relates to firms with a single bank relationship in periods of adverse cash flow shocks (by construction 25% of the observations experience adverse cash flow shocks, and15% of the firms have a single bank relationship). Second, the lack of significance may reflect heterogeneity across firms with a single bank relationship. Having a single bank may reflect the strategic choice of a firm with sufficient financing from other sources (own funds, equity, ...). Alternatively, firms may be restricted to a single bank due to financial constraints. These two cases will of course have very different implications for financial constraints, so that the coefficient turns insignificant The next sections indeed highlight two opposite cases in how firms adjust their financing in response to the adverse liquidity shock (some firms can compensate for the liquidity drop through increased (bank) debt, while some others experience a reduction in external credit in addition to the adverse cash flow shock).

single bank and firms with multiple bank relationships face financial constraints that bind mainly in case of large liquidity shortfalls.

Table 6: Estimates of the investment equation with cash flow-capital ratio

	coef,	tstat		coef,	tstat		coef,	tstat		coef,	tstat	
constant	0.04	2.69	***	0.04	2.22	**	0.08	4.02	***	0.12	3.05	***
I_{it-1}/K_{it-2}	0.07	2.40	**	0.06	2.34	**	0.06	1.79	*	0.09	1.57	+
Δy_{it}	0.22	0.81		0.21	0.81		0.20	0.64		0.37	1.15	
Δy_{it-1}	0.06	1.94	**	0.05	1.91	*	0.05	1.64	*	0.05	1.42	
CF_{it}/K_{it-1}	0.19	2.96	***	0.22	3.78	***	0.00	-0.03		-0.11	-0.83	
$D_{bad}.CF_{it}/K_{t-1}$							0.29	2.60	***	0.45	2.39	**
$D_1.CF_{it}/K_{it-1}$				-0.10	-1.04					0.21	1.12	
$D_1.D_{bad}.CF_{it}/K_{it-1}$										-0.37	-0.82	
$(y-k)_{it-2}$	0.00	-0.49		0.00	-0.65		0.00	0.33		0.00	0.35	
D_{bad}							-0.05	-1.60	+	-0.22	-1.64	*
D_1				0.03	1.18					-0.17	-1.47	+
$D_1.D_{bad}$										0.66	1.45	+
		p-value			p-value			p-value			p-value	
Sargan	37.08	0.21		35.61	0.22		30.75	0.43		19.90	0.80	
m_1	-7.97	0.00		-8.09	0.00		-8.26	0.00		-4.31	0.00	
m_2	-0,61	0,54		-0,57	0,57		-0,37	0,71		1,10	0,27	

D_{bad} is a dummy that is equal to 1 when Δ(CF/K) is below the first quartile

D_1 si a dummy that is equal to 1 if the firm has a single bank relationship

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level, + significant at the 15% level,

We find that the number of bank relationship does not affect the degree of financial constraints, either in normal times or in case of adverse liquidity shocks, for the firms in our sample. This contrasts with previous findings that bank relationships allow to smooth financial constraints (see, for instance, Elston, 1998, Garcia-Macro and Ocafia, 1999, Hoshi et al, 1991[13]). Noticing that we explicitly exclude very small firms from our sample, our results indicate that the idea that bank relationships may soften asymmetric information problems and reduce financial constraints for very small firms does not translate to medium and large firms.[14] Further, contrary to Suzuki and

13 Hoshi et al (1991) find that investment of Japanese firms belonging to a keiretsu are less sensitive to liquidity. Elston (1998) shows that, in Germany, the cash flow sensitivity of investment is lower for firms in which banks have a high direct equity stake. Garcia-Macro and Ocafia (1999) show that the neoclassical model, without financing constrints, holds for Spanish firms in which banks have a high ownership, while it fails to represent the other firms. For the effect of lending relationship on the interest rate charged to borrowers,.

14 One may also argue that the number of bank relationship is not a sufficient proxy of bank relationship. The length and duration of the relationship may be important as well. Unfortunately, the period covered by the Credit Register data does not allow us to investigate the effect of the duration of the bank relationship properly.

Wright (1985), Elsas and Krahnen (1998), Berlin and Mester (1998), we do find no evidence that bank relationships allows the firm to escape financial constraints in exceptional times[15].

V. How do firms manage periods of adverse liquidity shocks as a function of bank relationships

The results in the above section revealed no difference in cash flow sensitivity of investment between firms with a single versus multiple bank relationships. We now examine in more detail how firm investment and bank (and other) financing respond to adverse cash flow shocks as a function of bank relationships. In line with the above results we expect little difference between firms with a single versus firms with multiple bank relationships.

In the analysis we make a distinction between firms that increase bank debt following the adverse shock and firms that decrease bank debt. Extra financing should be associated with higher investment, irrespective of bank relationships. Also, if net trade debt is a substitute for bank debt, one should expect net trade debt to increase when bank debt decreases and vice versa, again irrespective of bank relationships. We first use a Chi-squared test of significant differences in the medians of investment and net trade debt between firms that increase versus firms that decrease bank debt.

However our main focus is on testing whether firms with a single versus firms with multiple bank relationships have different financing behaviour at times of adverse cash flow shocks, *conditional on either increasing bank debt or decreasing bank debt*. If bank relationships matter, in times of adverse cash flow shocks one should expect to find significant differences in the *amount* of credit firms obtain, *conditional* on obtaining credit. We test whether firms that increase bank debt following an adverse cash flow shocks increase bank debt by more or less depending on whether they have a single or multiple bank relationships.

Table 7 reports the median value of the changes in bank debt, trade debt and investment over the absolute value of the change in cash flow, in periods of adverse cash flow shocks. The absolute value of the change in cash flow signifies the amount of loss in liquidity and is used to standardize the changes in bank debt, trade debt and investment. Table 7 also reports indicators such as size (total assets), profitability as measured by profits over assets, and debt ratios the beginning of the period, i.e. just before the adverse cash flow shock.

15 Suzuki and Wright (1985) argue that in Japan keiretsu members benefit from rescue operations from banks of the group that reduce their bankruptcy risk. Elsas and Krahnen (1998) show that housebanks provide liquidity insurance to their clients. They increase their credit to their clients when they experience a (small) unexpected drop in credit rating, while, on the contrary, other banks will reduce their credit to firms. Also, Berlin and Mester (1998) argue that, in case of interest rate shocks, banks may smooth interest rate fluctuations for clients with which they maintain strong relationships, and even reallocate their credits towards them.

Table 7: median change in debt and investment over the absolute value of cash flow change in case of large negative cash flow shocks

	Δ(bank debt)				Δ(bank debt)>0				Δ(bank debt)<0			
	>0	<0	X²		1 bank	>1 bank	X²		1 bank	>1 bank	X²	
# obs	690	718			107	583			152	566		
changes in financing and expenditures over the absolute value of the change in cash flow												
Δ(bank debt)/|ΔCF1	0.893	-0.644	1353	***	0.508	0.924	2.49		-0.695	-0.641	0.03	
Δ(net trade debt)/|ΔCF|	-0.114	0.141	9.56	***	-0.011	-0.141	0.90		0.067	0.153	0.83	
Δ(bankdebt+net trade debt)/|ΔCF|	0.807	-0.631	198.1	***	0.672	0.815	0.28		-0.689	-0.604	0.53	
Δ(investment)/|ΔCF|	-0.080	-0.201	12.38	***	-0.032	-0.086	0.28		-0.216	-0.198	0.13	
initial values (t-1)												
assets (millions euros)	8.951	7.583	7.11	***	4.943	9.501	10.63	***	5.974	8.037	6.54	**
profits/assets	0.135	0.140	1.14		0.134	0.136	0.01		0.142	0.140	0.00	
credit lines/assets	0.144	0.117	11.64	***	0.097	0.154	12.05	***	0.066	0.131	26.17	***
leverage	1.661	1.537	1.64		1.846	1.601	3.99	**	1.265	1.611	5.64	**
Net trade debt/assets	-0.081	-0.093	1.92		-0.106	-0.077	1.87		-0.088	-0.094	0.13	
bank debt/assets	0.133	0.172	13.14	***	0.076	0.141	3.99	**	0.160	0.175	0.13	

X² is a test of equality of the medians

* significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level

1408 observations

There are 1408 periods (i.e. observations) of adverse cash flow shocks. A first finding is that following an adverse cash flow shock, approximately one half of the periods (690) firms benefit from an increase in bank debt while the other half of the periods (718) firms experience a reduction in bank credit, which reduces the available liquidity further. Firms that experience a cut in bank debt significantly increase debt from their trade partners (a median increase of 0.14 as a fraction of the drop in cash flow). Likewise firms that increase bank debt reduce their reliance on trade debt significantly (a median drop of 0.11 as a fraction of the drop in cash flow). So trade debt clearly seems to function as a substitute for bank debt. Firms that can increase their bank lending also increase the total amount of debt (the sum of bank debt and trade debt). Firms that decrease their bank lending do not compensate for this through a sufficiently high increase in trade debt, so that the total amount of credit diminishes. The substitution of bank debt by trade debt indicates that the financing behaviour in times of adverse cash flow shocks is at least partially explained by supply of credit by banks rather than simply a demand reaction by firms. Indeed if trade debt is more expensive than bank debt as suggested by Petersen and Rajan (1994), the substitution behaviour evidenced here can be explained by rationing of bank debt during adverse cash flow shocks.

Firms that benefit from increases in bank lending, obtain extra credit that compensate for 89 percents of the reduction in cash flow. Still, they cut investment by 0.08 of the reduction in cash

flow. Firms that, in addition to the liquidity shortfall experience reductions in bank credit, reduce their investment spending by a much higher 0.20. What distinguishes the groups that increase and decrease bank lending is their size and initial bank lending. Firms that benefit from a compensation in bank debt following the large negative cash flow shock are significantly larger and have a significantly lower initial bank debt over assets ratio. These last findings also indicate that bank supply is affected during adverse cash flow shocks. This is consistent with banks being more willing to lend to larger firms and firms with initially low leverage, especially in periods of adverse shocks.

The Chi-squared test reveals that there are no significant differences between firms with a single bank relationship and firms with multiple bank relationships with respect to bank debt and trade debt financing and investment following an adverse cash flow shock. The amount of extra credit (or credit cuts) is of the same order of magnitude whether the firm has a single bank or multiple banks relationships.

The significant cash flow sensitivity and the substitution of bank debt by trade debt during times of adverse cash flow shocks indicate that financial constraints bind. Having a single or multiple bank relationships however does not seems to affect the degree of financial constraints. In case of adverse liquidity shocks, larger firms and firms with initially lower bank-debt over assets ratio compensate the cash flow shortfall through extra bank credit. Smaller firms and firms with higher initial bank debt experience a reduction in external finance in addition to the cash flow drop. They also cut their investment spending more severely. There is no significant difference between firms with a single and multiple bank relationships. The next section examines more precisely what determines the probability of obtaining extra bank debt, in the spirit of Cole (1998). More specifically, we examine what determines the probability of obtaining extra bank debt, especially in periods of large negative cash flow shocks. In addition, we investigate whether the number of bank relationships affects this probability.

VI. What explain the probability of obtaining extra bank debt in periods of adverse cash flow shocks

The above section showed that firms that obtained extra bank credit compared to firms that repaid debt were on average larger and on average had initial low amounts of bank debt. *Conditional on obtaining extra bank debt,* we found no difference between single bank and multiple bank relationship firms. In this section we analyze more formally the probability of obtaining extra bank credit in normal times versus in times of adverse cash flow shocks. The main question we are interested in is whether single bank relationship firms significantly change their probability of obtaining extra credit in bad times. We would interpret a change in this probability as a change in the supply of credit towards single bank relationship firms. If a single bank relationship is important during bad times, one would expect that credit would be more often granted during those bad times.

We use a probit estimation to estimate the probability of obtaining extra bank debt during normal times versus times of adverse cash flow shocks. Our analysis is related to Cole (1998). Our explanatory variables are size of the firm, initial level of bank debt over assets, initial cash flow over assets, the initial level of credit lines over assets and a dummy for a single bank relationship. We also include time dummies and industry dummies. Table A.2 in appendix reports the estimation of the Probit model with random effects; the coefficient are of the same order of magnitude. The initial cash flow over asset is used to control for credit demand. We expect a higher cash flow over assets to reduce the probability of obtaining extra credit, since more liquid firms should have less need for extra credit. We expect larger firms and firms that have initial lower levels of debt to have a higher probability to obtain extra credit. Banks should be more willing to lend to large firms with low leverage. And we test formally if during adverse cash flow shocks, single bank firms have a different probability of obtaining extra credit.

Table 8: Probit model : Probability of obtaining extra bank debt in normal times and during periods of adverse cash flow shocks

Dependant variable: D(Δbank>0) 1408 observations. All equations include time and industry dummies

	entire period				**bad times**				**entire period**			
	marginal	coef.	std err		marginal	coef.	std err		marginal	coef.	std err	
$size_{it-1}$	0.01	0,04	0,02	**	0.02	0.05	0.03	*	0,01	0,03	0,02	**
bank debt/A_{it-1}	-0.38	-0,97	0,11	***	-0.49	-1.27	0.23	***	-0,35	-0,90	0,12	***
credit lines/A_{it-1}	0.21	0,53	0,10	***	0.27	0.69	0.22	***	0,19	0,48	0,12	***
CF_{it-1}/A_{it-1}	-0.22	-0,57	0,23	***	-0.55	-1.42	0.44	***	-0,17	-0,45	0,27	*
D_1	-0.06	-0,15	0,05	***	-0.08	-0.22	0.09	**	-0,05	-0,14	0,05	***
D_{bad}*$size_{it-1}$									0,01	0,01	0,01	**
D_{bad}*bank debt/A_{it-1}									-0,10	-0,26	0,25	
D_{bad}*credit lines/A_{it-1}									0,08	0,20	0,24	
D_{bad}*CF_{it-1}/A_{it-1}									-0,29	-0,74	0,48	
D_{bad}*D_1									-0,02	-0,05	0,10	
Log L		-4017				-931				-4013		
# obs		5956				1408				5956		

D_1 is a dummy that is equal to 1 if the firm has a single bank relationship

D_{bad} is a dummy that is equal to 1 when Δ(CF/K) is below the first quartile

marginal : Marginal effects are computed for firms with multiple bank relationship in 2002 in the food industry

Our first regression shows the results over all periods (both normal and bad times). The results show that the probability of obtaining extra bank debt is higher for larger firms with lower bank debt over assets ratio, higher credit lines, confirming the earlier results. In addition, the probability of obtaining extra bank debt is higher for firms with lower cash flow. Also firms with a single bank relationship have a lower probability to obtain bank credit. This is consistent with the evidence given in Table 1 that for firms with a single bank relationship, banks are not their most important

source of finance (they have lower bank debt in percentage of their total assets). This contrasts with the finding of Cole (1998) that firms with multiple sources of financial services have a lower probability of receiving credit. In the second regression the results are obtained during adverse cash flow shocks period only. The same results hold: large firms with low leverage and higher credit lines are more likely to obtain credit. Again single bank relationship firms have a lower probability to obtain bank credit.

Although it is possible that firms that are larger and have less bank credit endogenously demand more credit in normal times and during adverse cash flow shocks, a more likely interpretation is that in general, banks are more willing to extend their credit to firms that are larger and that are not too highly bank indebted. Finally, firms with a single bank relationship have a lower probability of obtaining extra bank debt in all times. So whereas the earlier finding indicate no difference between firms with a single bank relationship and a multiple bank relationship, here we find that firms with single relationship are less likely to obtain extra credit in normal times and following adverse cash flow shocks, controlling for size and initial liquidity.

In principle times of adverse cash flow shocks should be times where extra credit is demanded. However, a priori the increase in demand should not be different for single bank and multiple bank relationship firms. If however, single bank relationship firms are better shielded from adverse cash flow shocks by their bank than multiple bank relationship firms one should expect that the probability of obtaining extra bank debt for single bank relationship firms to go up during adverse cash flow shocks. We test whether the probability *changes* during times of adverse cash flow shocks compared to normal times. Our findings are in column (3). The only factor that significantly increase the probability of obtaining extra credit in bad times versus normal times is size. Larger firms are more likely to obtain extra credit. We interpret this as consistent with larger firms facing less asymmetric information problems during adverse cash flow shocks. Single bank relationship firms do not show a different probability of obtaining credit during times of adverse cash flow shocks. So size and not bank relationships seems to matter in times of adverse cash flow shocks. The results are consistent with the macro literature on credit market imperfections and monetary policy (see e.g. Gertler and Gilchrist (1993, 1994)). That literature shows that in either tight money periods or recessions credit towards larger firms increases relative to credit to smaller firms.

Conclusion

This paper examines how firm do adjust their investment and financing in periods of adverse liquidity shocks. We find that these periods are the ones in which financial constraints become binding. We then examine the role of banking relationships in this context. We find that the number of bank relationship does not influence the degree of financial constraints the firm faces. On the contrary, financial constraints bind essentially in periods of large negative cash flow shocks. In some case, firms may compensate for this thanks to increased lending from their creditors. However, in some other cases, the negative effect of these events on firms investment is reinforced when lenders cut their credit to firms. This forces firms to reduce their investment spending

strongly. The probability of obtaining extra bank debt is higher for larger firms with lower bank debt to assets ratio. In case of adverse liquidity shocks, the probability of obtaining extra bank debt is lower, and banks may be more reluctant to provide additional credit to smaller and more levered firms.

All in all, we find no strong evidence that the number of bank relationships influence investment and financing decisions. Having a single bank relationship does not affect the degree of financial constraints. Investment behaviour is identical for firms with a single bank and firms with multiple bank relationships, this holds in normal times as well as in periods of adverse liquidity shocks. Having a single bank relationship reduces the probability of obtaining increases in bank credit. However, firms with a single bank do not face stronger financial constraints. When financial constraints bind, in periods of adverse liquidity shocks, they obtain the same amount of bank debt as firms with multiple bank relationships (conditional on the probability of obtaining extra bank credit). In addition, they may turn to trade debt. In case of adverse liquidity shocks, what really impedes investment in these periods is when firms cumulate a drop in cash flow and a contraction of external bank credit. The second depends more on the size and initial leverage of the firm than on the number of bank relationships.

References

Allayannis, G. and A. Mozundar (2004), "The Impact of Negative Cash Flow and Influential Observations on Investment-Cash Flow Sensitivity Estimates", *Journal of Banking and Finance*, 28, 901-930.

Arellano, M. and S. Bond (1991), "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations", *Review of Economic Studies*, 58, 277-297

Arellano, M. and O. Bover (1995), "Another look at the instrumental variable estimation of error components models", *Journal of Econometrics*, 68, 29-51

Berger, A. N. and G.F. Udell (1995), "Relationship Lending and Lines of Credit in Small Firm Finance", *Journal of Business*, 68 (3),. 351-81

Berlin, M. and L. Mester (19989), "Deposits and relationship lending", *Review of Financial Studies*, 12, 579-607.

Berlin, M. and L. Mester (1998), "On the profitability and cost of relationship lending ", *Journal of Banking and Finance*, 22, 873-897

Blundell, R. and S. Bond (1998), "Initial conditions and moment restrictions in dynamic panel data models", *Journal of Econometrics*, 87, 115-143.

Bond, S., J. Elston, J. Mairesse and B. Mulkay (2003), "Financial factors and investment in Belgium, France, Germany and the UK: a comparison using company panel data", *The Review of Economics and Statistics*, 85(1), 153-165.

Chirinko, R.S. and J. A. Elston (2006), "Finance, control and profitability: the influence of German banks", *Journal of Economic Behaviour and Organization*, 59, 69-88.

Clearly, S. (1999), "The relationship between firm investment and financial status", *The Journal of Finance*, 54 (2), 673-692.

Cole, R.A. (1998), "The importance of relationships to the availability of credit", *Journal of Banking and Finance*, 22(6-8), 959-977.

Conigliani, C., G. Ferri and A. Generale (1997), "The impact of bank-firm relations on the propagation of monetary policy squeezes: an empirical assessment for Italy", *Banca Nazionale del Lavoro Quarterly Review*, 50 (202), 271-299.

D'Auria, C., A. Foglia and P. M. Reedtz (1999), "Bank interest rates and credit relationships in Italy", *Journal of Banking and Finance*, 23 (7), 1067-1093.

Degryse, H. and P. Van Cayseele (2000), "Relationship lending with a bank-based system: evidence from European small business data", *Journal-of-Financial-Intermediation*, 9(1), 90-109.

Degryse, H. and S. Ongana (2002), "Distance, lending relationships, and competition ", *Center for Economic Studies Discussion Paper*, n°02.16.

Degryse, H., N. Masschelein and J. Mitchell (2005), "SMEs and Bank Lending Relationships: the Impact of Mergers", *CEPR Discussion Paper Series* no. 5061

Detragiache E., P. Garella and L. Guiso (2000), Multiple versus single banking relationships: theory and evidence, *Journal of Finance*, 55(3), 1133-1161.

Elyasiani, E. and L. G. Goldberg (2004), "Relationship lending: a survey of the literature", *Journal of Economics and Business*, 56, 315-330.

Elsas, R. and J. P. Krahnen (1998), "Is relationship lending special? Evidence from credit-file in Germany", *Journal of Banking and Finance*,.22 (10-11), 1283-1316

Elston, J. A. (1996, 1998), "Investment, liquidity constraints and bank relationships: evidence from German manufacturing firms", *CEPR Discussion Paper* n° 1329 (1996) + in Black, S.W. and Moersch (eds.): *Competition and convergence in financial markets*, North Holland, Elsevier Science, 1998.

Fazzari S., Hubbard G.R. and B.C. Petersen (1988), "Financing constraints and corporate investment", *Brookings Papers on Economic Activity*, 1, 141-195

Fazzari S., Hubbard G.R. and B.C. Petersen (2000), "Investment-cash flow sensitivities are useful: a comment on Kaplan and Zingales ", *Quarterly Journal of Economics*, 115(2), 695-705

Garcia-Macro, T. and C. Ocaña (1999), "The effect of bank monitoring on the investment behavior of Spanish firms", *Journal of Banking and Finance*, 23 (11), 1579-1603.

Gertler M. and Gilchrist S (1993) “The role of credit market imperfections in the monetary transmission mechanism: arguments and evidence”, *The Scandinavian Journal of Economics*,

Gertler M. and Gilchrist S (1994), “Monetary policy, business cycles , and the behaviour of small manufacturing firms”, *The Quarterly Journal of Economics,59.309-340.*

Harhoff D. and Körting (1998), "Lending relationships in Germany-Empirical evidence from survey data", *Journal of Banking and Finance*, 22, 1317-1353.

Hoshi, T., A. Kashyap and D. Scharfstein (1991), "Corporate structure, liquidity and investment: evidence from Japanese industrial groups", *Quarterly Journal of Economics*, 106 (1), 33-60.

Houston, J. and C. James (1996), "Bank information monopolies and the mix of private and public debt claims", *The Journal of Finance*, 51 (5), 1863-1889.

Houston, J. and C. James (2001), "Do relationships have limits? Banking relationships, financial constraints, and investment", *Journal of Business*, 74, 347-374.

Kaplan, S.N. and L. Zingales (1997), "Do investment cash flow sensitivities provide useful measures of financing constraints?", *Quarterly Journal of Economics*, 112(1), 169-215

Kaplan, S.N. and L. Zingales (2000), "Investment-cash flow sensitivities are not valid measures of financing constraints", *Quarterly Journal of Economics*, 115(2),707-712

Mairesse, J., Hall, B.H. and B. Mulkay (1999), "Firm level investment in France and the United States: an exploration of what we have learned in twenty years", *NBER Working Paper* n° 7437

Ongena S. and D.C. Smith, (2000), "What determines the number of bank relationships? Cross-country evidence, *Journal of Financial Intermediation* 9, 26-56.

Suzuki, S. and R.W. Wright (1985), "Financial structure and bankruptcy risk in Japanese companies", *Journal of International Business Studies*, 16 (1), 97-110.

Petersen M.A. and R. Rajan (1994), "The benefits of lending relationships: evidence from small business data", *Journal of Finance*, 49(1), 3-37.

Rajan R. (1992), "Insiders and outsiders: the choice between informed and arm's length debt", *The Journal of Finance* 47, 1367-1400.

Vickery, J. (2005), "Banking relationships and the credit cycle: evidence from the Asian financial crisis", mimeo.

Von Thadden (1992), "The commitment of finance, duplicated monitoring, and the investment horizon", mimeo.

Windmeijer, F. (2004), "A finite sample correction for the variance of linear two-step GMM estimators", *Journal of Econometrics*, 126(1), 25-51.

Appendix

Data appendix

The main variables of our analysis are defined as follow. Output is defined by turnover. Cash flow is defined as the sum of net profits, depreciation, changes in investment grants, changes in provisions and deferred taxes, amounts written off on stocks and contracts on progress and on trade debt, and adjusted for relevant financial charges. We use value added and investment prices to obtain real series.

For the construction of the capital stock, we distinguish between five different types of capital goods: (1) land and buildings, (2) plant and machinery, (3) furniture and motor vehicles, (4) leasing, and (5) other. For each of these capital goods and each sector we construct the capital stock in the following way. We use the perpetual inventory method to construct the real capital stock, i.e.:

$$\overline{K_t} = \overline{K_{t-1}} .(1-\delta) + p_t.I_t/p_t$$

We use the industry-specific price index of investment goods provided by the National Accounts, in which the price index at 1995 is equal to one. Nominal investment is the sum of several factors, each of which is deflated by the investment price index of the time at which the investment was made. In particular, the acquisition of tangible assets in the current year is deflated by current prices, but sales and the disposal of old capital are deflated by the prices related to the age of this capital.[16] The initial nominal capital stock at historical prices in t is equal to the sum of all acquisitions of new capital minus (accumulated) depreciation over the entire history of the firm up to t-1. The real initial capital stock is obtained by deflating the initial nominal capital stock with investment prices related to the age of the capital stock.[17] We construct depreciation rates by sector and type of capital good, based on the lifetimes of the capital goods reported in the National Accounts.

We define bank relationship across the range of all bank products.. Firm i has a relationship with bank j in period t, if bank j provides credit or short-term facilities or a collateral to firm I in year t. Developing a bank relationship through some bank products may facilitate access to (long-term) credit when necessary. In addition, although the natural way to finance fixed investment is through long-term debt or equity issues, it appears that some firms have no long-term debt at all, and finance their investment through other sources. This is another reason to consider a broader range of products that long-term credit alone. We therefore think the relevant definition of bank relationship should cover all types of bank products, long-term credit, short-term credit, credit lines, collateral, ….

16 The average age of sold and used capital is estimated from the annual accounts information on depreciation. Details will be provided by the authors on request.

17 This is again inferred from annual accounts information on depreciation.

.

The data is trimmed as follow. We focus on profit maximising firms, that is we exclude foreign and public companies and non-profit associations. We consider only annual accounts going from January to December in order to ensure consistency with price indexes (constructed over the entire year) and consistency between units[18]. We also exclude a couple of observations that concerned firms that lose a bank relationship due to a bank merger; this concerns only 1% of the original sample I/K, CF/K, Δy and Y/K are trimmed by P5-P95 year by year (and P/K?) Financial ratios (liquidity, coverage, leverage, ratio1k and ratio2k) and debt charges are trimmed by P5-P95 year by year. For estimation purposes, we retain only firms that exist for at least 7 consecutive years

Predictive power of cash flow for future sales growth

Table A.1. below reports simple forecasting models for future sales growth, along the lines of Bond et al. (2003). The aim is to test whether our finding of a positive cash flow coefficient in the investment equation (1) is due to cash flow proxying for future profits rather than to financial constraints. We estimate an autoregressive model for sales growth, through least squares with time and industry dummies as well as with the system GMM estimator (as in the investment equation). There is no robust evidence that cash flow is predictor of future sales growth. This suggests that we may be confident on our interpretation that an excessive sensitivity of investment to cash flow is an indication of financial constraints.

18 In some cases annual accounts refer to only a part of the year (for seasonal activities for example). In some other case, the period covered is spanned over several years. For instance in 1997 a firm reports for the period August 1996 to July 1997.If, for the future she wants to report for the period from January to December. Then in 1998, she will report from August 1997 to December 1998.

Table A.1: Predictive power of cash flow for future sales growth

Dependant variable:Δy.. All equations include time dummies

	LS with time and industry dummies			LS with time and industry dummies			SGMM estimation			SGMM estimation		
Parameter	coef.	std err		coef.	std err		coef.	std err		coef.	std err	
c	0.051	11.91	***	0.061	7.24	***	0.050	10.12	***	0.037	4.12	***
I_{it-1}/K_{it-2}	0.060	5.24	***	0.046	4.11	***	0.016	1.21		0.019	1.08	
I_{it-2}/K_{it-3}				0.036	3.60	***				0.017	1.06	
Δy_{it-1}	-0.010	-0.65		-0.060	-3.86	***	-0.068	-3.38	***	-0.076	-2.87	***
Δy_{it-2}				0.001	0.06					-0.025	-1.03	
CF_{it-1}/K_{it-2}	-0.008	-1.70	*	0.001	0.14		0.017	1.56		0.033	1.44	
CF_{it-2}/K_{it-3}				-0.004	-0.59					0.029	2.21	**
								p-value			p-value	
Sargan							39.739	0.04		30.252	0.14	
m_1							-20.321	0.00		-19.587	0.00	
m_2							-1.970	0.05		-1.510	0.13	

Estimates of the probit model for the probability of an increase in bank debt, with random effects

Table A.2. reports the Maximum Likelihood estimates of the Probit model of section VI, with time dummies and random effects. The coefficients are of the same order of magnitude as in Table 8. As before, having a single bank relationship reduces the probability of receiving extra bank debt.

Table A.2: Probability of obtaining extra bank debt in normal times and during periods of adverse cash flow shocks

Dependant variable: D(Δbank>0) 1408 observations. Probit model with time dummies and random effects $\upsilon i \sim N(0,\sigma\upsilon^2)$

	adverse cash flow shocks			normal times					
	coef.	std err		coef.	std err		coef.	std err	
$size_{it-1}$	0.07	0.03	**	0.04	0.02	**	0,03	0,02	*
bank debt/A_{it-1}	-1.28	0.26	***	-1.36	0.14	***	-1,27	0,15	***
credit lines/A_{it-1}	0.74	0.23	***	0.64	0.12	***	0,60	0,13	***
CF_{it-1}/A_{it-1}	-1.26	0.44	***	-0.60	0.25	**	-0,45	0,30	
D_1	-0.21	0.10	**	-0.18	0.05	***	-0,17	0,06	***
D_{bad}*$size_{it-1}$							0,01	0,01	**
D_{bad}*bank debt/A_{it-1}							-0,36	0,27	
D_{bad}*credit lines/A_{it-1}							0,18	0,26	
D_{bad}*CF_{it-1}/A_{it-1}							-0,67	0,51	
D_{bad}*D_1							-0,08	0,11	
$\sigma\upsilon^2$	0.12	0.10		0.18	0.03	***	0,18	0,03	***
Log L	-942			-4001			-3997		
# obs	1408			5956			5956		

D_1 is a dummy that is equal to 1 if the firm has a single bank relationship

D_{bad} is a dummy that is equal to 1 when Δ(CF/K) is below the first quartile