Business groups, investment, and firm value

van der Molen, R.M.

Chapter 3

Financing constraints and investment

3.1 Introduction

Business groups abound in many developing (and developed) economies. However, apart from this, little is known about business groups in general, since they typically take different forms in different countries. The affiliated companies are linked through a large variety of relationships, also varying from one country to another. The most general among these ties are family ownership and financial interlinkages. The business group can be regarded as an intermediate form of integration, 'excluding, on the one hand, a set of firms bound merely by short-term strategic alliances and, on the other, a set of firms legally consolidated into a single one' (Granovetter, 1994).

In India, business groups form an important part of the private sector; in 1993, group affiliated firms accounted for more than 80 percent of the private sector's assets, profits and sales (Khanna, 1997). Indian business groups are typically diversified collections of legally independent firms that usually have a large proportion of family ownership. They contain up to more than 80 firms, which are typically clustered in several industries. Their origin often dates back to the colonial 'managing agency' system, where the managing agency controlled large numbers of companies across a range of

This chapter is a slightly adjusted version of Lensink, Van der Molen and Gangopadhyay (2003).

industries. The companies affiliated to a business group are often linked through cross-holdings of equity and interlocking directorates, and usually emphasize a common identity.

Why is the business group such a widespread phenomenon? Although several explanations have been proposed[1], we focus mainly on the role of informational imperfections. These imperfections are detrimental to the efficient functioning of markets, increasing the scope for firms, which will try to internalize tasks that would otherwise be delegated to the market. More specifically, with ill-functioning capital markets, business groups may play an important role in generating and allocating funds to investment projects. With respect to corporate investment, this may imply that business group affiliates may have better access to external capital, either from within the group or from outside the group.

We compare the investment behavior of business group affiliates with that of stand-alone companies and test the hypothesis that group affiliated firms are less capital constrained than stand-alone companies. We test for the presence of capital constraints by estimating the cash flow sensitivity of investment spending, taking the firm's cash flow as a proxy for internal funds. The data set we use contains 694 listed Indian companies, from 1989 to 1997. Using OLS as well as GMM estimation techniques to estimate an accelerator cum cash flow investment equation, we find evidence that the investment spending of stand-alone companies is more sensitive to changes in cash flow than that of business group affiliates, which is in line with our hypothesis.

The rest of the chapter is organized as follows. In section 3.2, we give some theoretical foundations for our main hypothesis. Section 3.3 reviews the related literature. Section 3.4 contains descriptive statistics about the firms in our sample and the variables we use in our estimations. Because business group affiliation is just one of many characteristics that may influence a firm's access to external finance, section 3.5 investigates the impact of other possibly important firm characteristics. In section 3.6, we present the results of our estimations on the effect of group affiliation. In section 3.7, these results are discussed. Section 3.8 concludes.

[1] See Ghemawat and Khanna (1998) for an overview.

3.2 Group affiliation and financing constraints

From a theoretical perspective, business group affiliation may enhance a firm's access to external capital for several reasons. First, business group affiliation may improve a firm's access to external capital because banks and other financial institutions may be more willing to lend to firms that belong to a business group.[2] As mentioned before, one of the main characteristics of business groups is the existence of financial relationships between affiliated firms. These relationships take the form of cross-holdings of equity, inter-firm loans, or mutual debt guarantees. These financial interlinkages may serve to mitigate moral hazard problems within the group (Berglöf and Perotti, 1994) or may be an effective means of risk sharing, because of the diversified nature of business groups. In markets rendered imperfect by asymmetric information, group membership may signal high quality, because of assortative matching of high quality firms (Ghatak and Kali, 2001), or relative stability in cash flows (Gangopadhyay and Lensink, 2001), reducing the harmful effects of adverse selection. Together with the existence of debt-guarantees, it may reduce the probability of financial distress. Reputational effects are also likely to play a role; the group name may serve as a high-quality brand name, or familiarity with other firms of the same group may induce a creditor to be more willing to lend to a firm. Especially in a developing country like India, reputational effects may be of great importance, since the absence of a smoothly functioning and reliable legal system may make contract enforcement via a court very costly.[3] Moreover, Dutta (1997) notes that corruption is widespread in the government owned financial institutions in India. This increases the importance of establishing and using political connections and effective lobbying instruments, a task for which large business groups are likely to be better suited than stand-alone firms.

Second, a firm may be able to obtain funding from other group companies through an intra-group capital market. Since the companies are legally

[2] Note that in India, financial institutions are not allowed to be part of a business group. Therefore, in contrast to e.g. the Japanese *keiretsu*, Indian groups do not have a main bank that belongs to the group.

[3] Although Indian law has a common-law origin, law enforcement is typically much more difficult than in the UK or the US (see La Porta et al., 1998). For this reason, banks may be more willing to lend to group affiliates.

separate entities, there is no corporate headquarters like in a diversified firm, which has the authority to decide on the allocation of funds between affiliated companies. Nevertheless, family ownership and cross-holdings of equity create strong network effects, inducing the affiliated companies to support each other with inter-corporate loans, deposits and investments. According to Dutta (1997), other group companies are an important source of funding for new projects. If one member of the network needs funding for his project, the other members of the network will usually contribute to the realization of this project, provided it has family approval. However, because there may be legal restrictions to the amount companies are allowed to invest in each other, the inter-corporate funding often takes the form of short-term deposits or is provided by family-controlled investment companies. This makes it hard to observe the extent to which intra-group lending takes place. There is some empirical evidence that intra-group loans are substantial (Khanna and Yafeh, 2005). Funding projects (partially) through intra-group transfers may also have a positive impact on banks' and financial institutions' willingness to invest in the project, since the funding by other group companies may be a credible signal of high project quality.

Typically, the efficiency of internal markets depends on a trade-off between market imperfections and agency problems. Ghemawat and Khanna (1998) argue that the informational problems are likely to be severe in India, whereas the agency problems may be partly relieved by the alignment of incentives within the network. Thus, the scope for intra-group capital markets is substantial, whereas the agency problems due to lacking market discipline are limited because of the strong network effects. Although the group superstructure may not have the formal authority to allocate funds to different projects, it may have informational advantages. Because the group superstructure, i.e., the controlling family or the collective CEO's of the affiliated companies, has better access to firm specific information and may be better suited for enforcing the disclosure of information, it may do a better job in assessing project profitability and allocating funds than the capital market.

To summarize, we can say that there are several ways in which business groups may mitigate adverse selection and moral hazard problems in financial markets. We hypothesize, therefore, that business group affiliates may have better access to external funds than their stand-alone counterparts. Although

there is some literature on Indian business groups and on the investment behavior of Indian firms (for references, see the next section), our analysis is to our knowledge the first to combine these two issues. We explicitly look at the effect of business group affiliation on investment spending by Indian companies.

3.3 Related literature

3.3.1 Investment-cash flow sensitivity and business groups

Since the seminal paper by Fazzari et al. (1988), a large literature has emerged on the relationship between internal funds and corporate investment.[4] A general finding of this literature is the importance of internal funds as a determinant of investment spending. The higher the cost difference between internal and external funds, the more a firm will rely on its own funds when financing investment spending. Most of this literature concentrates on developed countries. However, the issues of financing constraints and access to capital markets are likely to be even more relevant in developing countries. Still, there are relatively few investment studies for developing countries.

Most of the literature takes the following approach. The sample is divided according to an *a priori* measure of financing constraints (e.g. firm size, age, or dividend-payout ratio), after which the investment-cash flow sensitivities of the different subsamples are compared. One of the selection criteria which have been used, and which will be used in this chapter, is business group affiliation. Hoshi et al. (1991) were the first to use business group affiliation as a selection criterion. They compare the investment of Japanese keiretsu firms with stand-alone companies. They estimate an investment equation by regressing investment on liquidity, Tobin's q, and lagged production. They find evidence that keiretsu firms, who typically have strong relationships with a main bank, are less sensitive to fluctuations in their internal funds than firms that do not have such a relationship. They interpret this as evidence that the keiretsu structure mitigates information problems, i.e., that keiretsu firms suffer less from market imperfections. Looking at Korean chaebols, Shin and Park (1999) find that chaebol firms' investment decisions

[4] See Lensink, Bo, and Sterken (2001) for an overview of this literature.

are independent of internal funds, while investments of non-chaebol firms are significantly (positively) sensitive to internal funds. They also find evidence for the existence of internal capital markets in chaebols, which may explain why investment spending is independent of internal funds. This is interpreted as evidence that the asymmetric information problems between firms within the same chaebol are reduced. Shin and Park use liquidity, Tobin's q, and lagged sales growth as regressors. Their sample consists only of two years, 1994 and 1995, which leaves them only one observation per firm. Other examples of studies that compare the investment behavior of group members and stand-alone firms are Perotti and Gelfer (2001) on Russian financial industrial groups and Hermes and Lensink (1998) on Chilean Grupo's. The evidence they find is consistent with Hoshi et al. (1991). All studies find that the dependency of investment on internal funds is lower for group affiliates than for stand-alone firms.

Hence, despite the different countries and the differences in institutional structures, the outcomes of these studies are rather consistent. We can therefore conclude that there is some empirical evidence that asymmetric information problems are less detrimental to group affiliated firms, at least with respect to financing corporate investment.

3.3.2 Investment studies on India

We are not the first to estimate an investment equation for a panel of Indian firms. However, none of these studies consider the effect of business group affiliation on investment spending. Eastwood and Kohli (1999) study the promotion of small-scale industry in India by directed bank lending. For the 1965-1978 period, they find that small firms were more financially constrained than large firms. They also look at the effect of Indian industrial policy of directing bank credit to small firms. The introduction of this policy in the late 1960s relaxed financing constraints faced by small-scale enterprises and induced these firms to invest more. Athey and Laumas (1994) use a sample of 256 firms from 1978 to 1986 to estimate the sensitivity of investment to internal funds in a simple sales accelerator model. They find that internal funds are a relatively more important determinant of investment spending for large firms and for firms that produce luxury goods. They explain the greater sensitivity of large firms' investment by the industrial policy of stimu-

lating small-scale enterprises. This preferential treatment makes small firms less financially constrained than large firms. At first sight, this finding appears to be at odds with the results of Eastwood and Kohli (1999). The different results may be explained by the different time periods that are investigated. The positive effect of industrial policy on small firms' access to external capital dominates the negative effect of being small only in the later period.

Athey and Reeser (2000) estimate a q-model of investment, using a sample of 142 firms from 1981 to 1986. They divide their sample into three groups - small firms (i.e., those who are eligible for the directed credit), large firms with limited access to capital markets, and large firms with easy access to capital markets. The latter group consists of firms that are very large or belong to of one of the top three business groups (Tata, Birla, and Mafatlal). They hypothesize that these firms will suffer less from asymmetric information problems. They find that internal funds are insignificant for small firms and large firms with easy access to capital markets, whereas investment of large firms with limited access to capital markets is sensitive to internal funds.

Instead of using size as a criterion for firm classification, Ganesh-Kumar et al. (2001) classify their sample of Indian firms with respect to outward orientation. They conjecture that export-orientated firms will face lower costs of external funds, and thus have lower investment-cash flow sensitivity. Behind this conjecture is the idea that a higher export orientation implies a greater ability to compete in world markets. In the new, liberalized Indian environment, the ability to compete in world markets may be an important determinant of investment project quality. Therefore, these firms may face lower costs of external funds. Using a GMM approach, they estimate an investment equation with lagged sales and cash flow as regressors. The authors find evidence that is consistent with their conjecture, i.e., investment spending of exporting firms is less sensitive to cash flow than that of domestic firms.

A paper very close to our research, in that it explicitly compares group affiliates and stand-alone companies in India, is Khanna and Palepu (2000). The main difference with this chapter is that Khanna and Palepu (2000) focus on the relative performance of business group affiliates in India, rather than

on their relative access to external finance. They find that group affiliation is beneficial to its members only if a group is sufficiently diversified. Firms that are affiliated to a group that is below this threshold degree of diversification are outperformed by comparable stand-alone firms. They touch on the issue of group firms' access to external capital, as they try to explain this positive impact of group affiliation on firm performance. They find evidence that group affiliated firms have disproportionately good access to international source of capital. These firms issue more global depository rights (GDRs) and are more closely followed by foreign financial analysts. They find no evidence that the role of internal capital markets differs between group affiliates and stand-alone companies. This suggests that the benefits of group affiliation are in generating capital rather than in allocating it.

From this short literature review, we can see that there is some empirical evidence that group affiliation enhances a firm's access to external funds. Moreover, the investment literature on India has largely ignored the impact of group affiliation on financing constraints so far. This is exactly the void this chapter tries to fill.

3.4 Data

The variables are extracted from the CIMM database of the Center for Monitoring the Indian Economy (CMIE). We have yearly data for the 1989-1997 period. Constructing a balanced set resulted in a sample of 694 firms, of which 459 are group affiliates and 235 are private companies. Since the dependent variable is investment, derived by taking the first difference of gross fixed assets, the first year of observations (1989) is not taken into account in the estimates. The data set contains 694 firms, with 8 observations for each firm.

In tables 3.1 and 3.2, we give some descriptive statistics about our sample of firms. Table 3.1 shows that, on average, group affiliated firms are more than four times as large as stand-alone firms, irrespective of whether size is measured in terms of sales or in terms of total assets. Moreover, group affiliates are typically almost four years older than stand-alone companies. Note also that the spread of firm size and age in our sample is very large. Group firms also have significantly lower debt-to-assets ratios, and are less

Table 3.1. Descriptive statistics
ASSETS denotes total assets. AGE is the number of years since incorporation. DTOA measures the total borrowings of a company as a fraction of its total assets. EXPORT is the share of total sales that is exported. ROA is measured as (profit after tax + dividends paid)/total assets. Statistical significance at the ten-, five-, and one-percent level is indicated by †, *, and **, respectively. Statistical significance refers to the differences between the subsamples.

	mean	median	max	min
GROUP AFFILIATES				
ASSETS	2,521.46**	734.70**	195,361.40	6.30
AGE	35.30**	31.00**	134.00	0.00
DTOA	0.42	0.38	15.09	0.00
SALES	2,118.39**	800.00**	99,264.90	0.00
EXPORT	0.06	0.02	0.97	0.00
ROA	0.05*	0.06**	1.24	-7.27
STAND-ALONE COMPANIES				
ASSETS	576.11	230.30	61,634.30	1.10
AGE	31.57	26.00	110.00	2.00
DTOA	0.44*	0.41**	0.00	3.75
SALES	483.72	274.00	10,066.70	0.00
EXPORT	0.07*	0.00	1.00	0.00
ROA	0.04	0.05	4.82	-2.51

orientated towards exports, although these differences are very small.[5] The performance of group affiliates, measured by their return on assets (ROA), appears to be slightly better than that of stand-alone companies. This result is probably not very robust, since we used only a crude measure of ROA. Moreover, Khanna and Palepu (2000) find that the relationship between performance and group affiliation is non-linear.

From table 3.2, panel A, we can see that there are some remarkable differences in the composition of corporate debt between group affiliates and stand-alone firms. Stand-alone firms rely more on bank debt as a source of

[5] To get an idea of which of these variables are significantly related to group affiliation, we regressed group affiliation on firm size, age and leverage. We find that firm size is very significant, whereas the age and leverage of a firm are not significant.

Table 3.2. Debt and Equity.
Group companies include holding companies, subsidiaries and group companies, i.e., companies under the same management. This implies that this category is not by definition confined to group companies. Loans from other companies represents loans from companies that are not included in group companies. Foreign borrowing refers to foreign institutions, not foreign currency. Other forms of debt include deferred payments, hire purchase loans, and other miscellaneous loans.
The variables in panel B are defined as follows: Corporate ownership measures the stake held by companies not included in the other categories. Director's ownership is the stake owned by the directors and their relatives. Top-50 ownership measures the stake held by the 50 largest shareholders, other than those in the above categories. The rest of the shares are held by the public. Significance at the one and five percent level is indicated by **and *, respectively.

	Group affiliates		**Stand-alone firms**	
	mean	median	mean	median
Panel A: composition of corporate debt				
Bank	0.392	0.365	0.475**	0.437**
Other fin. inst.	0.263	0.215	0.273	0.223
Government	0.023	0**	0.022	0
Group cos.	0.006**	0*	0	0
Other cos.	0.026**	0*	0.017	0
Foreign	0.012**	0*	0.002	0
Other	0.278**	0.232**	0.209	0.133
Panel B: equity ownership				
Foreign	0.1	0.04**	0.07**	0.02
Dom. Institutional	0.18**	0.17**	0.13	0.09
Corporate	0.35**	0.34**	0.25	0.22
Directors	0.06	0.01	0.19**	0.16**
Top 50	0.05	0.03	0.08**	0.05**
Dispersed	0.26	0.24	0.28**	0.27**

funding. Group companies borrow more from fellow group companies, i.e., companies that are affiliated to the same group, although the amounts are relatively small. This does not necessarily imply that the intra-group capital market in Indian business groups is of minor importance. As noted before, not

all inter-firm funding may show up in the official amount of loans. Moreover, this funding may also take the form of investments in group companies. Panel A also shows that other companies and foreign lenders are a more important source of debt finance for group affiliates. Finally, group affiliates rely more on other forms of debt, which contains deferred payments, hire purchase loans, and other miscellaneous loans.

Panel B of table 3.2 gives some insights in the ownership structure of business group affiliates relative to that of stand-alone firms. The most remarkable difference is that a larger part of group affiliates' equity is held by other companies. We interpret this as evidence that group affiliates play an important role in funding each other's projects. This evidence is confirmed when we look at the total investment in shares and debentures of group companies or subsidiaries as a part of total investment in shares and debentures that a company makes in a year. In our sample, the average share of these investments that goes to group companies is 0.36 for group affiliates and 0.18 for stand-alone companies.[6] Note that the director's ownership for group affiliates is remarkably low compared to that of stand-alone companies. These differences in ownership structure are consistent with the importance of family ownership in India in general, and with the idea that, within business groups, the family exercises her control indirectly through corporate ownership. If we interpret both corporate ownership and directors' ownership as measures of insider ownership, the figures also suggest that insider ownership be not confined to business groups. Thus, expropriation of minority shareholders may be present in both group affiliates and stand-alone companies. The general picture that emerges from this table is consistent with studies of the governance of Indian companies (Bertrand et al., 2002 and Sarkar and Sarkar, 1999). From table 3.2, it is clear that financial interlinkages between group affiliates are significant. Therefore, the theoretical considerations that we presented in section 3.2 may very well apply to our sample.

To estimate the cash flow sensitivity for our sample of firms, we estimate a standard accelerator cum cash flow investment equation. In the basic

[6] Investment in group companies includes holding companies and subsidiaries. Therefore, if a stand-alone company invests in a subsidiary, this is classified as investment in a group company.

Table 3.3. Descriptive statistics
I is investment, measured as the change in gross fixed assets, ΔS is the change in sales, CF is cash flow, measured as the sum of net profits and depreciation, and K measures beginning-of-period total assets.

	mean	**stdev**	**max**	**min**
I/K				
All firms	0.128	0.318	15	-1.383
Group affiliates	0.128	0.222	3.574	-1.064
Stand-alones	0.128	0.45	15	-1.383
$\Delta S/K$				
All firms	0.232	0.537	13.36	-4.846
Group affiliates	0.24	0.534	10.663	-4.846
Stand-alones	0.216	0.543	13.36	-3.044
CF/K				
All firms	0.094	0.153	3.909	-3.837
Group affiliates	0.095	0.138	1.393	-3.837
Stand-alones	0.091	0.179	3.909	-1.37

regressions, investment (I) is explained by the change in sales (ΔS) and cash flow (CF), where all variables are scaled by the beginning-of-period book value of total assets (K). We measure cash flow as the sum of net profits and depreciation. Table 3.3 gives some descriptive statistics of the variables for the total data set as well as for the sub-samples of group affiliates and stand-alone companies. From table 3.3, we see that the most remarkable difference between group affiliates and stand-alone firms is the much higher standard deviation of net investment for stand-alone companies.

Table 3.4 gives a correlation matrix of the main variables, again for the total data set and for the two sub-samples. The most important difference between group-affiliated and stand-alone companies concerns the correlation coefficient of cash flow and investment. This coefficient is much lower for group affiliates than for stand-alone firms. The more a firm is financially constrained, the higher will be the sensitivity of its investment spending to a measure of internal funds, such as cash flow. The much lower correlation

Table 3.4. Correlation matrix
The tabel presents pairwise correlations between the independent variables in our regressions. I is investment, measured as the change in gross fixed assets, ΔS is the change in sales, CF is cash flow, measured as the sum of net profits and depreciation, and K measures beginning-of-period total assets.

	All firms		**Group affiliates**		**Stand-alone companies**	
	I/K	$\Delta S/K$	I/K	$\Delta S/K$	I/K	$\Delta S/K$
$\Delta S/K$	0.152		0.234		0.234	
CF/K	0.377	0.152	0.227	0.309	0.505	0.261

coefficient between net investment and cash flow for group related firms may therefore be a first indication that group affiliates suffer less from financing constraints than stand-alone companies.

3.5 Determinants of financing constraints

The differences in firm size and age that we found in the previous section warrant some further discussion, since differences in these variables may affect the degree of financing constraints a firm faces. In our sample, a group affiliate is typically larger and older than a stand-alone company. Therefore, if group affiliates and stand-alone companies face different financing constraints, this may be due to differences in firm size and age. So before we can make any inferences about the effect of business group affiliation on financing constraints, we have to take a closer look at the effects of size and age on the cash flow-sensitivity of investment spending in our sample. Moreover, Ganesh-Kumar et al. (2001) find evidence that firms that are more export orientated are less financially constrained. Although we find no large differences between the export-orientation of group affiliates and stand-alone companies, we are interested in the effect of export-orientation on financing constraints. In this section, we therefore examine the importance of size, age, and export-orientation as determinants of the sensitivity of investment spending to changes in cash flow.

The idea is that large (old, export orientated) firms have a different cash

flow sensitivity than small (young, not export orientated) firms. However, it is not a priori clear when a firm can be considered large (old, export orientated). Therefore, we start the analysis in this section by using a threshold estimation technique. This technique allows us to investigate whether there exists a threshold size (age, export orientation) such that firms that are above this threshold have a significantly different cash flow coefficient than firms below this threshold. The main advantage of the threshold estimation technique is that the value of the criterion (in our case, size, age or export orientation) at which a significant change in coefficients occurs is endogenously determined in the estimation procedure. We apply the approach set out by Hansen (1999), who has further developed the statistical theory of threshold models. The regression model reads as follows: for each company i and year t,

$$\begin{aligned} \frac{I_{it}}{K_{it}} &= \alpha_i + \beta_1 \frac{S_{it} - S_{i,t-1}}{K_{it}} + \beta_2 \frac{CF_{it}}{K_{it}} I_{P_{it} \leq \hat{P}^*} \\ &\quad + \beta_3 \frac{CF_{it}}{K_{it}} I_{P_{it} > \hat{P}^*} + \eta_{it} \end{aligned} \tag{3.1}$$

where I is an indicator function, which takes the value of 1 if its argument is true, and 0 otherwise, and $\hat{P}^*$ is the estimated threshold value of P, where P can be total assets, age or export-orientation. In this specification, β_2 and β_3 measure the cash flow sensitivity of investment for firms that are below and above the threshold level, respectively. The error term η_{it} consists of a time-constant firm-specific error term that captures inter-firm heterogeneity and an idiosyncratic error term. Both error terms have zero expectation.

We estimate the threshold by using so-called conditional least squares. First, the observations are sorted on the threshold variable. Next, the equation is estimated for all values of the threshold variable. For all threshold values, the sum of squared residuals is computed. The optimal value of the threshold is the value that minimizes the sum of squared residuals. The search for the thresholds is restricted to specific quantiles (the more quantiles the finer the grid to which the search is limited). The advantage of this is that the amount of regressions is reduced, but that it still generates precise estimates (see Hansen (1999), pp. 349-350).

The estimation results of this procedure are presented in table 3.5. In

Table 3.5. Threshold regressions
Dependent variable is the amount of capital investment. Thresholds are chosen to minimize the sum of squared residuals (see Hansen, 1999). An asterisk indicates the threshold value for that variable. I is an indicator function, taking the value of one if its argument is true, and zero otherwise. ASSETS denotes total assets, AGE is the number of years since incorporation, and EXPORT is a proxy for export orientation, measured as the share of a company's total sales that is exported. Statistical significance at the ten-, five-, and one-percent level is indicated by †, *, and **, respectively.

Variable	**Coefficient** (Std. Err.)		
	I	II	III
ΔS/K	0.063**	0.071**	0.066**
	(0.018)	(0.020)	(0.020)
CF/K $*$ $I_{ASSETS_{it} \leq ASSETS^*}$	0.246†		
	(0.137)		
CF/K $*$ $I_{ASSETS_{it} > ASSETS^*}$	1.499**		
	(0.284)		
CF/K $*$ $I_{AGE_{it} \leq AGE^*}$		0.166	
		(0.151)	
CF/K $*$ $I_{AGE_{it} > AGE^*}$		0.675*	
		(0.264)	
CF/K $*$ $I_{EXPORT_{it} \leq EXPORT^*}$			0.236
			(0.167)
CF/K $*$ $I_{EXPORT_{it} > EXPORT^*}$			0.380**
			(0.083)
Threshold estimate	2062	54	0.003
SSE (no threshold)	263.74	263.74	263.74
SSE (single threshold)	256.75	260.95	263.36
LR test	151.157	59.278	7.934
Bootstrap p-value	0.000	0.020	0.093
N	5552	5552	5552

columns I to III, we use size, age, and export orientation, respectively, as the firm characteristic that may affect the investment-cash flow sensitivity. In all three cases, the values of the cash flow coefficient for variables below and above the threshold differ substantially. First, the effects of firm size on investment-cash flow sensitivities that we find are consistent with the results

of Athey and Laumas (1994) and Athey and Reeser (2000). Since the cash flow coefficients for small firms are insignificant and those of large firms significantly positive, the regressions suggest that small firms have better access to capital than large firms. From the second column of table 3.5, we find that young firms have a lower cash flow coefficient than old firms. Moreover, a Likelihood Ratio test of the significance of the threshold suggests that there exist significant thresholds, for total assets at 2,062 and for age at 54. The results from column III suggest that more export-orientated firms suffer more from financial constraints. However, we also test whether the threshold effect is statistically significant under the null of no threshold, and find that the threshold for export-orientation is not significant at the 5 percent level. This suggests that the cash flow sensitivity of investment does not depend on export orientation, a finding which is at odds with that of Ganesh-Kumar et al. (2001). One reason for this discrepancy may be the difference in the classification methods used. We use an endogenously determined threshold, whereas Ganesh-Kumar et al. (2001) use a rather *ad hoc* way to classify firms into export orientated and not-export orientated. We believe that an endogenously determined threshold leads to more reliable results.

Another way to estimate whether and how the cash flow sensitivity of investment depends on a firm's size, age or export orientation, is by estimating a model that includes the interaction between cash flow and one of these variables as an explanatory variable. This allows the cash flow sensitivity to vary directly with size, age or export orientation. As a robustness check, we also estimate the model with interaction terms. We estimate the following model:

$$\frac{I_{it}}{K_{it}} = \alpha_i + \beta_1 \frac{S_{it} - S_{i,t-1}}{K_{it}} + \beta_2 \frac{CF_{it}}{K_{it}} + \beta_3 \frac{CF_{it}}{K_{it}} * P_{it} + \eta_{it} \qquad (3.2)$$

As before, P can be either firm size (measured by the natural log of K), age, or export orientation. In model 3.2, β_3 measures how the cash flow sensitivity of investment changes with a change in P. The results of these estimates are presented in table 3.6. We find a positive coefficient for β_3 in columns I and II, indicating that the cash flow sensitivity of investment increases as a firm gets larger (older). These results suggest that larger (older) firms are more financially constrained than small (young) firms, which is consistent with

Table 3.6. Interaction terms
Dependent variable is the amount of capital investment. All equations are estimated in first differences. Time dummies were insignificant, and are therefore not taken into account. The reported standard errors are robust to heteroskedasticity. Statistical significance at the ten-, five-, and one-percent level is indicated by †, *, and **, respectively.

Variable	**Coefficient** (Std. Err.)		
	I	II	III
$\Delta S/K$	0.044**	0.042**	0.038**
	(0.009)	(0.010)	(0.010)
CF/K	-1.285**	-0.081	0.277**
	(0.083)	(0.069)	(0.042)
$(CF/K) * ln(\text{ASSETS})$	0.3626**		
	(0.017)		
$(CF/K) *$ AGE		0.011**	
		(0.002)	
$(CF/K) *$ EXPORT			-0.345
			(1.154)

the results from the threshold model. Moreover, we find no significant effect of a firm's export orientation on its cash flow-sensitivity. This confirms our earlier result that export orientation is not a significant determinant of a firm's financing constraints. The results are thus consistent with the results of table 3.5.

3.6 Group affiliation and financing constraints

Now that we have studied the effects of firm size and age on investment-cash flow sensitivity, we turn to the central issue of this chapter: the effect of group affiliation on the cash flow sensitivity of investment. Although group affiliation and firm size are correlated, analyzing the effect of group affiliation on the investment-cash flow sensitivity is still worth while. Because firm size is partly determined by investment spending, it is difficult

to identify exactly what causes the relationship between firm size and the cash flow sensitivity of investment. More specifically, it is not clear whether this results from an economic relationship or is a mere statistical artifact. Group affiliation, on the other hand, is likely to suffer less from endogeneity problems. We have no reason to believe that investment spending determines whether a company is affiliated to a group or not. Moreover, business group affiliation typically is constant over time. In our sample, all firms are either affiliated to a business group or not, and their ownership status is constant over the sample period. Business group affiliation can thus be considered exogenous. Hence, the relationship between group affiliation and the cash flow sensitivity is more likely to be economically meaningful. We start by estimating a standard sales accelerator cum cash flow investment model. The equation we estimate reads as follows:

$$\frac{I_{it}}{K_{it}} = \alpha_i + \beta_1 \frac{S_{it} - S_{i,t-1}}{K_{it}} + \beta_2 \frac{CF_{it}}{K_{it}} + \beta_3 \frac{CF_{it}}{K_{it}} * (1 - d_i) + \eta_{it} \qquad (3.3)$$

where d_i is a group affiliation dummy, taking the value of 1 if firm i is affiliated to a business group, and 0 otherwise. Equation (3.3) implies that β_2 measures the cash flow sensitivity for group affiliates, $(\beta_2 + \beta_3)$ denotes the cash flow sensitivity for stand-alone companies, and β_3 indicates the difference between the cash flow sensitivity of group affiliates and that of stand-alone companies.[7]

First, we estimate equation 3.3 by ordinary least squares. The model is estimated in first differences, to account for fixed effects.[8] The results of this estimation are presented in table 3.7, column I. The sales coefficient has the expected sign and is significant. The cash flow coefficient is significantly positive for group affiliates. Moreover, the cash flow coefficient is significantly higher for stand-alone companies. This suggests that stand-alone firms are more financially constrained then group firms; a result consistent with our hypothesis.

As we saw in section 3.4, group-firms are typically larger and older than stand-alone firms. Moreover, in section 3.5 we saw that a firm's size and

[7] We also estimated a dynamic model where we included lagged investment as an explanatory variable. The results are similar.

[8] Time dummies are found to be insignificant, and are therefore left out.

Table 3.7. OLS estimates of cash flow sensitivity
Dependent variable is the amount of capital investment. All equations are estimated in first differences. d is a dummy variable, taking the value of one for group companies, and zero otherwise. I is an indicator function, taking the value of one if its argument is true, and zero otherwise. Statistical significance at the ten-, five-, and one-percent level is indicated by †, *, and **, respectively.

Variable	**Coefficient** (Std. Err.)		
	I	II	III
$\Delta S/K$	0.042^{**}	0.033^{**}	0.042^{**}
	(0.010)	(0.010)	(0.010)
CF/K	0.132^{*}		
	(0.053)		
$(CF/K) * (1-d)$	0.328^{**}		
	(0.079)		
$CF/K * I_{\text{ASSETS}_{it} \leq 2{,}062}$		$0.091^{\dagger}$	
		(0.052)	
$CF/K * I_{\text{ASSETS}_{it} \leq 2{,}062} * (1-d)$		0.362^{**}	
		(0.078)	
$CF/K * I_{\text{ASSETS}_{it} > 2{,}062}$		1.700	
		(0.189)	
$CF/K * I_{\text{ASSETS}_{it} > 2{,}062} * (1-d)$		3.497^{**}	
		(0.556)	
$CF/K * I_{\text{AGE}_{it} \leq 54}$			0.123^{*}
			(0.055)
$CF/K * I_{\text{AGE}_{it} \leq 54} * (1-d)$			0.339^{**}
			(0.094)
$CF/K * I_{\text{AGE}_{it} > 54}$			0.230
			(0.170)
$CF/K * I_{\text{AGE}_{it} > 54} * (1-d)$			0.228
			(0.194)
N	4858	4858	4858
RSS	739.240	711.010	739.170
TSS	758.240	758.240	758.240

age have a significant impact on its investment-cash flow sensitivity. One may argue that the different characteristics of the two sub-samples drive the

result just described. However, as group firms are typically larger and older than stand-alone companies, and because we found in section 3.5 that being large or old tends to increase cash flow sensitivities, we would expect group affiliates to have higher cash flow sensitivities if group affiliation *per se* had no effect. The result of table 3.7, column I, is just the opposite: group firms have lower cash flow coefficients than stand-alone companies. Note that this result implies that business group affiliation has a separate effect on a firm's investment-cash flow sensitivity, which cannot be explained by its size or age alone.

We also test this proposition by estimating our model in a different way: we test the effect of group affiliation on the cash flow sensitivity of firms in the same size or age category.[9] Classifying firms into size and age categories controls for differences in cash flow sensitivities resulting from differences in firm size and age. The size and age categories are determined using the thresholds that we found in section 3.5. We estimate the following model:

$$\begin{aligned} \frac{I_{it}}{K_{it}} &= \alpha_i + \beta_1 \frac{S_{it} - S_{i,t-1}}{K_{it}} + \\ &\beta_2 \frac{CF_{it}}{K_{it}} * I_{P_{it} \leq \hat{P}^*} + \beta_3 \frac{CF_{it}}{K_{it}} * I_{P_{it} \leq \hat{P}^*} * (1 - d_i) + \\ &\beta_4 \frac{CF_{it}}{K_{it}} * I_{P_{it} > \hat{P}^*} + \beta_5 \frac{CF_{it}}{K_{it}} * I_{P_{it} > \hat{P}^*} * (1 - d_i) + \eta_{it} \end{aligned} \tag{3.4}$$

where the variables are defined as before. So, in this model, β_2 is the cash flow coefficient for small (young) group affiliates, $\beta_2 + \beta_3$ measures the cash flow sensitivity of small (young) stand-alone companies, β_4 is the cash flow coefficient for large (old) group affiliates, and $\beta_4 + \beta_5$ measures the cash flow sensitivity of large (old) stand-alone companies.

The results of these regressions are reported in columns II and III of table 3.7. In column II, we use the size categories, whereas column III uses the age categories. Again, we find that the change in sales has a significantly positive effect on investment. From column II, we can conclude that large firms have higher cash flow sensitivities than small firms, a result consistent with the results of section 3.5. Moreover, we can conclude that our earlier result of

[9] We no longer use the export orientation of a firm as a classification criterion, since we did not find this to be an important determinant of cash flow sensitivities.

group affiliates having lower cash flow sensitivities than their stand-alone counterparts remains unchanged after splitting the sample in small and large firms. In the subsample of small firms, group affiliates have significantly lower cash flow sensitivities than stand-alone companies. The same is true for the subsample of large firms. Column III gives the results after controlling for firm age. For old firms, cash flow is not significant, nor is there a significant difference between the cash flow coefficients of group affiliates and stand-alones. However, the cash flow coefficient is significant for young firms, and it is significantly higher for young stand-alones. The cash flow coefficients that we find in the subsamples of old and young firms are not consistent with our earlier finding of cash flow coefficients rising with firm age. Nevertheless, we do find evidence for a group affiliation effect for young firms.

The results in table 3.7 suggest that there is a separate effect of business group affiliation on a firm's investment-cash flow sensitivity, apart from the effects of a firm's size and age. Moreover, these effects of business group affiliation are broadly consistent with our hypothesis, i.e., group affiliation lowers the sensitivity of investment spending to changes in cash flow, *ceteris paribus*.

Again, using a threshold estimation technique is just one way to estimate our model. As in section 3.5, we also estimated the model using interaction terms. The following model is estimated:

$$\begin{aligned} \frac{I_{it}}{K_{it}} &= \alpha_i + \beta_1 \frac{S_{it} - S_{i,t-1}}{K_{it}} + \beta_2 \frac{CF_{it}}{K_{it}} + \beta_3 \frac{CF_{it}}{K_{it}} * P_{it} + \\ & \beta_4 \frac{CF_{it}}{K_{it}} * P_{it} * (1 - d_i) + \eta_{it} \end{aligned} \tag{3.5}$$

where P_{it} is either firm size or age. In this model, β_4 measures the difference between the cash flow sensitivity of stand-alone companies and group affiliates of the same size and age, respectively. The results of estimating (3.6) are presented in table 3.8. Interacting cash flow with firm size, we find that β_3 is significantly positive (column I): larger firms have higher cash flow sensitivities. Moreover, we see that β_4 is significantly positive, implying that, for a given size, group firms have significantly lower cash flow coefficients than stand-alone companies. Column II shows the results of interacting cash flow with age. Cash flow coefficients are found to increase

Table 3.8. Interaction terms
All equations are estimated in first differences. Time dummies where insignificant, and therefore not taken into account. The reported standard errors are robust to heteroskedasticity. Statistical significance at the ten-, five-, and one-percent level is indicated by †, *, and **, respectively.

Variable	**Coefficient** (Std. Err.)	
	I	II
$\Delta S/K$	0.055**	0.042**
	(0.009)	(0.010)
CF/K	-1.243**	-0.080
	(0.082)	(0.071)
$(CF/K) * ln(\text{ASSETS})$	0.298**	
	(0.018)	
$(CF/K) * ln(\text{ASSETS}) * (1-d)$	0.131**	
	(0.016)	
$(CF/K) * \text{AGE}$		0.011**
		(0.003)
$(CF/K) * \text{AGE} * (1-d)$		0.000
		(0.002)

with firm age. The difference between cash flow sensitivities of group firms and stand-alone companies is insignificant. This is broadly consistent with the threshold estimation results: correcting for firm size, we find higher cash flow coefficients and a significant impact of group affiliation.

Estimating our models using OLS might be problematic due to measurement error and endogeneity problems, which are typically large in investment studies. When we think of the observed variables (firm size, investment, sales) as the outcomes of an optimization process, a change in one of the variables is likely to affect the optimal value of the other variables. Moreover, it is difficult to distinguish between variables which are treated as fixed, and variables which are set to maximize the firm's objective function. Because of these endogeneity problems, we want to estimate models (3.3) and (3.5) using an instrumental variables approach. More specifically, we esti-

Table 3.9. System GMM estimates of cash flow sensitivity
Dependent variable is the amount of capital investment. Heteroskedasticity-robust standard errors are in parentheses. For the equation in first differences, lagged levels are used as instruments. In general, we used values for $t-2$ up to $t-7$. For the equation in levels, first differences are used as instruments. Here we used, in general, the one period lagged values. However, the exact set of instruments slightly differs per variable and per equation. It is determined by comparing the Sargan test-statistics of different possibilities. The exact set of instruments can be obtained on request. Equations 2 and 3 are estimated with Moore-Penrose pseudo inverse to evaluate the weighting matrix. The reason is that the total number of instruments in these estimates is relatively large, leading to difficulties in inverting the matrix required to compute the two-step GMM estimator. Statistical significance at the ten-, five-, and one-percent level is indicated by †, *, and **, respectively.

Variable	**Coefficient** (Std. Err.)		
	I	II	III
$\Delta S/K$	-0.002	-0.057	-0.007
	(0.045)	(0.015)	(0.026)
CF/K	0.379		
	(0.306)		
$(CF/K)*(1-d)$	2.224**		
	(0.635)		
$CF/K * I_{\text{ASSETS}_{it}\leq 2{,}062}$		0.418**	
		(0.086)	
$CF/K * I_{\text{ASSETS}_{it}\leq 2{,}062} * (1-d)$		1.797**	
		(0.126)	
$CF/K * I_{\text{ASSETS}_{it}>2{,}062}$		1.193**	
		(0.166)	
$CF/K * I_{\text{ASSETS}_{it}>2{,}062} * (1-d)$		0.733**	
		(0.154)	
$CF/K * I_{\text{AGE}_{it}\leq 54}$			0.242
			(0.252)
$CF/K * I_{\text{AGE}_{it}\leq 54} * (1-d)$			2.032**
			(0.652)
$CF/K * I_{\text{AGE}_{it}>54}$			0.116
			(0.101)
$CF/K * I_{\text{AGE}_{it}>54} * (1-d)$			0.950**
			(0.158)
N	5552	5552	5552

Table 3.9. (continued)

M1	-2.46	-2.771	-2.571
p-value	(0.014)	(0.006)	(0.010)
M2	0.391	0.603	0.199
p-value	(0.696)	(0.547)	(0.842)
Sargan	46.95	80.68	104.45
p-value	(0.596)	(0.395)	(0.414)
Differenced Sargan	20.6	24.62	20.58
degrees of freedom	24	26	26
Critical value	21.07	35.56	35.56
WALDJS	25.83	582.44	111.59
p-value	(0.000)	(0.000)	(0.000)

mate our investment models using the system GMM estimator.[10] For details about this estimation technique, we refer to appendix B.

The results of the GMM estimation are presented in table 3.9. The results of estimating (3.3) are in column I, and the results of estimating (3.5) are in columns II and III. The results for the accelerator effect are disappointing, since in all three models, the coefficient for sales is not significant at the 10 percent level. This difference with our OLS estimates may result from the endogeneity of sales. From column I, we can conclude that cash flow is insignificant for group affiliates. Moreover, stand-alone firms have a significantly higher coefficient than group affiliates, a result that is in line with our hypothesis. In column II, we find that cash flow is a significant determinant of investment spending for both large and small firms. Furthermore, group affiliates have a significantly lower cash flow coefficient, irrespective of the size category. Column III shows that there is a significant difference between the cash flow coefficients of stand-alones and group affiliates, both for young and old firms.

So although cash flow is not significant in all models estimated, we do find that in all specifications there is a significant difference between the investment-cash flow sensitivities of stand-alone companies and group affiliates. Thus, the results from the GMM estimations reinforce the results from the OLS estimations, although there are differences in the size of the coefficients. We interpret this as evidence that members of business groups

[10] We estimate this model using a new version of DPD98 for Gauss (Arellano and Bond, 1998).

are less financially constrained than stand-alone firms.

3.7 Some qualifications

Although the above mentioned methodology has been followed by numerous researchers, it is not undisputed. To value our results it is important to have a closer look at these critiques. The main critique focuses on three issues; the (time independent) *a priori* classification of firms in different groups, the problem that internal funds may also proxy for the profitability of investment and the use of investment-cash flow sensitivity as a measure of financial constraints. Hu and Schiantarelli (1998) criticize the *a priori* classification of firms. They point at three possible weaknesses of this approach. First, financing constraints are likely to be determined by a number of factors. A single indicator may not be able to distinguish between the effect of financing constraints and firm-specific effects. Second, the financing constraints may differ per year. This may especially be the case when the macroeconomic environment changes dramatically over time. Finally, the variable used to select firms may be correlated with the dependent variable, in which case the analysis suffers from selection bias. To address these weaknesses, Hu and Schiantarelli propose to estimate an endogenous switching model, where the premium on external finance is endogenously determined by a switching function.

We believe, however, that our classification is largely immune to this critique. First, business group affiliation does not seem to change a lot over time, at least not over the period in our sample. Second, business group affiliation seems to be a truly exogenous variable. We think this is the most important difference between using size or age as a classification criterion and classifying firms according to business group affiliation.

Some authors argue that the relationship between investment and measures for internal funds may suffer from the fact that internal funds may proxy for the profitability of investment. In that case, a positive relationship between internal funds and investment may be expected since firms with more liquidity are doing well and have better possibilities to invest (Hoshi et al., 1991). This may imply that the cash flow coefficient cannot be interpreted in terms of capital market imperfections. The usual way to get around

this problem is to add Tobin's q as an independent variable. Although we agree with the possibility that the cash flow sensitivity may provide a weak indication of the existence of capital market imperfections, we have not added Tobin's q to the model. We have two reasons for this. First, the empirical measurement of q requires data on prices and numbers of stock outstanding. Concerning our sample, we are not able to come up with a proxy for q for many firms in our sample. Therefore, if we would estimate a q-model, the sample would have been decreased considerably. Moreover, since data to construct q are in particular missing for stand-alone and thus smaller firms, estimating a q-model would probably create a selection bias. Second, it is well known that there are serious measurement problems with respect to q. Theoretically, a measure of marginal q is needed. However, since marginal q is not observable, average q is usually taken as a proxy. This probably introduces additional measurement problems. In our investment model, the sales accelerator proxies for future profitability. Kaplan and Zingales (1997) are the most prominent critics of the use of the investment-cash flow sensitivity as a measure of financial constraints. They argue that the sensitivity of investment to cash flow not necessarily increases monotonically with the degree of financing constraints. In particular, they show that the investment-cash flow sensitivity as a measure of financing constraints breaks down for certain specifications of a firm's cost and production functions. This is a significant critique, and it is provides a major challenge to the literature on investment-cash flow sensitivities, including the current chapter. Therefore, we are careful in our interpretation of the results.

3.8 Conclusion

In this chapter, we study the effect of business group affiliation on corporate investment behavior in India. We estimated several models and specifications. Although there are some differences in the outcomes, the general picture that emerges from our results can be summarized by three main statements. First, we find in almost all cases that there is a significantly positive group affiliation effect: stand-alone companies have higher cash flow sensitivities than group affiliates. Only in one case, the difference turns out to be insignificant. Second, we find a significant impact of firm size on the

cash flow sensitivity of firm investment. A larger firm typically has a higher cash flow coefficient. A third result is the effect of a firm's age: we find some evidence that younger firms have lower cash flow coefficients. This last result is not as strong as the first two; in some cases age does not seem to matter. For the purpose of this chapter, the first result is of course the most important one. When we interpret the cash flow sensitivity as a measure of financing constraints, this suggests that business group affiliates have better access to external funds than stand-alone firms, a conclusion that is broadly consistent with our hypothesis. Although we do find evidence that group affiliates are less financially constrained than stand-alone companies, we do not know what causes this difference. As mentioned in section 3.2, it can be caused either by better access to financial institutions or by the existence of an intra-group capital market. Based on the evidence in this chapter, we cannot be conclusive about which explanation is prevalent.

Furthermore, note that our results do not say anything about the efficiency of the investments. Although group affiliates have better access to external funds, we do not investigate whether group affiliates should indeed face lower financing constraints, either from the lender's perspective or from a social welfare perspective. Group affiliates' better access to external funds may be because group affiliation signals high quality, but it may also be because the group has better access to the bureaucracy of the government-owned financial institutions. We also leave aside the issue of the allocation of funds to different projects within a firm or a group. Group affiliates and stand-alone companies may not be equally efficient in allocating funds to the most profitable projects, which may also affect their access to external funds.

In this chapter, we choose not to look at differences between affiliated firms, although this definitely is an interesting topic. An affiliate's access to external funds may be determined not just by affiliation *per se*, but also by the type of group to which it is affiliated. Group characteristics that may be of importance in this respect may be e.g. the degree of diversification, group size and group composition. Finally, given the difficulties in comparing investment-cash flow sensitivities across firms, to find a more conclusive answer to our research question, we will have to find other ways of assessing the impact of group affiliation on a firm's access to external funds.