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FINANCING AND INVESTMENT INTERDEPENDENCIES IN UNQUOTED BELGIAN COMPANIES:

THE ROLE OF VENTURE CAPITAL*

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Editorial

On May 27-28, 2002 the National Bank of Belgium hosted a Conference on *"New views on firms' investment and finance decisions"*. Papers presented at this conference are made available to a broader audience in the NBB Working Papers no 21 to 33.

Abstract

There is ample empirical evidence that investments in (public) companies are correlated with cash flow. This may either be explained as evidence of financing constraints (Fazzari, Hubbard and Petersen, 1988), as excessive conservatism by managers, restraining investments to the internally generated cash flow (Kaplan and Zingales, 2000). We test the investment-cash flow sensitivity in unquoted Belgian companies with a modified sales accelerator model, using unbalanced panel data and GMM techniques. We show that investments in tangible fixed assets are positively related to cash flow. Contrary to our expectations, this sensitivity is not reduced, but it increases, when companies receive venture capital. We interpret the results as evidence of the presence of financing constraints and underinvestment problems in unquoted companies. Venture capital intermediaries are not able to eliminate financing constraints in Belgian unquoted companies.

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1. INTRODUCTION

In a perfect financial market, funds are always available for positive net present value investment projects and firm value is independent of its financial structure. Investment and financing decisions can then be separated (Modigliani and Miller, 1958): there is always enough financing available for value-creating investment projects. Financial markets, however, are not perfect. In the presence of market imperfections, investors may ration capital and positive net present value projects may be denied financing, or only be able to obtain certain types of funding (Fluck, Holtz-Eaking and Rosen, 1998). This makes financing and investment decisions interdependent in the real world, and especially in entrepreneurial companies.

Fazarri, Hubbard and Petersen (1988) have initiated a substantial empirical literature showing a positive relationship between internally generated cash flow and capital spending (fixed plant and equipment) in quoted companies. Himmelberg and Petersen (1994) showed a comparable sensitivity of investments in research and development (R&D) to internal cash flow. There are several explanations for this sensitivity. First, firms may face a financing constraint due to information asymmetries, making that firms are unable to attract equity (Myers and Majluf, 1984) or debt (Stiglitz and Weiss, 1981) from outside parties to finance positive net present value projects. This has as a consequence that investments are restricted to the amount of internally generated cash flow. This is referred to as the underinvestment problem. Alternatively, the positive relation may be a consequence of investing excess cash in negative net present value projects rather than distributing it to the shareholders (Jensen, 1986), leading to an overinvestment problem. In a sample of large, quoted companies, Kaplan and Zingales (1997) show however that less constrained firms exhibit a higher sensitivity of investments to cash flow. They argue therefore that the positive relationship between cash flow and investments may be caused by excessive conservatism of managers (Kaplan and Zingales, 2000), or by non-optimizing behavior (Hines and Thaler, 1995).

Although there is a large body of empirical literature documenting the relationship between investments and cash flow in large, quoted companies, little is known about this relationship in young, unquoted companies. This relationship is interesting as young companies face high information asymmetries and therefore financing constraints are likely to be important (Gompers, 1995). The purpose of this paper is to empirically investigate the relationship between capital spending and internally generated cash flow in young, unquoted companies, and more specifically the role that venture capital intermediaries may play in this relationship. A sample of Belgian companies is used to test the relationship. First, an overview of the relevant literature is given and hypotheses are derived. Thereafter, the sample, the variables, and the method of analysis are described; the fourth section reports the results. Finally, conclusions and further research questions are proposed.

2. REVIEW OF THE LITERATURE

In the absence of capital market frictions, internal and external finance can be viewed as perfect substitutes. However, when managers possess private information about the investment opportunities of the firm this is no longer valid. Myers and Majluf (1984) argue that if outside suppliers of capital are not fully informed about the value of the firm's assets and investment opportunities, then the market may undervalue the firm's equity. Firms then prefer internal funds to external funds because the former are less costly. However, when internal funds are exhausted, firms that face finance constraints may reject positive net present value projects. This is referred to as the underinvestment problem, leading to a positive relationship between cash flow and investments: internally generated cash flow becomes an important determinant of investment spending (Vogt, 1994). We refer to Hubbard (1998) for an extensive overview of the empirical literature on the cash flow sensitivity of investments.

There is a second explanation for the positive relation between internally generated cash and investment spending, namely the free cash flow hypothesis (Jensen, 1986). Here the focus is on agency problems caused by the separation of ownership and control and the incentives that managers have to undertake actions that are not in the interest of the shareholders. Jensen (1986) argues that managers may pursue other goals than value maximization. In order to achieve their objectives, managers will spend internal funds on investment projects, even if these do not create value. Thus, the free cash flow that is at the discretion of the managers after profitable projects are undertaken may be invested in projects that increase firm size but destroy value. This is referred to as the overinvestment problem. There is evidence that reliance upon external funds (e.g. provided by capital markets or bank credit) may involve discipline and monitoring by the external financial party and thereby reduce overinvestment. For example, Goergen and Renneboog (2001) have shown that ownership structure does influence the cash flow/investment relationship. When industrial companies or families control large shareholdings, there is evidence of increased overinvestment. In contrast, large institutional holdings reduce suboptimal investing.

Kaplan and Zingales (2000) explain the positive relationship between cash flow and investments in a different way. They have shown that the positive relationship between cash flow and investments is stronger in firms that are not likely to be confronted with cash constraints

(Kaplan and Zingales, 1997). Possible explanations for their findings are excessive conservatism by managers, restraining investments to the internally generated cash flow (Kaplan and Zingales, 2000) or by non-optimizing behavior by managers (Hines and Thaler, 1995). Yet, a shortcoming of Kaplan and Zingales (1997, 2000) is that they assume that all companies are able to raise enough financing, but that the cost of external funding is higher for financially constrained companies due to their intrinsic characteristics. However, financial constrains may be more severe: information asymmetries may cause a firm to be denied outside (debt or equity) financing, even if the firm has positive net present value projects. Either a firm can attract outside financing, and then the relationship between cash flow and investment will be weaker, or it cannot, and then there will be a strong sensitivity of the level of investments to internally generated cash flows. In firms that face large information asymmetries, a positive relation between internally generated cash flow and investment is therefore likely to be evidence of cash constraints.

Venture capital (VC) companies, as financial intermediaries in private equity markets, help to close the funding gap by reducing information asymmetries. Amit et al. (1998) argue that one of the primary reasons for the existence of VC companies is their information processing capacities which may reduce information asymmetries, and hence adverse selection and moral hazard problems. The role of VCs is essentially to screen, contract, and monitor investments (Berger and Udell, 1998; Manigart and Sapienza, 1999) in order to minimize the costs of delegating decisions to entrepreneurs (agency and moral hazard costs) or to induce them to reveal critical information on their activities (reducing information asymmetries). Haubrick (1990), Rajan (1992), Admati and Pfleiderer (1994) and Reid (1996) stress the role of VC companies as inside investors in gaining private information on investment projects during both pre-investment screening and post-investment monitoring, thereby reducing information asymmetries between entrepreneurs and investors. This allows VC companies to invest profitably in projects that uninformed outsiders reject and hence to reduce the underinvestment problem. Investments of VC backed companies are thus likely to be less constrained by internal cash flow generation than those of comparable non-VC backed companies.

Postinvestment monitoring by VC companies, e.g. through a seat on the board of directors, also reduces overinvestment problems of cash rich companies, because it prevents managers from undertaking actions that are not in the interest of the company. For example, Sapienza, et al. (1996) found evidence that venture capitalists' monitoring increases in response to agency risks. Monitoring leads to better information availability for venture capitalists, early problem detection and effective decision making in VC backed companies (Mitchell et al., 1997). Well-performed monitoring by venture capitalists should reduce the divergence of interests between managers and outside investors, and should thus reduce the overinvestment problem (Goergen and Renneboog, 2001). Therefore, VC backed companies which generate excess cash are less likely to invest in negative NPV projects than non-VC backed companies, as the former are closely monitored by the VCs during the whole investment process. Companies, backed by VC firms, are therefore less likely to have problems with under- and overinvestment. Foregoing leads to following hypothesis:

> *Hypothesis 1:* The positive relation between internally generated cash flows and investments is attenuated when a VC firm invests in a company. On the one hand, liquidity constraints are relaxed thanks to reduced information asymmetries, and on the other hand the free cash flow problem is attenuated thanks to increased monitoring by outside shareholders.

The reduced sensitivity of VC backed companies to internally generated cash flow is likely to be more pronounced for young companies than for more mature companies. Information asymmetries and therefore finance constraints are especially important in the early life of a company (Amit et al., 1998). Yet, young and high growth companies often develop products and ideas that require substantial capital, exceeding the internally generated cash flows or entrepreneurs' own funds, especially in the formative stage of their firm's life cycle (Gompers, 1995). Companies with large information asymmetries, that lack tangible assets that might serve as collateral for bank debt and that are associated with significant ex ante uncertainty about their cash flows, are moreover unlikely to receive significant bank loans (Maier and Walker, 1987 ; Gompers, 1995 ; Admati and Pfleiderer, 1994). Younger companies are therefore more likely to be cash constrained than older companies. The information processing capacities of VC firms should enable VC backed companies to reduce the large information asymmetries. This leads to following hypothesis:

> *Hypothesis 2:* The positive relation between internally generated cash flows and investments is more attenuated in young VC backed companies than in mature VC backed companies.

3. METHOD OF ANALYSIS

3.1 Sample and research design

Foregoing hypotheses will be tested on a sample of unquoted Belgian VC backed companies and comparable (matched) non-VC backed companies. In contrast with the U.S. where most studies on the relation between cash flow and investments have been done, Belgium has a

Continental European financial system. Only a minority of Belgian firms are quoted on a stock exchange, while the most important source of external financing is debt, and more specifically bank loans. The venture capital industry, however, is quite well developed in Belgium. The first player on the market, namely GIMV, was established and financially backed by the Flemish government in 1980 ; the first private VC firms emerged in the mid-eighties (Ooghe et al., 1991). Since then, the Belgian VC market has grown at a steady rate, while it has shown an exponential growth in 1998-1999, as in most European countries, followed by a slowdown in 2000 (statistics of the European Venture Capital Association, EVCA). Investments by Belgian private equity companies equalled 0.288% of GDP in 1999 and 0.231% of GDP in 2000, while this was 0.383% in Europe on average. However, Belgian VC companies are quite active in early stage and in high tech investments compared to their European colleagues. For example, 58.7% (in 1999) and 70.8% (in 2000) of all private equity investments in Belgium went to high tech companies, compared to European averages of 25.6% in 1999 and 31.4% in 2000. Of all funds raised in 2000 by Belgian private equity firms, 97.9% is allocated to early stage and expansion investments. This compares to a mere 46.1% in Europe as a whole, where (management) buy-out, replacement capital and other later stage transactions are more prevalent (EVCA, 2001).

A sample of VC backed companies is constructed using secondary sources. Yearly accounts of VC firms, press clippings, press releases and websites are used to identify Belgian companies that received VC between 1987 and 1997. The total sample is composed of 859 companies, representing 56% of the total number of investments in Belgium from 1987 to 1997 (EVCA statistics). After excluding companies in the financial sector and holding companies, and companies for which the yearly accounts are not found in the files of the National Bank of Belgium, 565 companies remain (see also Manigart, Baeyens and Van Hyfte, 2002).

Following Megginson and Weiss (1991) and Lerner (1999), each VC backed company is matched with a non VC backed company on following criteria, measured in the year before the VC funding (or the year of VC funding, for the companies that received VC from their inception) : activity (NACE-code), size (with total assets as proxy), and stage. The pre-investment situation of the VC backed companies is used, so as not to introduce a size bias caused by the funding itself. For matching purposes, a start-up company is defined as a company at most 2 years old at the time of funding, an early stage company is between 3 and 5 years old at the time of funding and a mature company is older than 5 years at the time of funding.

The main data for the study are the yearly accounts of the companies, from the year of the investment up to at most 5 years after the initial investment or up to 1999. This yields an unbalanced panel with 4991 company-year data. For each company-year, more than 50 variables from the financial accounts (balance sheet, profit and loss statement, and additional information) are recorded. Moreover, for each company, it is known whether it still exists as an independent entity, whether and when it has gone bankrupt, been involved in a merger or acquisition, been closed or split. This set-up allows us to include surviving (successful) and failing (unsuccessful) companies, in contrast to most studies of this type.[1] Including both surviving and non-surviving companies eliminates a positive survivor bias and increases the validity of the results.

3.2 The model

Goergen and Renneboog (2001) distinguish four classes of empirically testable models of the investment/cash flow sensitivity. In the neoclassical models, the relative cost of capital is the main determinant of corporate investment:

Investment level = f (Capital cost, cash flow, other variables)

A widely used model is the sales accelerator model (Deloof, 1998; Mairesse et al., 1999), where it is assumed that investment grows along with total sales as a measure of the output of a company:

Investment level = f (Sales, cash flow, other variables)

In foregoing models, a positive relation between investment and cash flow is assumed to be evidence of liquidity constraints. However, these models do not include forward-looking variables: they do not incorporate expectations about the future profitability of investments (Mairesse et al., 1999). Models incorporating Tobin's Q take the future into account, as the expectation of future profitability is captured by the forward-looking stock market valuation :

Investment level = f(Tobin's Q, cash flow, other variables)

Finally, Euler-equation models (Bond and Meghir, 1994 a, b) assume that the level of investment is a function of discounted expected future investment adjusted for the impact of the expected changes in the input prices and net marginal output :

Investment $level_t$ = f(Investment $level_{t-1}$, cash flow, sales, other variables)

We use a modified accelerator model (Mairesse et al., 1999) to test the relationship between investments in tangible fixed assets and cash flows. In this traditional model, it is assumed that, in

1 Manigart, Baeyens and Van Hyfte (2002) have shown that 44% of Belgian VC backed companies do not exist as an independent entity 9 years after the investment, due to bankruptcy, closure, acquisition or other causes.

the long run, investments grow along with total output of the firm as measured by sales and the capital cost:

$$\log(K_{it}) = \alpha_t + \beta*\log(\text{sales}) - \sigma* \log(\text{capital cost})$$

with:
K_{it}: capital stock for firm i at time t

Taking the first difference and assuming $\Delta \log (K_{it}) \approx I_{it}/K_{i,t-1} - \delta$ leads to:

$$I_{it}/K_{i,t-1} = \delta + \beta*\Delta\log (\text{sales}) - \sigma*\log(\text{capital cost})$$

The cost of capital, difficult to measure, is in general proxied by time dummies and firms' specific effects (Cincera, 2002). Following Fazzari et al. (1998), foregoing model is augmented by cash flow effects as an indication of internal finance, in order to test the presence of financial constraints.

Investments are estimated as a function of sales (and lagged sales) and cash flow (and lagged cash flow). As a large number of companies in our database do not report sales, value added is used as a proxy of output, rather than sales (Cincera, 2002; Van Cayseele, 2002). Given the increased importance of outsourcing non-core activities and refocusing on core competences, value added may well be a better proxy of firm output than sales. Investments, value added and cash flow are scaled by beginning-of-year net fixed assets (or capital stock) (Mairesse et al., 1999). The model used here is then:

$$(\frac{I_{it}}{K_{i,t-1}})_{\text{tang}} = \alpha + \beta_1 * (\frac{I_{it-1}}{K_{i,t-2}})_{\text{tang}} + \beta_2 * \Delta\log VA_{it} + \beta_3 * \Delta\log VA_{i,t-1} + \beta_4 * \frac{CF_{it}}{K_{i,t-1}} + \beta_5 * \frac{CF_{i,t-1}}{K_{i,t-2}} + \varepsilon_{it}$$

with :

$I_{it} =$ investment of firm i in period t in tangible fixed assets

$K_{i,t-1} =$ beginning-of-year net fixed assets

$GM_{it} =$ value added of firm i during period t

$CF_{it} =$ cash flow of firm i in period t

We control for future firm-specific investment opportunities by not only including lagged value added, but also adding past investments in intangible assets to the model It can be argued that past investments in research and development (Van Cayseele, 2002; Titman and Wessels, 1988; Cincera, 2002) indicate the growth potential and future profitability of companies. As a large number of companies in our database do not report investments in research and development, past investments in intangible assets is used as a proxy of future investment opportunities, leading to following model :

$$(\frac{I_{it}}{K_{i,t-1}})_{tang} = \alpha + \lambda * (\frac{I_{it-1}}{K_{i,t-2}})_{intang} + \beta_1 * (\frac{I_{it-1}}{K_{i,t-2}})_{tang} + \beta_2 * \Delta \log VA_{it} + \beta_3 * \Delta \log VA_{i,t-1} + \beta_4 * \frac{CF_{it}}{K_{i,t-1}} + \beta_5 * \frac{CF_{i,t-1}}{K_{i,t-2}} + \varepsilon_{it}$$

The effect of receiving VC funding on the relationship between cash flow and investment is measured by including (VC * CF_{it})/$K_{i,t-1}$, where VC is a dummy that takes value 1 if a company is VC backed or 0 else. Our central hypothesis is supported if the coefficient of the cross term is negative.

As a check of the robustness of the findings, the hypotheses are tested in another way. The sample is split in two subsamples, one consisting of all VC backed companies and the second one consisting of all non-VC backed companies. The model is then estimated in each subsample separately. The hypothesis is supported if the cash flow coefficient is significantly positive in the subsample of non-VC backed companies and not significant or significantly smaller in the subsample of VC backed companies.

Foregoing models are tested on the total sample and on the sample of young and of mature companies separately, in order to test hypothesis 2. For this purpose, young companies are defined as start-up and early stage companies, i.e. companies that are at most five years old at the time of VC funding. Mature companies are later stage companies that are more than five years old at the time of VC funding.

3.3 Method of analysis

Data have been analysed with unbalanced panel data techniques and with GMM. Unbalanced panel data techniques are used, because not all companies remain in the database for five years.[2] The econometric model is the usual linear regression model with firm effects and year effects:

[2] We have tested the investment model up to 3 years after venture capital investment, up to 4 years after venture capital investment and up to 5 years after venture capital investment. The results are consistent across the time frame considered. We report the models up to 5 years after venture capital investment.

$$y_{it} = x_{it}\beta + \alpha_i + \delta_t + \varepsilon_{it} = x_{it}\beta + \eta_{it}$$

with $i = 1,...,N$ (N = number of companies)

$t = 1, ..., T$ (T = number of years)

y_{it} = dependent variable (investments in tangible fixed assets/beginning-of-year tangible and intangible fixed assets)

x_{it} = the vector of the explanatory variables (including lagged y_{it})

α_i = firm-specific effects

δ_i = time-specific effects

ε_i = disturbance term

The overall disturbance term η_{it} in this model consists of firm effects, α_i, time effects, δ_i, and idiosyncratic pure disturbances. This overall disturbance term accounts for a variety of specification errors. Because the number of years, T, is small (in our case, between 2 to 5) and the number of firms, N, is reasonably large (between 124 and 598), the time-specific effects are estimated simply by including a full set of time dummies in all models. We focus rather on the treatment of the "permanent" differences across firms, the αi. Potential correlations between the explanatory variables, x_t's, and the frim-specific effects, α_i's can lead to potential biases in the parameters β. These biases can be corrected by using the within firm transformation or by first differencing, which removes firm-specific effects.

As Mairesse et al. (1999) indicate, the within or first differenced estimates of traditional panel data analyses can still be biased due to: (1) random measurement errors in the explanatory variables x_{it} , (2) simultaneity between the contemporaneous x_{it} and the contemporaneous disturbance ε_{it}, (3) endogeneity of the contemporaneous x_{it} with respect to the past disturbances. The use of instrumental variables can correct these three potential biases. An instrument is a variable that can be assumed to be uncorrelated with the models error, but correlated with the variable itself (Verbeek, 2000). More specifically, we apply the generalized method of moments (GMM) estimator proposed by Arellano and Bond (1991). Here firm-specific effects are first removed by forming first differences. In such a model, endogenous variables lagged two or more periods will be valid instruments provided there is no serial correlation in the time-varying component of the error terms in equation. We test for serial correlation in the first difference residuals to make sure that this condition is met. We also test for instrument validity using a Sargan test of over-identifying restrictions. We refer to Mairesse et al. (1999) for a fuller account of the GMM techniques.

In this study, we first analyse the investment – cash flow relation using panel data techniques. Thereafter GMM techniques are used. Because the variables in the GMM analyses are first differenced variables and therefore more lags of the variables are needed, the sample that can be used to perform GMM is smaller than that of the panel data analyses. In order to be sure that potential differences in the results of the panel data and the GMM analyses are due to the technique that is used – and not because of a different sample of observations - the results of panel data analyses on the smaller GMM sample are also reported in Appendix. GMM analyses are conducted on the total and mature sample only. GMM analyses are not appropriate to study the sample of young companies because too much lags – which are not available for young companies - are needed.

Table 1, panels A and B, shows how the final samples for panel data and GMM are constructed. First, company-year data with negative cash flows or negative investments are removed from the unbalanced panel of 4991 observations. Especially young companies often have negative cash flows and/or negative investments. For example, as much as 83% (515 of 618 companies) of the young companies in our sample have negative cash flows in at least one year, compared to 42% of the mature companies. In the sample of young companies 77 % (479 of 618 companies) of the firms has diinvested in at least one year, compared to 31 % of the mature companies have . Company-year data with missing values are also removed. Due to missing values of at least one of the variables in the analyses, almost 40% of the young companies' observations are lost for panel data analyses. From the remaining observations, company-year data with outliers are filtered using a 0.5 % top and bottom percentile.[3] Finally, companies that have an insufficient number of company-year data are removed from the sample. Whereas panel data analyses require at least 2 observations per company, for GMM analyses at least 3 observations are needed. The final sample for the panel data analyses consists of 598 companies of which 261 are young companies and 337 are mature companies. For the GMM analyses only two third or 402 companies remain. Slightly more VC backed than non VC backed companies are lost.

3.4 The variables

The computation of the variables is given in appendix 1. Table 2 reports the basic statistics of the dependent and independent variables (in the sample used for panel data analyses).[4] Despite careful matching, the absolute amounts of investments in tangible assets by VC backed companies

3 We also used other filters for outliers. They did not have an impact on our main conclusions.
4 The basic statistics of the dependent and independent variables in the smaller sample used for the GMM analyses is given in appendix 3. The main conclusions with respect to the variables are the same for both samples.

are significantly larger, compared to those of their non VC backed counterparts. Also value added and cash flows are larger for VC backed firms. When scaling these variables to beginning of year fixed assets, we see that there is no significant difference in investments in tangible assets between VC companies and non-VC backed counterparts (panel A). This is counterintuitive : common wisdom goes that VC backed companies have more investment opportunities and thus have a higher investment rate. Therefore, we have taken a closer look at the investment behaviour of the companies in the sample. Appendix 2 gives the amount invested in tangible assets for every year after VC funding.[5] Not surprisingly, VC backed companies invest more in the year they receive VC funding (year 0). Investments of VC backed companies (median value : 39.9 % of beginning of year fixed assets, K) are significantly higher than those of non-VC backed companies (median value: 26.7 % of K). In later years, however, there is no significant difference between the investment behaviour of VC backed and non-VC backed companies, although both the median and mean investment of VC backed companies is lower in all the years following the funding.[6] It seems that receiving VC has only a short-term effect on investment behavior, with significantly higher investments in the year of VC funding and (not significantly) lower investments thereafter.

Looking at the investment behavior of young and mature companies separately yields the same conclusions (table 2 and appendix 2, panels B and C). Especially young VC backed companies invest more during the year of VC funding. Whereas the median investment of non-VC backed companies is 27% of K, the median investment of young VC backed companies in the year of funding is more than twice this ratio (56% of K) and that of mature VC backed companies is 34% of K. Moreover, the mean investment of young VC backed companies in the year of funding is as large as 151% of K, which is more than three times the mean investment of young non-VC backed companies (49% of K). After the year of participation non-VC backed companies tend to invest slightly larger amounts, however not significantly so.

Table 2, panel A, further shows that the (lagged) investments in intangible assets are significantly larger for VC backed companies, compared to non-VC backed companies. Whereas non-VC backed companies invest on average 2% of K in intangible assets, VC backed companies invest on average up to 5% of K in intangibles. This indicates that VC backed companies may have larger growth opportunities than VC backed companies, although this is not followed by more investments in tangible assets (cfr. supra). The growth in value added (? log VA) is significantly

5 The basic statistics of investments in tangible assets by year after VC participation in the smaller sample used for GMM analyses is given in appendix 4. The main conclusions with respect to the variables are the same for both samples.

6 VC backed companies invest significantly less than non-VC backed companies in the fourth year after they receive VC funding.

higher for VC backed companies than for non-VC backed companies: VC backed companies have a growth in the log of value added of 8.8% (median value), compared to 4.6% for non-VC backed companies. Yet, the value added (not shown in the table) and the cash flow are significantly higher for non-VC backed companies. Non-VC backed companies have a median value added of 2.1 times K, compared to a median value added of 1.6 times K for VC backed companies. Whereas for non-VC backed companies the median cash flow is 47% of K, cash flows of VC backed companies are 40% of K. The same conclusions hold for the subsamples of mature companies on the one hand and of young companies on the other hand.

We may conclude that, while investments in tangible assets by VC backed firms are not significantly different from those of non-VC backed (except for the year of VC funding), investments in intangible assets are significantly larger for VC backed companies. Value added and cash flows, on the contrary are significantly larger for non-VC backed companies. Yet, VC backed companies have a significantly higher growth of their value added, consistent with the finding that they may have higher growth opportunities thanks to their higher investments in intangibles. However, growth opportunities in value added are not followed by growth in tangible assets. It seems that companies use VC to increase current expenses (e.g. expenses for prototyping, establishing market presence, distribution channels, …) to build their company, as evidenced by their smaller value added and cash flows, rather than for investments in fixed assets.

4. ANALYSIS AND RESULTS

Table 3, panels A, B and C give the panel data estimates of the investments in tangible fixed assets for the total sample, the sample of young companies and the sample of mature companies respectively.[7] As the Hausman (1978) test statistics indicate that the fixed effects models are to be used, we do not report the random effects models.

Table 4, panels A and B give the GMM analyses for the total sample and the sample of mature companies. The consistency of the GMM estimators relies on the assumption that the error term in levels lacks serial correlation. The error term in the first difference equation should therefore show MA(1) properties; that is, we expect a first order serial correlation, but no second order serial correlation. The m(1) and m(2) statistics of Arellano and Bond (1991), reported in Table 4, indicate a first order serial correlation and reject second order serial correlation, consistent with conditions for consistent estimators. Another specification test is the Sargan test for overidentified restrictions. As shown in table 4 this test does not reject the null hypothesis that the model is correctly specified and that the instruments are uncorrelated with the residuals for the GMM estimations. We can therefore conclude that there is no misspecification in our GMM models.

The first half of tables 3 and 4 gives the estimates of the limited model without investment in intangible assets (as proxy for investment opportunities) as independent variable, while the estimates of the expanded model, including investment in intangible assets, is given in the second half of tables 3 and 4. An examination of the first and second halves of tables 3 and 4 shows that there are only small, non-significant differences between the models with and without investment in intangible assets. The coefficient of the investment in intangible assets is never significant. In the remainder of the paper, we will concentrate on the more elaborate models including investment in intangible assets.

Panel data analyses show that the output accelerator model explains variation in investments in tangible assets. Indeed, the sum of the coefficients of value added and value added lagged is significant and positive in all models (table 3). Investments in tangible assets grow with increasing value added, as well in VC backed companies as in non-VC backed companies. In more refined GMM analyses, however, the sum of the value added coefficients is not significant in most models (table 4) and when it is significant, it is even negative. Comparing the results of the panel data analyses in the expanded sample (table3) and in the reduced GMM sample (appendix 4) shows that the difference in the findings for the coefficient of the value added is caused by the more limited sample in the GMM analyses, rather than with the different econometric estimation procedure. As the investment-output relationship is not our core interest in this paper, we do not further investigate this difference.

Investments in tangible assets are significantly and positively related to cash flows, generated in the same and in the previous year, as the sum of the CF coefficients is significant and positive in all (sub)samples, in all models and estimated with both estimation techniques. The cash flow coefficients are large compared to those found in other studies ; in the GMM specification they are close to one. This may hint that there are large liquidity constraints in the companies in our sample. These companies are smaller than in most of the other studies dealing with the investment-cash flow relationship. Our results therefore may be interpreted as evidence of the existence of severe liquidity constraints in small, unquoted companies.

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[7] Appendix 5 gives the panel data estimates for the smaller sample used for the GMM analyses.

Contrary to hypothesis 1, the sum of the VC*CF coefficients (total sample) is positive and significant in the panel data estimation (table 3, panel A), but not significant in the GMM estimation (table 4, panel A). Yet, the sum of the CF coefficients in the sample of VC backed companies is considerably higher than the sum of the CF coefficients in the sample of non-VC backed companies in all specifications. These results indicate that hypothesis 1 is not supported for unquoted Belgian companies: the positive relation between internally generated cash flows and investments is not attenuated when VC invest in a company. On the contrary, despite VC funding investments by VC backed companies appear to be more cash constrained than their VC backed counterparts. Our results hold also in the model with investments in intangible assets as proxy for better investment opportunities. Despite the information processing capacities of venture capitalists and the increased legitimacy they provide to their portfolio companies, they are not able to eliminate the investment-cash flow sensitivity in small, unquoted companies.

When the sample is split between young and mature companies (table 3, panels B and C and table 4, panel B), foregoing results are even stronger. The positive relation between investments and past and current cash flow is positive and significant in all specifications (including GMM for mature companies), and this relation is considerably stronger for VC backed companies compared to non VC backed companies, even after controlling for investment opportunities. Our results do not support hypothesis 2: venture capital funding does not decrease the investment–cash flow sensitivity, neither for young (only panel data estimates)[8], nor for mature companies. The panel data analyses show higher coefficients for VC * Cash Flow in the samples of young (value of 0.604) companies than in the sample of mature companies (value of 0.353). In the split samples, the young VC backed companies have the highest cash flow coefficient, followed by the mature VC backed companies. Hypothesis 2 is clearly not supported. Receiving venture capital does not reduce the sensitivity of investments in tangible assets to the internally generated cash flow, on the contrary. Surprisingly, this sensitivity is smallest for young, non-VC backed companies.[9]

5. DISCUSSION AND CONCLUSIONS

One of the primary reasons for the existence of VC companies is their capacity to process information, thereby reducing information asymmetries. The role of VC companies consists basically of pre-investment screening, post-investment monitoring and value-adding (Manigart and Sapienza, 1999). If they perform these roles well, then VC funding should lead to the reduction of

8 GMM models cannot be estimated on the sample of young companies (cfr. supra).
9 This conclusion should be interpreted cautiously, as panel data analyses are not the econometrically best estimation technique for the problem at hand.

both under- and overinvestment problems. Pre-investment screening should allow venture capitalist to invest profitably in projects that would be turned down by uninformed investors, hence reducing financing constraints and underinvestment problems. Moreover, post-investment monitoring should reduce overinvestment problems of cash rich companies. We therefore expect that investments by venture capital backed companies will be less sensitive to the available amount of internally generated cash flow than investments in comparable companies that did not receive VC.

We find that, with exception of the year of funding, VC backed companies do not invest more in tangible assets, but they have lower value added and cash flows than non-VC backed companies. This may be explained by the fact that VC backed companies increase their expenses in order to build their company (prototyping, establishing market presence, distribution channels, …). These are, however, not reported as investments in yearly accounts. Investments in intangible assets are higher (but still quite small and unimportant) for VC backed companies. Receiving VC thus leads to higher expenses and higher investments in intangibles. These types of expenses are difficult to finance wiht debt, given that they yield no collateral for the debtor. Receiving VC helps a company to finance these needs, for which attracting ohter sources of financing may prove to be the most difficult.

Yet, we show that the empirically well documented sensitivity of investments in fixed assets to internally generated cash flow holds in a sample of unquoted Belgian companies. Contrary to our expectations, however, VC backed companies - both young and mature - are more cash constrained than their non-VC backed counterparts. This finding holds when controlling for the availability of firm-specific investment opportunities. We interpret these results as evidence of the presence of more severe financial constraints for VC backed companies than for non-VC backed companies.

Especially young companies are likely to face severe financial constraints for several reasons. There are no internally generated funds accumulated in the past. Information asymmetries are high, as there is no history of past performances. Risk is considerably higher than in existing companies, as it is well documented that bankruptcy rates are considerably higher for young companies than for older, established companies due to, among other factors, low legitimacy of new companies and the fact that routines are not yet established. This makes that external funding – either equity or debt - is often not available for those companies, implying that the cost of external funding is infinite. Given the likelihood of financial constraints in a young firm, we interpret the high sensitivity of investments to the available internal cash flow in young VC backed companies as evidence of the existence of severe liquidity constraints. It is likely that the unavailability of funding leads to underinvestment in VC backed companies, as they limit their investments to the level of internally generated cash flow. Our findings show that funding provided by VC funds is not able to eliminate financing constraints for investments in fixed assets. Despite the fact that VC firms decrease information asymmetries and increase the legitimacy of their portfolio companies, they are not able to reduce liquidity constraints. Apparently, receiving VC funding alone does not provide companies with the necessary financing, eventually from other sources, to pursue their investment opportunities in fixed assets. This calls into question the efficiency of the Belgian VC industry in reducing information asymmetries and play their key roles of financial intermediaries. It is an open question whether this finding is specific for the Belgian VC industry or applies to the VC industry in other countries as well. Yet, VCs seem to play a positive role in financing more intangible assets and expenses.

Appendix 1.
Variable definition

	Variable	Measure
$(I_{it} / K_{i,t-1})_{tangible}$	Investments in tangible fixed assets scaled by beginning-of-year intangible and tangible fixed assets	[acquisition value + sales and disposals (<0) + revaluation surplusses of acquisitions from third parties - depreciations and amounts written down (<0) of tangible fixed assets] / [beginning-of-year stock of intangible and tangible fixed assets]
$(I_{it} / K_{i,t-1})_{intangible}$	Investments in intangible fixed assets scaled by beginning-of-year intangible and tangible fixed assets	[acquisition value + sales and disposals (<0) + revaluation surplusses of acquisitions from third parties - depreciations and amounts written down (<0) of intangible fixed assets] / [beginning-of-year stock of intangible and tangible fixed assets]
$\Delta \log VA$	First difference of log value added	
$\Delta \log VA_{i,t-1}$	First difference of lag of log value added	
$CF_{it} / K_{i,t-1}$	Cash flow scaled by beginning-of-year intangible and tangible fixed assets	[Cash generated (or used), after dividend payout, not taking into account the changes in long term or short term financing, changes in working capital, investments in fixed assets and the sales of fixed assets]/ [beginning-of-year stock of intangible and tangible fixed assets]
$CF_{i,t-1} / K_{i,t-2}$	Lag of cash flow scaled by beginning-of-year intangible and tangible fixed assets	Lagged variable of cash flow scaled by beginning-of-year intangible and tangible fixed assets
VC	Venture capital	Dummy variable: =1, when firm received VC financing between 1987 and 1997; =0 else
$VC*[CF_{it} / K_{i,t-1}]$	Cross term of VC and cash flow scaled by beginning-of-year intangible and tangible fixed assets	VC multiplied by cash flow scaled by beginning-of-year intangible and tangible fixed assets
$VC*[CF_{i,t-1} / K_{i,t-2}]$	Cross term of VC and lag of cash flow scaled by beginning-of-year intangible and tangible fixed assets	VC multiplied by lag of cash flow scaled by beginning-of-year intangible and tangible fixed assets

Appendix 2

Basic statistics of investments in tangible assets $(Ii,t / Ki,t\text{-}1)_{tang}$ by year after VC participation

Panel A: total sample

Year after VC	VC + non VC						VC			non VC			Sign.
participation	# observations	Median	Mean	St. Dev.	Minimum	Maximum	Median	Mean	St. Dev.	Median	Mean	St.Dev.	
0	350	0.310	0.665	1.093	0.004	9.391	0.399	0.899	1.432	0.267	0.477	0.659	***
1	414	0.299	0.537	0.749	0.007	5.997	0.285	0.596	0.944	0.301	0.492	0.556	
2	442	0.262	0.532	0.943	0.002	10.220	0.246	0.442	0.691	0.271	0.605	1.103	
3	448	0.240	0.480	0.693	0.003	6.131	0.223	0.428	0.639	0.251	0.526	0.736	
4	388	0.236	0.463	0.749	0.003	5.328	0.205	0.403	0.656	0.278	0.517	0.823	*
5	304	0.208	0.398	0.601	0.003	4.473	0.249	0.504	0.792	0.187	0.300	0.313	

Panel B: mature companies

Year after VC	VC + non VC						VC			non VC			Sign.
participation	# observations	Median	Mean	St. Dev.	Minimum	Maximum	Median	Mean	St. Dev.	Median	Mean	St.Dev.	
0	276	0.289	0.594	0.844	0.004	5.767	0.342	0.740	0.992	0.260	0.475	0.681	**
1	283	0.296	0.501	0.697	0.007	5.997	0.265	0.589	0.924	0.300	0.432	0.433	
2	262	0.274	0.500	0.879	0.008	10.220	0.266	0.401	0.469	0.292	0.583	1.106	
3	248	0.246	0.468	0.675	0.003	6.131	0.246	0.435	0.676	0.245	0.497	0.675	
4	211	0.239	0.431	0.624	0.003	4.910	0.207	0.450	0.767	0.286	0.414	0.468	
5	161	0.254	0.417	0.613	0.006	4.473	0.259	0.510	0.802	0.245	0.332	0.348	

Panel C: young companies

Year after VC	VC + non VC						VC			non VC			Sign.
participation	# observations	Median	Mean	St. Dev.	Minimum	Maximum	Median	Mean	St. Dev.	Median	Mean	St.Dev.	
0	74	0.398	0.931	1.714	0.001	9.391	0.564	1.515	2.419	0.267	0.485	0.579	***
1	131	0.324	0.613	0.847	0.010	5.649	0.337	0.613	0.999	0.315	0.613	0.734	
2	180	0.219	0.578	1.030	0.002	7.511	0.180	0.504	0.931	0.237	0.636	1.103	
3	200	0.226	0.494	0.717	0.003	5.292	0.208	0.419	0.595	0.310	0.563	0.808	
4	177	0.230	0.501	0.876	0.005	5.328	0.176	0.351	0.503	0.246	0.647	1.109	
5	143	0.168	0.376	0.588	0.003	4.177	0.178	0.496	0.786	0.159	0.264	0.266	

Significance level of Wilcoxon rank sum test (two tailed): * $0.050 \leq p < 0.100$; ** $0.010 \leq p < 0.050$; *** $0.0001 \leq p < 0.010$

Appendix 3

Basic statistics of dependent and independent variables for the smaller GMM sample

Panel A: total sample

	VC + non VC					VC			non VC			
	Median	Mean	St.Dev.	Minimum	Maximum	Median	Mean	St. Dev.	Median	Mean	St.Dev.	Sign.
$(I_{i,t} / K_{i,t-1})_{tang}$	0.263	0.488	0.735	0.002	8.049	0.251	0.496	0.807	0.279	0.482	0.673	
$(I_{i,t-1} / K_{i,t-2})_{tang}$	0.276	0.566	0.973	0.003	11.314	0.270	0.568	0.943	0.278	0.566	0.996	
$(I_{i,t-1} / K_{i,t-2})_{intang}$ (1)	0.000	0.030	0.127	0.000	1.378	0.000	0.046	0.157	0.000	0.017	0.094	****
Δ log $VA_{i,t}$	0.058	0.064	0.238	-1.129	1.292	0.071	0.084	0.240	0.046	0.049	0.236	***
Δ log $VA_{i,t-1}$	0.074	0.091	0.250	-1.102	1.320	0.099	0.119	0.268	0.059	0.069	0.232	****
$CF_{it} / K_{i,t-1}$	0.435	0.658	0.708	0.013	5.842	0.397	0.590	0.616	0.476	0.712	0.769	***
$CF_{i,t-1} / K_{i,t-2}$	0.459	0.700	0.771	0.008	8.112	0.417	0.634	0.691	0.499	0.753	0.825	***
# observations	1756					777			979			
# firms	402					179			223			

Panel B: mature companies

	VC + non VC					VC			non VC			
	Median	Mean	St.Dev.	Minimum	Maximum	Median	Mean	St. Dev.	Median	Mean	St.Dev.	Sign.
$(I_{i,t} / K_{i,t-1})_{tang}$	0.271	0.476	0.677	0.003	6.131	0.252	0.489	0.748	0.288	0.465	0.614	
$(I_{i,t-1} / K_{i,t-2})_{tang}$	0.276	0.526	0.833	0.003	11.314	0.263	0.525	0.764	0.286	0.527	0.885	
$(I_{i,t-1} / K_{i,t-2})_{intang}$ (2)	0.000	0.023	0.103	0.000	1.333	0.000	0.037	0.0132	0.000	0.011	0.070	***
Δ log $VA_{i,t}$	0.053	0.057	0.222	-1.119	1.274	0.069	0.074	0.214	0.041	0.043	0.228	***
Δ log $VA_{i,t-1}$	0.068	0.078	0.225	-1.102	1.274	0.087	0.098	0.226	0.056	0.062	0.222	***
$CF_{it} / K_{i,t-1}$	0.437	0.665	0.721	0.013	5.841	0.407	0.597	0.602	0.467	0.720	0.799	**
$CF_{i,t-1} / K_{i,t-2}$	0.454	0.698	0.769	0.008	8.112	0.420	0.630	0.637	0.495	0.752	0.856	***
# observations	1252					555			697			
# firms	275					122			153			

Significance level of Wilcoxon rank sum test (two tailed): ** $0.010 \leq p < 0.050$; *** $0.0001 \leq p < 0.010$; **** $p < 0.0001$

Appendix 4

Basic statistics of investments in tangible assets $(Ii,t / Ki,t-1)_{tang}$ by year after VC participation for the smaller GMM sample

Panel A: total sample

Year after VC	VC + non VC						VC			non VC			Sign.
participation	# observations	Median	Mean	St. Dev.	Minimum	Maximum	Median	Mean	St. Dev.	Median	Mean	St.Dev.	
0	230	0.325	0.660	1.004	0.004	8.049	0.372	0.822	1.257	0.310	0.539	0.747	*
1	296	0.298	0.489	0.657	0.008	5.649	0.285	0.538	0.854	0.302	0.451	0.449	
2	336	0.260	0.477	0.709	0.002	5.225	0.235	0.382	0.433	0.274	0.554	0.862	
3	352	0.243	0.497	0.726	0.003	6.131	0.222	0.449	0.697	0.268	0.535	0.748	
4	305	0.238	0.432	0.657	0.003	5.055	0.207	0.400	0.664	0.278	0.458	0.653	
5	237	0.209	0.395	0.638	0.003	4.472	0.202	0.498	0.876	0.212	0.310	0.314	

Panel B: large companies

Year after VC	VC + non VC						VC			non VC			Sign.
participation	# observations	Median	Mean	St. Dev.	Minimum	Maximum	Median	Mean	St. Dev.	Median	Mean	St.Dev.	
0	197	0.323	0.609	0.832	0.004	5.131	0.341	0.713	0.915	0.303	0.531	0.759	
1	241	0.295	0.472	0.609	0.008	4.982	0.263	0.521	0.789	0.299	0.434	0.421	
2	241	0.269	0.458	0.645	0.008	5.225	0.258	0.374	0.426	0.287	0.527	0.776	
3	234	0.246	0.474	0.689	0.003	6.131	0.235	0.434	0.699	0.257	0.506	0.682	
4	194	0.236	0.430	0.634	0.003	4.911	0.205	0.450	0.795	0.286	0.413	0.468	
5	145	0.252	0.399	0.617	0.006	4.473	0.252	0.481	0.832	0.254	0.326	0.339	

Significance level of Wilcoxon rank sum test (two tailed): * $0.050 \le p < 0.100$;

Appendix 5.
Results of panel data analyses for the smaller GMM sample
Panel A: total sample

	Total Sample	VC backed	Non VC backed	Total Sample	VC backed	Non VC backed
Intercept	-0.044	-1.984 ****	-0.114	-2.083 ****	-1.967 ****	-0.169
$(I_{i,t-1} / K_{i,t-2})_{tang}$	-0.088 ****	-0.114 ***	-0.067 ***	-0.092 ****	-0.120 ***	-0.071 ***
$(I_{i,t-1} / K_{i,t-2})_{intang}$				0.193	0.207	0.119
Δ log $VA_{i,t}$	0.196 **	0.404 ****	0.020	0.194 **	0.412 ***	0.015
Δ log $VA_{i,t-1}$	-0.134 *	-0.240 *	-0.045	-0.138 *	-0.235 *	-0.057
Sum of value added coefficients	0.062	0.164	-0.025	0.056	0.177	-0.042
$CF_{it} / K_{i,t-1}$	0.565 ****	0.811 ****	0.601 ****	0.562 ****	0.803 ****	0.598 ****
$CF_{i,,t-1} / K_{i,t-2}$	0.177 ***	0.201 **	0.138 **	0.179 ***	0.202 **	0.140 ***
Sum of CF coefficients	0.742 ****	1.012 ****	0.739 ****	0.741 ****	1.005 ****	0.738 ****
VC * $[CF_{it} / K_{i,t-1}]$	0.321			0.317 ***		
VC * $[CF_{i,,t-1} / K_{i,t-2}]$	-0.037			-0.038		
*Sum of VC * CF coefficients*	0.284 ***			0.279 ***		
# observations	1756	777	979	1736	768	968
# firms	402	179	223	400	179	221

Panel B: mature companies

	Total Sample	VC backed	Non VC backed	Total Sample	VC backed	Non VC backed
Intercept	-0.078	0.152	-0.136	0.074	0.169	-0.142
$(I_{i,t-1} / K_{i,t-2})_{tang}$	-0.084 ***	-0.125 **	-0.061 *	-0.097 ***	-0.152 ***	-0.065 **
$(I_{i,t-1} / K_{i,t-2})_{intang}$				0.340	0.516	-0.059
Δ log $VA_{i,t}$	0.103	0.014	0.170	0.098	0.015	0.161
Δ log $VA_{i,t-1}$	-0.111	-0.263 *	-0.004	-0.131	-0.295 *	-0.025
Sum of value added coefficients	-0.008	-0.249	0.166	-0.033	-0.280	0.136
$CF_{it} / K_{i,t-1}$	0.447 ****	0.843 ****	0.449 ****	0.441 ****	0.837 ****	0.443 ****
$CF_{i,,t-1} / K_{i,t-2}$	0.164 ***	0.232 **	0.139 **	0.170 **	0.230 *	0.145 ***
Sum of CF coefficients	0.611 ****	1.075 ****	0.588 ****	0.611 ****	1.067 ****	0.588 ****
VC * $[CF_{it} / K_{i,t-1}]$	0.424 ****			0.429 ****		
VC * $[CF_{i,,t-1} / K_{i,t-2}]$	0.025			0.011		
*Sum of VC * CF coefficients*	0.449 ***			0.440 ***		
# observations	1252	555	697	1238	549	689
# firms	275	122	153	274	122	152

Significance level of Wilcoxon rank sum test (two tailed): ** $0.010 \leq p < 0.050$; *** $0.0001 \leq p < 0.010$; **** $p < 0.0001$

Table 1: Description of the sample
Panel A: Panel data analyses

	Total sample			Mature companies			Young companies		
Number of observations (companies)	VC + non VC	VC	non VC	VC + non VC	VC	non VC	VC + non VC	VC	non VC
Sample at start:	4991 (1130)	2440 (565)	2551 (565)	2348 (512)	1129 (256)	1219 (256)	2643 (618)	1311 (309)	1332 (309)
Remove observations with [(1)]:									
- Negative cash flows	1931 (732)	1070 (389)	861 (343)	587 (217)	343 (119)	244 (98)	1344 (515)	727 (270)	617 (245)
- Negative investments	1599 (636)	790 (319)	809 (317)	408 (157)	211 (77)	197 (80)	1191 (479)	579 (242)	612 (237)
- Missing values	1264 (518)	721 (275)	543 (243)	215 (69)	139 (41)	76 (28)	1049 (449)	582 (234)	467 (215)
- Outliers [(2)]	169 (37)	75 (22)	94 (15)	81 (12)	30 (8)	51 (4)	88 (25)	45 (14)	43 (11)
- Insufficient observations per firm	101 (101)	46 (46)	55 (55)	47 (47)	21 (21)	26 (26)	54 (54)	25 (25)	29 (29)
Final sample	2346 (598)	1072 (278)	1274 (320)	1441 (337)	657 (154)	784 (183)	905 (261)	415 (124)	490 (137)
- % of sample at start	0.52 0.53	0.43 0.49	0.50 0.57	0.61 0.66	0.58 0.60	0.64 0.71	0.34 0.42	0.32 0.40	0.37 0.44

Panel B: GMM analyses

	Total sample			Mature companies		
Number of observations (companies)	VC + non VC	VC	non VC	VC + non VC	VC	non VC
Sample at start:	4991 (1130)	2440 (565)	2551 (565)	2348 (512)	1129 (256)	1219 (256)
Remove observations with [(1)]:						
- Negative cash flows	1931 (732)	1070 (389)	861 (343)	587 (217)	343 (119)	244 (98)
- Negative investments	1599 (636)	790 (319)	809 (317)	408 (157)	211 (77)	197 (80)
- Missing values	1751 (668)	960 (345)	791 (323)	323 (145)	196 (77)	127 (68)
- Outliers[(2)]	183 (49)	84 (24)	99 (25)	101 (17)	46 (10)	55 (7)
- Insufficient observations per firm[(3)]	366 (239)	183 (119)	183 (120)	145 (98)	73 (47)	72 (51)
Final sample	1756 (402)	777 (179)	979 (223)	1248 (247)	555 (122)	693 (152)
- % of sample at start	0.39 0.35	0.32 0.32	0.38 0.39	0.53 0.48	0.49 0.48	0.57 0.60

[(1)] Observations with missing values for one or more variables in the analyses, observations with negative (lagged) cash flow, with negative (lagged) investment, and firms for which only one observation is available are excluded from the sample. Moreover, outliers are filtered.
[(2)] The outliers are filtered using a 0.5 % top/bottom percentile filter .
[(3)] The minimum required number of observations per firm is two to conduct panel data analyses and three to conduct GMM analyses.

Table 2
Descriptives of dependent and independent variables

Panel A: total sample

	VC + non VC					VC			non VC			
	Median	Mean	St.Dev.	Minimum	Maximum	Median	Mean	St. Dev.	Median	Mean	St.Dev.	Sign.
$(I_{i,t})_{tang}$ ('000)	151	947	6762	0.074	215682	243	892	2636	107	993	8853	****
$(I_{i,t})_{intang}$ ('000)	0	121	1314	0.000	36925	0	110	625	0	130	1688	****
$VA_{i,t}$ ('000)	1288	4157	17211	11.825	599766	1625	4035	75974	995	4260	22296	****
CF_{it} ('000)	238	1273	9353	0.099	350158	335	1237	3320	186	1302	12323	****
K_{it} ('000)	662	3329	19787	1.239	554684	1029	3648	11649	429	3061	24635	****
$(I_{i,t} / K_{i,t-1})_{tang}$	0.259	0.514	0.825	0.002	10.220	0.252	0.533	0.893	0.270	0.498	0.763	
$(I_{i,t-1} / K_{i,t-2})_{tang}$	0.276	0.647	1.359	0.003	18.686	0.278	0.651	1.309	0.275	0.643	1.400	
$(I_{i,t-1} / K_{i,t-2})_{intang}$ (1)	0.000	0.034	0.147	0.000	1.949	0.000	0.051	0.179	0.000	0.020	0.112	****
$\Delta \log VA_{i,t}$	0.065	0.079	0.265	-1.129	1.292	0.088	0.106	0.265	0.046	0.057	0.263	****
$\Delta \log VA_{i,t-1}$	0.090	0.136	0.343	-1.102	2.568	0.114	0.174	0.368	0.069	0.104	0.316	****
$CF_{it} / K_{i,t-1}$	0.432	0.700	0.920	0.013	15.289	0.397	0.615	0.725	0.472	0.773	1.051	****
$CF_{i,t-1} / K_{i,t-2}$	0.454	0.783	1.185	0.011	20.529	0.411	0.680	0.910	0.498	0.870	1.368	****
# observations	2346					1072			1274			
# firms	598					278			320			

Panel B: mature companies

	VC + non VC					VC			non VC			Sign.
	Median	Mean	St.Dev.	Minimum	Maximum	Median	Mean	St. Dev.	Median	Mean	St.Dev.	
$(I_{i,t})_{tang}$ ('000)	189	787	3160	0.074	91951	285	796	1676	122	789	4001	****
$(I_{i,t})_{intang}$ ('000)	0	69	602	0.000	12925	0	77	420	0	62	721	****
$VA_{i,t}$ ('000)	1590	4068	8443	11.825	91003	1933	4293	7699	1350	3925	9021	****
CF_{it} ('000)	287	1005	2607	0.099	45948	384	1186	2945	224	853	2277	****
K_{it} ('000)	781	2551	7800	1.239	154965	1135	2916	6376	498	2244	8811	****
$(I_{i,t} / K_{i,t-1})_{tang}$	0.270	0.493	0.743	0.003	10.220	0.260	0.527	0.800	0.280	0.466	0.690	
$(I_{i,t-1} / K_{i,t-2})_{tang}$	0.276	0.566	1.136	0.003	18.686	0.278	0.573	1.009	0.276	0.560	1.233	
$(I_{i,t-1} / K_{i,t-2})_{intang}$ (2)	0.000	0.027	0.134	0.000	1.949	0.000	0.045	0.167	0.000	0.013	0.096	***
$\Delta \log VA_{i,t}$	0.053	0.058	0.230	-1.119	2.276	0.071	0.081	0.229	0.038	0.039	0.230	***
$\Delta \log VA_{i,t-1}$	0.070	0.086	0.254	-1.102	2.276	0.095	0.116	0.268	0.054	0.062	0.239	****
$CF_{it} / K_{i,t-1}$	0.440	0.692	0.830	0.013	12.624	0.417	0.628	0.677	0.477	0.745	0.937	**
$CF_{i,t-1} / K_{i,t-2}$	0.462	0.756	1.005	0.013	16.564	0.423	0.695	0.866	0.497	0.806	1.106	**
# observations	1441					657			784			
# firms	337					154			183			

Panel C: young companies

	VC + non VC					VC			non VC			Sign.
	Median	Mean	St.Dev.	Minimum	Maximum	Median	Mean	St. Dev.	Median	Mean	St.Dev.	
$(I_{i,t})_{tang}$ ('000)	119	1201	10128	0.248	215682	173	1042	3673	86	1336	13349	****
$(I_{i,t})_{intang}$ ('000)	0	204	1972	0.000	36925	0	162	853	0	239	2563	****
$VA_{i,t}$ ('000)	896	4299	25590	13.188	599766	1277	3712	7432	552	4796	34107	****
CF_{it} ('000)	180	1700	14689	0.447	350157	251	1319	3842	122	2022	19651	****
K_{it} ('000)	487	4569	30269	1.413	554684	752	4806	16866	307	4367	38116	****
$(I_{i,t} / K_{i,t-1})_{tang}$	0.239	0.547	0.941	0.002	9.391	0.228	0.543	1.023	0.246	0.550	0.867	
$(I_{i,t-1} / K_{i,t-2})_{tang}$	0.276	0.775	1.645	0.003	17.497	0.279	0.774	1.672	0.271	0.775	1.624	
$(I_{i,t-1} / K_{i,t-2})_{intang}$ (3)	0.000	0.044	0.166	0.000	1.705	0.000	0.060	0.196	0.000	0.030	0.133	****
$\Delta \log VA_{i,t}$	0.097	0.113	0.309	-1.129	1.292	0.122	0.145	0.310	0.066	0.085	0.306	***
$\Delta \log VA_{i,t-1}$	0.146	0.216	0.438	-1.002	2.568	0.179	0.267	0.472	0.118	0.171	0.402	***
$CF_{it} / K_{i,t-1}$	0.408	0.714	1.046	0.015	15.289	0.369	0.593	0.795	0.461	0.817	1.211	***
$CF_{i,t-1} / K_{i,t-2}$	0.444	0.827	1.424	0.011	20.529	0.374	0.657	0.977	0.502	0.971	1.701	****
# observations			905				415			490		
# firms			261				124			137		

Significance level of Wilcoxon rank sum test (two tailed): ** $0.010 \leq p < 0.050$; *** $0.0001 \leq p < 0.010$; **** $p < 0.0001$

(1) Statistics based on 2327 observations or 592 firms; (2) Statistics based on 1440 observations or 338 firms; (3) Statistics based on 887 observations or 254 firms;

Table 3
Results of panel data analyses
Panel A: total sample

	Total Sample	VC backed	Non VC backed	Total Sample	VC backed	Non VC backed
Intercept	-0.229	-0.096	-0.042	-0.202	-0.065	-0.060
$(I_{i,t-1} / K_{i,t-2})_{tang}$	-0.084 ****	-0.164 ****	-0.027	-0.092 ****	-0.180 ****	-0.026
$(I_{i,t-1} / K_{i,t-2})_{intang}$				-0.084	-0.134	0.117
Δ log $VA_{i,t}$	0.263 ***	0.395 ***	0.109	0.335 ****	0.488 ****	0.132
Δ log $VA_{i,t-1}$	0.082	0.099 *	0.039	0.131 **	0.146	0.075
Sum of value added coefficients	0.345 ***	0.494 ***	0.148	0.466 ****	0.634 ****	0.207
$CF_{it} / K_{i,t-1}$	0.274 ****	0.551 ****	0.312 ****	0.249 ****	0.411 ****	0.304 ****
$CF_{i,,t-1} / K_{i,t-2}$	0.046 *	0.242 ****	0.012	0.039	0.288 ****	-0.006 **
Sum of CF coefficients	0.320 ****	0.793 ****	0.324 ****	0.288 ****	0.699 ****	0.298 ****
VC * $[CF_{it} / K_{i,t-1}]$	0.347 ****			0.222 *		
VC * $[CF_{i,,t-1} / K_{i,t-2}]$	0.128 ***			0.176 **		
*Sum of VC * CF coefficients*	0.475 ****			0.398 ****		
# observations	2346	1072	1274	2327	1060	1267
# firms	598	278	320	592	275	317

Panel B: mature companies

	Total Sample	VC backed	Non VC backed	Total Sample	VC backed	Non VC backed
Intercept	-0.075	0.338	-0.177	0.189	0.403	-0.174
$(I_{i,t-1} / K_{i,t-2})_{tang}$	-0.059 ***	-0.130 ***	-0.026	-0.064 ***	-0.159 ****	-0.015
$(I_{i,t-1} / K_{i,t-2})_{intang}$				0.047	0.080	0.053
Δ log $VA_{i,t}$	0.189 ***	0.127	0.224 *	0.260 ***	0.261 *	0.207
Δ log $VA_{i,t-1}$	0.047	0.182	-0.077	0.108	0.231	0.005
Sum of value added coefficients	0.236	0.309	0.147	0.368 **	0.492 **	0.212
$CF_{it} / K_{i,t-1}$	0.346 ****	0.508 ****	0.353 ****	0.318 ****	0.352 ****	0.349 ****
$CF_{i,,t-1} / K_{i,t-2}$	0.070	0.245 ****	0.063	0.002	0.280 ****	-0.017
Sum of CF coefficients	0.416 ****	0.753 ****	0.416 ****	0.320 ****	0.632 ****	0.332 ****
VC * $[CF_{it} / K_{i,t-1}]$	0.202 **			0.073 *		
VC * $[CF_{i,,t-1} / K_{i,t-2}]$	0.151 **			0.244 ****		
*Sum of VC * CF coefficients*	0.353 ***			0.317 ***		
# observations	1441	657	784	1440	650	790
# firms	337	154	183	338	153	185

Panel C: young companies

	Total Sample	VC backed	Non VC backed	Total Sample	VC backed	Non VC backed
Intercept	-0.240	-0.174	-0.068	-0.209	-0.151	-0.088
$(I_{i,t-1} / K_{i,t-2})_{tang}$	-0.105 ****	-0.190 ****	-0.028	-0.120 ****	-0.197 ****	-0.035
$(I_{i,t-1} / K_{i,t-2})_{intang}$				-0.193	-0.374	0.141
$\Delta \log VA_{i,t}$	0.291 **	0.578 ***	-0.005	0.358 **	0.612 ***	0.038
$\Delta \log VA_{i,t-1}$	0.078	-0.055	0.126	0.117	-0.017	0.149
Sum of value added coefficients	0.369 **	0.523 **	0.121	0.475 ***	0.595 **	0.187
$CF_{it} / K_{i,t-1}$	0.230 ****	0.635 ****	0.277 ****	0.216 ****	0.503 ****	0.273 ****
$CF_{i,,t-1} / K_{i,t-2}$	0.039	0.226 ***	-0.010	0.080	0.274 ***	0.001
Sum of CF coefficients	0.269 ****	0.861 ****	0.267 ****	0.296 ****	0.777 ****	0.274 ****
VC * $[CF_{it} / K_{i,t-1}]$	0.520 ****			0.399 ****		
VC * $[CF_{i,,t-1} / K_{i,t-2}]$	0.084			0.099		
*Sum of VC * CF coefficients*	0.604 ****			0.498 ****		
# observations	905	415	490			
# firms	261	124	137	254	122	132

Table 4
Results of GMM analyses
Panel A: total sample

	Total Sample	VC backed	Non VC backed	Total Sample	VC backed	Non VC backed
Intercept	0.144 *	0.229 **	0.111	0.154 **	0.268 ***	0.105
$(I_{i,t-1} / K_{i,t-2})_{tang}$	-0.029	0.003	-0.099	-0.030	0.021	-0.116
$(I_{i,t-1} / K_{i,t-2})_{intang}$				-0.055	-0.131	0.420
Δ log $VA_{i,t}$	-0.159	0.074	-0.311 **	-0.156	0.075	-0.303 **
Δ log $VA_{i,t-1}$	-0.066	0.064	-0.122	-0.047	0.090	-0.131
Sum of value added coefficients	-0.225	0.138	-0.433 *	-0.203	0.165	-0.475 *
$CF_{it} / K_{i,t-1}$	0.894 ****	1.370 ****	0.844 ****	0.888 ****	1.319 ****	0.840 ****
$CF_{i,t-1} / K_{i,t-2}$	0.154 *	0.011	0.233 **	0.170	0.019	0.261 **
Sum of CF coefficients	1.138 ****	1.381 ****	1.077 ****	1.058 ****	1.338 ***	1.101 ***
VC * $[CF_{it} / K_{i,t-1}]$	0.360 *			0.304		
VC * $[CF_{i,t-1} / K_{i,t-2}]$	-0.103			-0.088		
*Sum of VC * CF coefficients*	0.257			0.216		
m(1) (p-value)	0.000	0.000	0.036	0.000	0.001	0.055
m(2) (p-value)	0.555	0.760	0.566	0.635	0.756	0.699
Sargan test (p-value)	0.464	0.317	0.871	0.441	0.332	0.851
# observations	1756	777	979	1736	768	968
# firms	402	179	223	400	179	221

Panel B: mature companies

	Total Sample	VC backed	Non VC backed	Total Sample
Intercept	0.135	0.229 **	0.112	0.148 ***
$(I_{i,t-1} / K_{i,t-2})_{tang}$	-0.021	0.003	-0.099	-0.005
$(I_{i,t-1} / K_{i,t-2})_{intang}$				-0.115
$VA_{it} / K_{i,t-1}$	-0.256 **	0.074	-0.311 **	-0.255 **
$VA_{i,t-1} / K_{i,t-2}$	-0.174 *	0.064	-0.122	-0.136
Sum of value added coefficients	-0.430 **	0.138	-0.433 *	-0.391 **
$CF_{it} / K_{i,t-1}$	0.644 ****	1.370 ****	0.844 ****	0.626 ****
$CF_{i,,t-1} / K_{i,t-2}$	0.271 ***	0.011	0.232 **	0.253 **
Sum of CF coefficients	0.915 ***	1.381 ****	1.076 ****	0.879 ***
VC * $[CF_{it} / K_{i,t-1}]$	0.580 ***			0.555 ***
VC * $[CF_{i,,t-1} / K_{i,t-2}]$	-0.167			-0.151
*Sum of VC * CF coefficients*	0.413 *			0.404 *
m(1) (p-value)	0.000	0.001	0.037	0.000
m(2) (p-value)	0.695	0.760	0.547	0.672
Sargan test (p-value)	0.426	0.317	0.871	0.326
# observations	1252	777	979	1238
# firms	275	179	223	274

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