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Dirk Engel and Joel Stiebale

Private Equity, Investment and Financial Constraints

Firm-Level Evidence for France and the United Kingdom

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Dirk Engel and Joel Stiebale*

Private Equity, Investment and Financial Constraints – Firm-Level Evidence for France and the United Kingdom

Abstract
The welfare effects of private equity transactions are debated controversially. We analyze the impact of expansion financing and buyouts by private equity investors on investment of portfolio firms in the UK and France – two countries with different financial systems. Unobserved heterogeneity and the endogeneity of private equity transactions financed by venture capital companies are addressed using dynamic panel data techniques. In both countries we find that portfolio firms display higher investment levels and a lower dependence on internal funds after expansion financing. Buyouts financed by venture capital companies are neither associated with a decrease in investment spending nor with an increase in the dependence on internal finance. In contrary, private equity based buyouts in the UK outperform non-private equity backed British firms in terms of both indicators. Contrasting the notion of several policy makers, we cannot detect that private equity based buyout financing yields higher financial constraints on average.

JEL Classification: G32, D92, G23

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1 Introduction

The growing number of leveraged buyouts (LBOs) and the accompanying growth of private equity markets before the turmoil in the debt markets in 2008 have raised a controversial debate. Particularly in Europe, there is an ongoing discussion about regulation of private equity transactions. Examples are a Green Paper by the European Commission (2005) and a famous speech of Germany's former vice chancellor Franz Müntefering, who equated private equity investors with locusts and stated that those investors would hollow out companies for their own benefit.[2] It is often argued that the high amount of debt used to finance a private equity transaction, which is usually secured by the portfolio firm´s assets or future cash flows, may lead to financial constraints and firm distress.

In contrast, theoretical and empirical contributions suggest that ownership changes shift resources to more efficient uses and more active managers (Harris et al., 2005; Jovanovic and Rousseau, 2008). Private equity investors may increase a firm's access to financial resources and in addition, these investors can reduce information asymmetries in financial markets by improving governance mechanisms in funded firms. The latter argument is based on active monitoring implemented via significant board rights of private equity investors and high incentives for its management to improve the profitability of the portfolio firm (e.g., Cumming et al., 2007; Kaplan and Strömberg, 2009).

Related to that, Brown and Petersen (2009) show that financial constraints, approximated by investment-cash flow sensitivities, decreased for US quoted manufacturing firms between 1970 and 2006. The authors argue that this decline is mainly due to improvements in capital markets. Agca and Mozumdar (2008b) find that increasing fund flows of insurance companies, pension funds, mutual funds and closed-end funds decreases investment-cash flow sensitivities of portfolio companies. Further, the authors detect that institutional ownership also reduces the sensitivity of investment to internal funds.

Our paper investigates the link between private equity investors, financial constraints and investment spending empirically. Surprisingly the impact of private equity on investment and

[2] See e.g. http://www.nytimes.com/2007/06/29/business/worldbusiness/29equity.html?fta=y (accessed February 15, 2009).

financial constraints has yet only been investigated for early stage investments (Bertoni et al. 2008, Manigart et al. 2003). To the best of our knowledge, there is no empirical study that analyzes the role of expansion financing and private equity based buyouts on investment and financial constraints of portfolio firms systematically.[3] Our paper aims to fill this gap. We further contribute to the current debate and the existing literature on private equity and venture capital by comparing the effects of both expansion financing and buyouts across countries including a country with a "market based" financial system and a well-developed private equity market, the UK, and a country with a less developed private equity market and a "bank based" financial system, France.

To evaluate the impact of private equity investors on investment and financial constraints, we estimate an investment equation which is derived from a sales accelerator model (see e.g., Harhoff, 1998; Mairesse et al., 1999). To take into account unobserved firm heterogeneity in general and the endogenous nature of private equity investments and other variables, the investment equations are estimated by generalized method of moments (GMM) techniques using lagged levels of the regressors and additional variables as instruments. Our empirical framework is applied to a large panel data set that covers firms from France and the UK over the period 1998-2007. Our results suggest that private equity backed transaction on average alleviate financial constraints and induce higher investment in portfolio firms. Splitting private equity transactions into buyouts and expansion investment, we find higher investment rates and a lower dependence on internal funds for firms in the UK after a buyout, while investment in buyout firms does not differ significantly from non-private equity financed firms in France.

The rest of this paper is organized as follows. In section two, we provide a brief review on the literature on the effects of private equity on the performance of portfolio firms and derive our hypotheses. Section three describes our empirical model, sections four provides a description of the data. Results of the econometric analysis are presented in section five, section six concludes.

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[3] Some empirical studies analyse the relationship between management buyouts - which are often but not always conducted in cooperation with private equity investors - and capital expenditures (Smith 1990, Kaplan 1990), productivity (Harris et al. 2005) and employment growth (Amess and Wright 2007). Recently, Davis et al. (2008) and Boucly et al. (2008) analyze differences in employment growth rates between firms affected by a private equity-financed leveraged buyout and other firms.

2 The economic role of financial intermediaries in funded firms

2.1 Theoretical background

Venture capitalists (VCs) raise funds from corporate investors or financial companies like banks, insurance companies or pension funds and provide private equity to the selected firms (portfolio firms). They hold the shares for about five years on average (see e.g., Manigart et al., 2002) and realize returns on private equity investment via selling their shares to other investors. Private equity investments of VCs are typically differentiated in venture capital financing on the one hand and financing of buyouts, turnaround or extensive restructuring on the other hand. Venture capital financing addresses the financing of new firms to realize market entry (early stage) and the market expansion of companies (expansion stage).[4] Financing of later stage transactions is mostly dominated by buyout financing. While shareholder (e.g. founders, families, firms) plan to phase out ownership, an existing management or an external management acquires shares on nominal equity with the help of VCs. While usually only a small fraction of debt is used to finance expansion financing which often comprises an increase in share capital, buyouts are usually financed with a share of debt between 60 and 90 per cent (Kaplan and Strömberg 2009).

Seminal work by Stiglitz and Weiss (1981) for the credit market and Jensen and Meckling (1976) and Myers and Majluf (1984) for the equity market point out that financial markets are characterized by information asymmetries between firms and financiers. If information asymmetries exist, the Modigliani-Miller theorem (Modigliani and Miller 1958), which is based on the assumption of perfect capital markets and predicts that the source of financing is irrelevant for investment decisions, does not hold. New institutional economic theory and finance theory suggest that specialized financial intermediaries like VCs are able to reduce some of these information asymmetries between entrepreneurs and financiers effectively. Risk-pooling (Amit et al., 1998), risk-diversification (Diamond, 1984, Norton and Tenenbaum, 1993), specialization (Chan 1983) and the better opportunity to syndicate investments (Lerner 1994) are the main arguments that explain that VCs have an advantage in screening potential targets, contracting, monitoring and advising selected portfolio firms compared to other investors (see e.g., Admati and Pfleiderer 1994 and Kaplan and Strömberg, 2001, 2009 for details).

[4] Note that the term venture capitalist includes firms that engage in venture capital financing and in buyout financing.

Three main arguments could be put forward for an outperformance of private equity financed firms: (i) provision of sufficient financial resources, (ii) monitoring and management support and (iii) signaling effects. Given that a VC decides to invest in a firm, the funded firm receives the capital within a short time period. VCs do not only provide capital but also management services (Gorman and Sahlman, 1989).[5] VCs usually monitor their portfolio firms intensively and obtain regular reports on performance, visit the firm and attend board meetings. The governance structure is beneficial to reduce agency costs and to improve operating efficiency of funded firms. While VCs mostly offer carried interest[6] to portfolio managers, the management of these portfolio companies has a high incentive to handle the value creation process successfully. In fact, many portfolio firms perform poorly at the time of acquisition and VCs use their board rights to replace the management team (Kaplan and Strömberg 2001). VCs might also provide value-added resources for their portfolio firms indirectly: investments of VCs can signalize firm's quality for uninformed third parties (e.g. banks, supplier, customers) implying a better access to external resources for portfolio firms (Stuart et al., 1999).

2.2 Previous empirical findings

Several empirical studies deal with the economic effects of VCs. Among others, Kortum and Lerner (2000) find that private equity investments of VCs spur innovation activities at the industry level. Recently, Engel and Keilbach (2007) discussed empirical findings at the firm level and argued that the high sophisticated screening procedure of VCs may drive the majority of the difference between private equity financed and non-private equity financed firms. Based on a matching procedure, they find that the early stage financed start-ups in their sample attained an annual employment growth rate that is 16% higher than in their comparison group. This is remarkably lower compared to other studies, e.g. Lerner (1999). They find no significant differences between the number of patents as well as the probability of a patent application between early stage financed start-ups and other firms.

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[5] Several studies dealt with the management advice of VCs in detail (Bygrave and Timmons, 1992; Hellmann and Puri, 2002, to mention a few).

[6] Carried interest is well known as the 80/20 rule. According to this rule, investors receive 80 percent of profits, while 20 percent of profits, known as carried interest, are received by the portfolio management of the VC.

While positive effects of early stage investments for start-ups and young firms by private equity investors are accepted by most researchers, the impacts of buyouts financed by private equity investors are less clear. With respect to later stage investments of private equity investors, an increasing number of studies has been published in recent years (Cumming et al., 2007 and Kaplan and Strömberg, 2009 summarize much of this literature). Harris et al. (2005) find that ownership changes in management buyouts[7] enhance labor and total factor productivity at the plant level, but they do not differentiate between private equity and non-private equity backed deals. They provide some evidence that this results from downsizing the workforce and outsourcing of intermediate production stages. Amess and Wright (2007a, 2007b) do not find significantly lower employment growth of buyout firms after a buyout transaction. In contrast to these findings, Boucly et al. (2009) detect that targets of LBOs in France display significantly higher growth rates in sales, assets and employment.

All these findings do not necessarily reflect the influence of private equity investors as there is evidence that private equity-financed LBOs are quite different from other LBOs. Amess et al. (2008) find that employment shrinks only after LBOs that are not private equity financed. In contrast, Davis et al. (2008) find that employment growth in US firms after a LBO financed by private equity investors shrinks more rapidly than in their comparison group. Their approach however, is rather descriptive as they only control for industry, initial size and firm age.

Only a few papers analyzed the effects of private equity financing on investment and investment-cash flow sensitivities - the standard measure to evaluate financial constraints. Manigart et al. (2003) use a panel data set for Belgium including 179 firms which have been financed by venture capital companies between 1987 and 1997 and a comparison group of 223 non-private equity financed firms. Applying a modified sales accelerator model (Mairesse et al., 1999), the authors detect that venture backed firms display a slightly higher investment-cash flow sensitivity than non-private equity financed firms. Nothing is known about differences in investment-cash flow sensitivities in the period before the private equity investments starts. Possibly, the investment-cash flow sensitivity of private equity financed firms is already larger in the period before the private equity investment. Reflecting this measurement issue the authors do not interpret their results as rejection of the above

[7] Buyout financing has increased remarkably during the 1990s in the United Kingdom and in the first decade of the 21st century in continental Europe (see Wright et al. 2006).

mentioned hypothesis. Instead, the authors argue that the empirical results confirm the general expectation that information asymmetries between private equity financed firms and creditors matter. The main question, whether these asymmetries are reduced or not remains unsolved.

Bertoni et al. (2008) use a sample of 379 Italian new technology based firms, including 52 firms that received early stage and/or expansion financing, within the period from 1994 to 2003. The authors estimate an Euler equation (see Bond and Meghir, 1994) and apply a two-step system GMM estimator to identify the effect of venture capital finance on investments of funded firms. In fact, the authors find that venture capital financed firms have a significantly higher investment rate than non-venture capital financed firms. In contrast to Manigart et al. (2003), investment-cash flow sensitivity for venture capital financed firms do not differ significantly from those of non-venture capital financed firm. While Manigart et al. (2003) do not consider differences in the investment rates of private equity financed firms compared with non-private equity financed firms, the results of both studies cannot be easily compared. It is possible that the significant higher investment-cash flow sensitivity in Manigart et al. (2003) is driven by higher investment spending of private equity financed firms.

Several conclusions can be derived from these studies: First, the two studies that analyze the effect of venture capital on investment do not answer the question whether financing constraints are significantly reduced due to the inflow of venture capital finance. Second, findings are available for venture capital investments only. Nothing is known about the effects of private equity backed buyouts on investment spending and investment-cash flow sensitivities of funded firms. Third, comparable findings for the real economy across countries are missing, but a prerequisite to derive a general statement. Finally, the small numbers of private equity financed firms and the use of survey data may potentially imply some imprecision in the estimates.

We tackle these research gaps with a particular interest in considering some of the above mentioned identification issues. We analyze investment rates and investment-cash flow sensitivity before and after private equity transaction undertaken by VCs and compare these findings with non-private equity financed firms. We differentiate between expansion and buyout financing and apply this methodology to two countries, namely the UK and France. It is commonly argued that VCs from well experienced markets like the US or UK venture capital market are more active in monitoring their firms and are more often engaged in hands-

on management than VCs from continental Europe (e.g., Wright et al., 2006; Bottazi et al., 2008). Both countries may also be different with respect to firms seeking and receiving private equity.

2.3 Predictions

The efforts of VCs can affect (i) the level of investment spending of funded firms and (ii) the dependence of investment on internal finance. Related to the first one, private equity financed expansion may help to increase investment opportunities. Investment spending of private equity financed firms with expansion financing should be clearly higher than for the remaining firms. The investment spending of buyouts is expected to be different from targets of expansion financing. Above mentioned empirical evidence suggests that after a buyout, the operating performance usually increases, but capital expenditures have sometimes found to be declining (e.g., Kaplan, 1989).

Concerning the dependence of investment on internal finance, monitoring and management support may reduce some kind of agency costs based on information asymmetries between shareholders and management. These efforts as well as capital infusion may provide strong signals for uninformed third parties. Capital infusion provides additional liquidity and offers increased securities for debt finance from creditors. Monitoring and management support allow a better control of the assignment of external resources for investment projects. If signaling effects work, investment-cash flow sensitivities should be reduced.

Considering Jensen's "free cash flow" theory, one may conclude that management support and monitoring additionally have a direct effect on investment-cash flow sensitivities in firms with over-investment. Managers of organizations with high levels of free cash flow[8], but low growth opportunities, tend to waste free cash flow for less profitable projects to realize their own non-value maximizing objectives. This overinvestment implies a positive relation between the investment rate and cash flow. Jensen (1986) argued that debt may have an important control function in those organizations, because repayment of debts limits the free cash flow. In a similar manner, effective monitoring of equity holders may have a similar effect under specific circumstances. Shleifer and Vishny (1997) point out that shareholder

[8] Free cash flow is operating cash flow minus cash flow from investment activity. The free cash flow can be used to buy back stocks or to payout dividends to shareholders.

with sufficiently large equity positions can gain more from information about the firm than those with very small equity positions. VCs often acquire high equity shares, thus incentives to play an active role in funded firms are very high. In fact, target firms of buyout financing might match the characteristics of firms with large "free cash flow" and low growth opportunities better than private equity financed firms with expansion financing. As a result, the active role of VCs may reduce investment-cash flow sensitivities in buyout firms additionally.

Private equity financed buyout transactions may also have a conflictive effect. The high amount of debt used to finance a private equity buyout transaction, which is usually secured by the portfolio firm´s assets or future cash flows, may lead to a worse access to external finance and increase the probability of firm distress. The remarkable increase in debt to assets ratios may limit the control function of debt in buyout based organizations. Such a control function is only feasible if the access to external financial resources in the next period is not affected by the increased debt level.

Based on these theoretical considerations we expect that investment-cash flow sensitivities are significantly reduced for private equity financed firms with expansion financing. Contrariwise, the effect on investment-cash flow sensitivities for buyout firms is ambiguous from a theoretical point of view.

3 Empirical approach

Empirical tests for imperfections in capital markets are usually based on the estimation of investment-cash flow sensitivities. In a variety of alternative investment models, a significantly positive relationship between cash flow and investment can − under specific circumstances − be interpreted as evidence for financial constraints. In incomplete financial markets external sources of financing are more expensive than internal sources. The higher the cost premium for external finance, the higher a firm's preference for internal financial resources. Since for a financially constrained firm external finance is not available or only available at prohibitively high costs, it will only invest if it has sufficient internal funds available.

Based on theoretical contributions about asymmetric information in capital markets, Fazzari et al. (1988) present a pioneer work to test for the degree of capital markets imperfections empirically. The authors applied a so called Q-model to estimate the relationship between investment and cash flow. Under certain assumptions on a firm's cost function[9], average Q – the ratio of a firm´s intrinsic value to the replacement cost of its assets – equals the unobserved shadow price of capital and should be a sufficient statistic for investment in the absence of financing constraints. The authors show that given the assumptions on a firm's cost function, the sensitivity of investment to internal funds is monotonically increasing with financial constraints faced by the firm. A proxy for Q is usually constructed from stock market valuations. The authors split their sample of US manufacturing firms according to their dividend policy in four classes. Their a priori expectation that firms paying lower dividends suffer mostly from financing constraints is consistent with their empirical results of higher investment-cash flow sensitivities among these firms.

A fundamental critique on the assumption of monotonicity regarding investment-cash flow sensitivities and financing constraints is formulated by Kaplan and Zingales (1997). The authors present a counter example in a theoretical model where a priori more financially constrained firms are characterized by lower investment-cash flow sensitivities than a priori less financially constrained firms, and find some empirical support for this prediction. Bond and van Reenen (2008) discuss the critique in detail and argue that the findings of Kaplan and Zingales (1997) only apply to static and not to dynamic investment models that are usually chosen in empirical investigations. Furthermore, the a priori expectation of financially constrained firms based on a subjective set of criteria and the small sample of Kaplan and Zingales (1997) may hamper the generalizability of their findings.[10]

The empirical implementation of the Q-model critically hinges on the assumption that stock market prices reflect expected discounted future profits. Among others, Schiantarelli (1996) and Hubbard (1998) argue that stock markets might not be efficient and stock price data could be a very imprecise proxy. Recently, Cummins et al. (2006) show that after controlling for

[9] The adjustment cost function is for example assumed to be homogenous of degree one in investment and capital. Most empirical implementations of the Q model are based on quadratic adjustment costs (see Bond and van Reenen 2008 for a discussion).

[10] A similar critique can be also derived from Jensen's (1986) free cash flow hypothesis. As mentioned in the previous section, management-led firms with free cash flow and ineffective corporate governance mechanisms may tend to over-invest and thus, the investment rate is positively related with cash flow.

analysts' forecasts in the regression –which they argue is a more precise proxy for expected discounted future profits– cash flow is no longer significantly related to investment spending.[11] However, Carpenter and Guariglia (2008) as well as Agca and Mozumdar (2008a) show that the results from Cummins et al. (2006) are not robust to small changes in the model specification and the time period investigated. Further, it should be noted that the firms used in the sample by Cummins et al. (2006) are listed companies with an average value of sales above 3 billion US $, which are arguably not the firms that are most likely to be financially constrained.

Due to the potential problems of the Q model and its non-applicability to unquoted firms, many researchers prefer alternative econometric approaches which avoid the use of stock price data. Bond and Meghir (1994) apply an Euler equation and extent the model to consider imperfections in product and financial markets. Both Euler equation and Q-models follow from a firm´s dynamic optimization problem and assume convex adjustment costs.

Many empirical studies find, however, large adjustments in firm-level data and thus, the assumption of convex adjustment costs might be violated (see Bond and van Reenen 2008 for details). Due to these problems, reduced form models like error-correction models (see e.g. Harhoff 1998, Mairesse et al. 1999, Bond et al. 2003) and dynamic versions of sales accelerator models (see Harhoff 1998, Manigart et al. 2002), which can be interpreted as an approximation to an unknown complex adjustment process, have been used increasingly in the last years. The restrictive assumption of convex adjustment costs is relaxed, but may induce the problem that cash flow can potentially be correlated with unobserved expected future profitability if the adjustment process is not described adequately. However, Bond et al. (2003) show that the ability of cash flow to forecast future cash flow or sales does not differ remarkably across groups of firms that are assumed to be differently affected by liquidity constraints. Hence, even if cash flow conveys some information about investment opportunities, *differences* in investment-cash flow sensitivities are a valid indicator for *differences* in the importance of financing constraints across groups of firms.

Since a lot of portfolio firms in our sample are unquoted and the severity of measurement error in Q models is an ongoing discussion, we do not consider this model. Instead, we apply

[11] Bond et al. (2004) applied the same methodology for UK quoted firms and reach a similar conclusion.

a dynamic version of a sales accelerator model (see e.g., Harhoff, 1998; Mairesse et al., 1999) to investigate the impact of private equity on investment and financial constraints of portfolio firms.

The dynamic sales accelerator model typically includes current and lagged sales growth, the lagged investment to capital ratio and cash flow or an alternative measure for internal finance. Since private equity investors might chose portfolio firms with high growth potential based on innovations, we control for lagged levels of intangible assets in our specification, to avoid a spurious correlation between private equity and investment of portfolio firms. For the same reason we also include banking debt, because firms selected by private equity investors might be confronted with credit rationing to a different extent than other firms before the acquisition and thus, may be characterized by different debt levels.

Our basic empirical model is given by:

$$\frac{I_{it}}{K_{i,t-1}} = \beta_1 \frac{I_{i,t-1}}{K_{i,t-2}} + \beta_2 \Delta y_{it} + \beta_3 \Delta y_{i,t-1} + \beta_4 \frac{ITA_{i,t-1}}{K_{i,t-1}} + \beta_5 \frac{B_{i,t-1}}{K_{i,t-1}} + \beta_6 \frac{C_{it}}{K_{i,t-1}} + D_i + Z_t + \varepsilon_{it} \quad (1)$$

where I_{it} denotes gross investments in tangible fixed assets of firm i in year t, $K_{i,t-1}$ is the value of tangible fixed asset at the end of the previous year, $t-1$. Δy_{it} ($\Delta y_{i,t-1}$) is the contemporary (lagged) one-year change of the logarithm of sales, $ITA_{i,t-1}$ denotes the lagged value of intangible assets, $B_{i,t-1}$ denotes the lagged value of long-term debt (which is predominantly banking debt), C_{it} is the current cash flow, D_i is a firm-fixed effect, Z_t contains period fixed effects and ε_{it} is an error term. Investment is computed as:

$$I_{it} = K_{it} - (1-\delta_{it}) K_{i,t-1} \quad (2)$$

where δ_{it} denotes the firm-specific rate of depreciation. Hence, our measure of investment explicitly allows for disinvestment and thus negative values of I_{it}.

To discriminate between private equity and non-private equity backed firms we add a dummy variable for private equity-backed firms and an interaction term with the cash flow to capital ratio to the model:

$$\begin{aligned} \frac{I_{it}}{K_{i,t-1}} &= \beta_1 \frac{I_{i,t-1}}{K_{i,t-2}} + \beta_2 \Delta y_{it} + \beta_3 \Delta y_{i,t-1} + \beta_4 \frac{ITA_{i,t-1}}{K_{i,t-1}} + \beta_5 \frac{B_{i,t-1}}{K_{i,t-1}} + \beta_6 \frac{C_{it}}{K_{i,t-1}} \\ &+ \beta_7 PE_{it} + \beta_8 PE_{it} \cdot \frac{C_{it}}{K_{i,t-1}} + D_i + Z_t + \varepsilon_{it}. \end{aligned} \quad (3)$$

PE_{it} is a time varying dummy variables which takes the value of one in all years we detected ownership of a venture capital company in firm *i*. $PE_{it} \cdot C_{it} / K_{i,t-1}$ measures the cash flow to capital ratio of portfolio firms owned by venture capital companies.

The main parameters of interest are β_7 and β_8. If we assume that investment-cash flow sensitivities are equal for all firms before private equity financing starts[12], a negative sign for β_8 implies a reduction in investment-cash flow sensitivities, while a positive sign for the parameters implies an increase in investment-cash flow sensitivities and hence in financial constraints. Equation (3) is estimated for UK and French firms separately. In alternative specifications we differentiate private equity between expansion financing (EF_{it}) and buyouts (BO_{it}).

The individual effects in the investment equation are necessarily correlated with the lagged dependent variable, which causes OLS as well as random or fixed effects estimator to be inconsistent (see e.g. Baltagi 2001). To avoid these biases we use a Difference GMM estimator which eliminates firm-specific effects by differencing equation (3) and then use lagged values of the regressors as instruments as proposed by Arellano and Bond (1991). [13]

The estimation procedure allows treating the explanatory variables as strictly exogenous, predetermined or endogenous. This implies that the explanatory variables are uncorrelated with all realizations of the error term, only correlated with past realizations of the error term or in addition correlated with present shocks, respectively. If the error term in equation (3) is serially uncorrelated, the error term in first differences follows a moving average process of order one. If this assumption holds and the model is correctly specified, one-period lagged levels of predetermined variables and two-periods lagged variables of endogenous variables are valid instruments. Similarly to the cash flow and sales growth variables, private equity financing might be endogenous as there might be feedback from past investment to future

[12] We will test this assumption explicitly in this paper.

[13] An alternative estimator for dynamic panel data models is the GMM system estimator (Blundell and Bond 1998) which has been found to be more efficient and less effected by weak instruments, especially in series that display high persistence, i.e. are close to a unit root. Unfortunately, our specification tests indicated that the additional assumptions regarding stationary and initial conditions of the variables were not met in our data. Further, we could reject unit roots for all variables in AR(1) models. We further found that for the estimates of the AR(1) processes with the difference GMM estimators were in all cases above the fixed effects estimator (which is biased downwards) and below the OLS estimator (which is biased upwards). Hence, we conclude that our results are not largely affected by weak instruments. Results are available upon request.

acquisitions by private equity investors, or these investors might select portfolio firms with higher unobserved future profitability. We will address this question carefully.

We treat cash flow and current sales growth as endogenous and lagged intangible assets and bank debt as predetermined. We either treat PE_{it} as exogenous or use lagged values of all regressors as instruments. In an alternative specification we use two year lagged values of ownership dispersion as an exclusion restriction. This variable is calculated as the Herfindahl index of equity shares across all owners. The higher the free float of a company´s shares or generally the more dispersed the shares of a company are across owners, the easier it should be for an external investor to acquire a firm. Hence, this variable should be negatively correlated with an acquisition by a private equity investor.

As we exclude firms that belong to a corporate group or are subject to an industrial M&A, this variable picks up variation in ownership concentration that do not imply differences in control rights. Although one might argue that ownership concentration might be correlated with corporate governance mechanisms that may affect investment and liquidity, this should only be true of control relevant stakes.[14] We will explicitly test the validity of this additional instrument. In an amplification of the model we use the predicted probability of acquisition – estimated by a Probit model – as an alternative instrument.

For estimation we use the more efficient two-step variant of the Difference GMM estimator, where the second-step estimation is based on weighted results from a consistent first-step estimator. To correct standard errors for heteroscedasticity and possible autocorrelation, the finite sample correction proposed by Windmeijer (2005) is applied in all GMM estimations.[15]

4 Data and Descriptives

The data used in this paper is compiled from two different sources. The first one is the ZEPHYR database, an M&A database published by Bureau van Dijk. ZEPHYR includes data on M&As, IPOs, joint ventures and private equity transactions and provides information about the date and value of a deal, the source of financing as well as a description of the type

[14] Empirical investigations indeed find that ownership concentration per se does not affect investment (see e.g. Audretsch and Elston (2002) for empirical evidence for German quoted firms).
[15] Estimation is based on the STATA program xtabond2 (Roodman 2003).

of transaction and the firms involved in the deal. Compared to other M&A data sources like Thompson Financial Securities data it has the advantage that there is no minimum deal value for a transaction to be included in the data base. When comparing aggregate statistics derived from own calculations of the ZEPHYR database with those from Thompson financial data we found that the coverage of transactions with a deal value above 10 million US $ is very similar.[16]

The second data set used is the AMADEUS database, a database that provides information on firms' balance sheet and profit and loss accounts for up to ten years as well as ownership and subsidiary information. The financial data include balance sheet items and information from profit and loss accounts and are collected from company reports which are supplemented by specialized regional information providers. Further, among other variables, AMADEUS includes information about employment, industry, legal form and date of incorporation. The database has been used in numerous empirical firm-level studies.[17] Since we merged six updates (no. 64, 88, 113, 136, 146 and 168) of the database we are able to consider entry and exit of firms and thus a broader sample of firms to identify equity holdings of venture capital companies. Observations from the AMADEUS database are merged with the transaction data from ZEPYHR by a common firm identifier. Since the availability of balance sheet data varies considerably across countries, we restrict our analysis to firms from the UK and France.

Based on the merged data set we identified target firms of private equity transaction and deleted all firms that were involved in other mergers and acquisitions or belong to an industrial corporate geroup. For a private equity backed transaction either the business description of the acquirer or the financing of the deal had to indicate the involvement of private equity.[18] We used a combination of the description of the deal type and information about acquired and final stake of an acquirer to classify buyouts and expansion financing. We classified deals that indicated the use of development capital or a capital increase and the acquisition of a minority stake by a private equity investor as expansion financing. Buyouts where defined as transactions in which a private equity investor acquires a majority stake and

[16] Results are available from the authors upon request.
[17] Konings et al. (2003) apply the dataset to investigate financial constraints and company investment in transition countries.
[18] See the data appendix for details.

the description of the deal type indicated a buyout. Our definition of buyouts includes private equity backed management buyouts, but excludes non-private equity financed management buyouts.

We performed some standard data cleaning procedures that are described in the data appendix. The available time period spans the years 1998 to 2007. Since our preferred estimation method is not applicable to panels with gaps and requires the availability of lagged values of the regressors, we only kept firms with at least three consecutive firm-year observations. Further, we only kept firms for which unconsolidated accounts were available and deleted firms with a median value of sales or total assets below € 2 million.

Table 2 provides some summary statistics for the key variables used in this study (see Table 1 for variable definitions). In contrast to many other studies for the UK and France (e.g. Bond et al. 2003), our sample contains a high share of small firms. In line with this observation, the investment to capital ratio as well as the cash flow to capital ratio is higher compared to these studies. In the UK, private equity backed firms are characterized by higher investment and cash flow to capital ratios than other firms, but this is not true for firms in France. Within both countries, private equity backed firms are on average larger and display higher levels of banking debt.

The separate statistics for buyout firms and firms with expansion financing display a large heterogeneity of private equity backed firms. Only firms with expansion financing are characterized by higher investment rates than non-private equity financed firms. On average they are younger, but larger than other firms and are characterized by lower cash flow to capital ratios. Noticeably, the average growth rates of employment and sales are within both countries a multiple of those of non-private equity backed firms. The comparison of mean values further shows that targets of private equity financed buyouts are substantially larger than targets of expansion financing and non-private equity financed firms. They have lower investment rates than the average firm, are older and display similar growth rates of employment and sales. Cash flow to capital ratios of buyout firms are remarkable high, given that this ratio is usually declining with firm size. The level of leverage in private equity financed buyout firms in France and the UK is similar to remaining private equity financed firms. This indicates that private equity investors carefully assure that their portfolio firms do not become overindebted.

Private equity financed firms display a higher share of intangible assets which indicates higher innovation efforts. Table 3 suggests that this is at least partly driven by differences in the distribution of firms across industries. Relative to other firms, private equity-backed firms more often operate in knowledge and technology intensive industries in which innovation activities are more important. While buyouts are in general more concentrated in manufacturing industries, more than fifty percent of firms with expansion financing are located in knowledge intensive service sectors. The latter one may reflect the "new economy hype" since many expansion financed firms had business emphasis on services based on radical breakthroughs in new technologies (i.e. information and communication technologies). The structure of the unbalanced panel used for estimation is depicted in Table 4. It indicates that buyouts are much more common in the UK, where they account for two thirds of all private equity financed firms in the sample. In general, private equity financed transactions are much more present in the UK relative to the number of observations. This finding is consistent with aggregate statistics of venture capital markets published by the European Private Equity & Venture Capital Association.[19]

In Tables 5 and 6 results from Probit regressions for the probability of an acquisition are depicted. Within both countries, private equity investors choose firms with higher sales growth and intangible assets, while a high concentration of ownership reduces the probability of an acquisition. A high cash flow ratio is positively associated with a buyout, but negatively correlated with future expansion financing. This seems plausible, as firms with low cash flow need capital infusion to exploit growth opportunities and firms with high cash flow are those where we expect a lower level of growth opportunities, but a higher capacity of handling increased debt levels.

5 Results

In Table 7 results from simple OLS and fixed effects regressions of our investment model are presented. These models do not account for endogeneity of the covariates and do not properly control for the dynamics in the investment decision. In particular, OLS and fixed effect regressions produce a biased estimate for the lagged dependent variable that also affects the

[19] See e.g. EVCA (2008). Note that average firm size is higher in our sample of British firms. However, this observation holds for different size classes.

estimates of the other coefficients. Furthermore, the coefficients of the other variables may be biased due to correlation with unobserved factors. The results of previous studies indicate that investment-cash flow sensitivities are biased downwards in OLS and fixed effects models due to simultaneity (see e.g. Bond et al. 2003). Hence, the results in table 7 rather serve as a benchmark for the GMM estimation described in section 3. In both countries we see that private equity financed firms are characterized by a significantly lower investment-cash flow sensitivity as well as a significantly higher investment rate. As columns (2) and (4) show, within-firm variation in private equity ownership is correlated with within-firm variation in investment spending and a lower correlation between variation in investment spending and variation in cash flow.

In Table 8 and 9 results from the Difference-GMM estimations are reported. The test statistics show that the validity of our instruments cannot be rejected at conventional significance levels as the Arellano-Bond test does not indicate autocorrelation of second order and the Hansen test does not reject the orthogonality of our instruments to the error term. Column (1) shows results were the private equity dummy is treated as exogenous, in column (2) the dummy variable is solely instrumented by lagged values of the regressors. In columns (3) we use in addition ownership dispersion (Own) lagged two periods and more and in column (4) we use the predicted probability of acquisition, $\hat{Pr}(\Delta PE_t = 1)$. Additional moment restrictions are created by lags of interaction terms of these additional instruments with the cash flow to capital ratio.

In both countries we fail to reject the hypothesis that private equity transactions are exogenous to the investment equation as indicated by the Difference-in-Hansen test in column (1). The general impression is that the results from the simple OLS and fixed effects regressions are confirmed: private equity transactions are associated with higher investment spending and a lower dependency of investment to internal funds of a similar magnitude in France and the UK. Interestingly, we cannot reject the null hypothesis that the cash flow sensitivity of private equity financed firms ($\beta_6 + \beta_8$ in equation (3) in section 3) is zero. This indicates that private equity financing offers the chance to alleviate liquidity constraints sharply.

The estimation results suggest that within both countries a change in private equity ownership leads to a change in investment spending of approximately 25% for firms with a zero change

in the cash flow to capital ratio. The overall effect of private equity investors is declining with an increasing change in the cash flow to capital ratio, approaching zero for a value of $\Delta(C_{it} / K_{i,t-1})$ close to 1.[20] Treating $PE_{i,t}$ as endogenous does not alter our conclusion substantially. The estimates for the coefficient of PE_{it} are a little higher, but the confidence intervals are clearly overlapping. The estimates for the coefficients of the interaction terms with cash flow are quite similar. We can neither reject exogeneity of PE_{it} in column (1) nor of our additional instruments in columns (2)-(4). Further, the Hansen tests for the validity of the lagged levels of the regressors as instruments and the autocorrelation test do not reject the validity of the instruments. We can fairly conclude that our results are not primarily driven by the endogeneity of private equity backed acquisitions.[21]

Irrespective from this positive effect of private equity financing on average, the debate about regulation of private equity financed deals focuses rather on buyouts than on expansion financing of private equity backed firms. Therefore, in Tables 10 and 11, we present findings for expansion financing and buyouts separately. In France, we see that only expansion financing affects investment and investment-cash flow sensitivities significantly, while in the UK both buyouts and expansion financing have a significant impact. Thus it seems that expansion financing clearly spurs investment and reduces financial constraints while the evidence for buyouts is mixed. Neither lower nor higher investment-cash flow sensitivities for buyout firms are detected in France.[22]

The degree of financial constraints is usually found to be quite heterogeneous across different groups of firms and it is often argued that it is higher for small firms. To check whether the impact of private equity investors differs across firms of different size, we estimated separate regressions for firms with a median value of total assets below and above 30 million € respectively.[23] The results are depicted in columns (2) and (3) of Table 10 and 11. We see that

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[20] This value is beyond the 95%-quantile of $\Delta(C_{it} / K_{i,t-1})$ within both countries.

[21] Results of a Hausman tests in which we compared the model in column (1) to the alternative specifications did not indicate invalidity of this specification as well.

[22] As the previous results did not indicate that endogeneity of private equity backed transactions is a severe problem in the Difference GMM estimations, we only present results that assume exogeneity of private equity for the heterogeneous effects. However, treating private equity as predetermined or endogenous yielded similar although less precisely determined coefficients.

[23] This threshold was chosen in order to ensure a sufficient number of firms with buyout financing and firms with expansion financing for each size class in both countries. While only a small fraction of firms without

the cash flow sensitivity of larger French firms is very small and not significantly different from zero, while it remains positive and significant for larger firms in the UK, although the coefficient is lower than for the group of smaller firms. This is line with Bond et al. (2003), who find significantly positive cash flow sensitivities for firms in the UK but insignificant cash flow sensitivities for French firms using a sample of predominantly large, publicly listed firms. Relationship banking that characterizes bank-based financial systems is often argued to be more effective in reducing information asymmetries than market based financial systems.

In both countries the effect of private equity investors and most importantly the interaction with cash flow is only significant for the sample of smaller firms. This finding is consistent with our interpretation that the effect of private equity investors on investment mainly stems from the reduction of financial constraints which are arguably more severe for smaller firms. For the subgroup of smaller firms, the results from the regressions presented in tables 8 and 9 are confirmed. Expansion financing is associated with higher investment and lower cash flow sensitivities in both countries, while the effect of buyouts is only significant for firms in the UK. All in all, the results indicate that expansion financing by venture capitalist can spur investment and alleviate financing constraints in portfolio firms, while buyouts do at least not undermine investment.

We can only speculate about the reasons behind this difference between France and the UK. On the one hand, targets of buyouts in France and the UK can be different in certain attributes like financial soundness, growth opportunities and attitudes of the owners or the management. On the other hand, the supply side conditions, namely the size and structure of private equity markets differ between both countries (see e.g., Wright et al. 2006). Since the UK private equity market has a long history of financing buyouts, one may argue that the UK market defines specific needs and capabilities to improve the allocation of financial resources as well as the efficiency in the corporate sector.

One potential concern is that first-differencing does not remove unobserved heterogeneity that interacts with other regressors, especially cash flow. Put differently, if private equity backed firms display different responses of investment to cash flow before an acquisition, our results might be misleading. To investigate this issue we compared investment-cash flow sensitivities of firms that receive private equity in the future, with other firms. Therefore we created a

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private equity financing in our sample has a value of total assets above 30 million € this is not true of private equity backed firms.

dummy variable $PREPE_{it}$ that equals one for firms without private equity ownership at time *t* that received private equity later in our sample period and interacted this variable with cash flow. We excluded firm-years with private equity ownership from the sample. The results are depicted in table 12.[24] We see that within both countries investment-cash flow sensitivities of firms receiving private equity are not significantly different from other firms, although the coefficient is negative. Thus it seems that the differences in investment cash flow sensitivities of private equity backed firms arise after an acquisition takes place.

Our results so far crucially depend on the ability of cash flows sensitivities within fixed effects and difference GMM models to identify financial constraints. As argued by Cummins et al. (2006) cash flow might be correlated with fundamental firm characteristics that are a predictor for future profitability and hence investment opportunities. This might be a problem, if the ability of cash flow to predict future profitability varies across private equity backed firm and other firms. To investigate this issue we follow Bond et al. (2003) and estimate simple forecasting models for future cash flow including all regressors from the investment model on the right hand side. Results in Table 13 show that the ability of cash flow to forecast future cash flow is not significantly different for private equity backed firms in the UK compared to other firms. The coefficient is only weakly significant in France and the small magnitude of the coefficient indicates that the different role of cash flow to forecast future profitability for private equity backed firm and other firms is unlikely to be the predominant explanation for the differences in investment-cash flow sensitivities.

Another concern is that firms with persistent negative cash flows might display a low sensitivity of internal funds to investment as they might be unable to adjust investments to changes to changes in internal financial resources (see e.g. Brown and Petersen 2009). This might be a problem in our analysis if firms with negative cash flow might be distributed unequally across private equity backed firms and other firms. However, excluding firm-year observations with negative cash flow from our sample did not change our results notably. We performed several further robustness checks, in which we ran regressions that contain an interaction of the private equity dummy with other regressors or an interaction of lagged size (total assets) with cash flow. These alternative specifications did not alter our main

[24] The model does not contain a level effect, as the dummy variable is time invariant within the estimation sample.

conclusions.[25] All in all, the results indicate that on average, private equity investors have the potential to reduce financial constraints in portfolio firms and buyouts do at least not enhance liquidity constraints.

6 Conclusion

While positive impacts of start up financing from private equity investors on the growth of portfolio firms are mostly accepted among policy makers and researchers, the impact of private equity financed buyouts on portfolio firms is subject to a controversial debate.

Using a large panel data set of French and British firms this paper analyzes the effects of both buyouts and expansion financing provided by venture capital companies on investment spending and the dependence of investment on internal finance in portfolio firms. We find that private equity financed firms in the UK and France are characterized by higher investment spending and a lower sensitivity of investment to internal finance. Using dynamic panel data and instrument variable techniques we find that neither unobserved heterogeneity nor endogeneity of private equity transactions are likely to be the predominant explanation for this finding. We cannot reject the null hypothesis that an acquisition by private equity investors is exogenous in our investment equations. Since investment spending of private equity financed firms is similar to other firms before the event of a private equity transaction, the lower investment-cash flow sensitivity of these firms indicate a reduction of financial constraints after the acquisition.

While we find that expansion financing spurs investment in both countries, buyouts have a positive impact on investment in the UK and no impact on investment in France. Consistent with the view that small and medium sized enterprises are mostly affected by financial constraints, we find that private equity is only associated with higher investment and lower investment-cash flow sensitivities for these firms. Hence, in contrast to the notion of several policy makers we do not find any evidence that private equity financed buyouts aggravate financial constraints in portfolio firms.

[25] Results of robustness checks are not reported to save space but are available upon request.

A useful extension of our analysis would be to examine the impact of private equity financed transactions on other measures of firm performance such as productivity or (employment) growth. Further, it might be interesting whether our results also extent to R&D expenditures or other investment types of intangible nature, which are even more dependent on financial structure and to decompose the effects of buyouts to the degree of debt that is used in the transaction. Regarding the remarkable cross-country differences in the effects of buyouts it would be interesting to analyse sources of the differences in detail. In this paper we can only speculate whether the outperformance of UK buyouts is driven by unobserved heterogeneity of target firms, private equity investors or governance mechanism.

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Appendix

Table 1: variable definitions

Variable	Definition
I_t / K_{t-1}	Investment (=purchases - sales of tangible fixed assets) /capital stock
C_t / K_{t-1}	cash flow / capital stock
Δy_t	one year (logarithmic) sales growth rate
ITA_{t-1} / K_{t-1}	intangibles assets / capital stock
B_{t-1} / K_{t-1}	long term debt / capital stock
total assets	total assets
employees	number of employees
K	capital stock (tangible fixed assets)
sales	sales
emp growth	one year (logarithmic) employment growth rate
age	firm age in years
PE	=1, for firms with private equity ownership
EF	=1, for firms with private equity ownership after expansion financing
BO	=1, for firms with private equity ownership after buyout financing

Note: all monetary variables are measured in 1000€ in prices of the year 2000

Table 2: Summary statistics

	UK							
	PE=0		PE=1		EF=1		IBO=1	
	mean	median	mean	median	mean	median	mean	median
I_t / K_{t-1}	0.190	0.095	0.239	0.147	0.360	0.212	0.192	0.128
C_t / K_{t-1}	0.463	0.261	0.785	0.561	0.315	0.276	0.966	0.656
Δy_t	0.026	0.031	0.053	0.057	0.079	0.082	0.043	0.043
ITA_{t-1} / K_{t-1}	0.032	0.000	0.087	0.000	0.105	0.000	0.081	0.000
B_{t-1} / K_{t-1}	0.437	0.161	1.071	0.141	1.281	0.393	0.992	0.089
sales	27,803	11,997	46,504	24,718	36,003	14,773	50,557	29,308
employees	185	84	341	169	237	105	381	184
emp growth	0.012	0.008	0.036	0.026	0.073	0.062	0.022	0.021
K	5,779	1,972	6,460	2,685	6,864	1,859	6,304	2,958
total assets	15,991	6,976	27,313	15,843	23,534	10,333	28,771	18,656
age	28	21	21	14	15	10	23	16
	France							
	PE=0		PE=1		EF=1		IBO=1	
	mean	median	mean	median	mean	median	mean	median
I_t / K_{t-1}	0.278	0.129	0.248	0.114	0.322	0.149	0.167	0.095
C_t / K_{t-1}	0.834	0.593	0.718	0.652	0.338	0.456	1.130	0.818
Δy_t	0.054	0.047	0.108	0.070	0.161	0.111	0.049	0.043
ITA_{t-1} / K_{t-1}	1.216	0.047	2.597	0.228	3.474	0.393	1.605	0.152
B_{t-1} / K_{t-1}	0.155	0.000	0.329	0.000	0.353	0.000	0.303	0.000
sales	31,906	8,197	47,025	13,625	29,018	6,068	67,389	27,476
employees	137	46	273	78	153	45	401	149
emp growth	0.023	0.000	0.041	0.011	0.072	0.041	0.010	0.000
K	6,686	511	12,206	1,040	11,436	523	13,081	2,074
total assets	15,132	4,608	39,982	15,230	27,467	9,102	54,031	23,275
age	25	20	24	15	16	9	32	24

Note: all monetary variables are measured in 1000€ in prices of the year 2000

Table 3: Industry distribution: share of firms across industry types

		Manufacturing		Services	
		hightech	lowtech	knowledge intense	other
France	PE	15.43	23.03	38.73	22.82
	EF	11.64	18.55	53.14	16.67
	BO	20.04	27.37	23.6	28.99
	Non-PE	6.17	19.72	15.66	58.46
UK	PE	14.87	22.7	28.93	33.5
	EF	7.87	16.75	51.27	24.11
	BO	17.56	25.23	19.88	37.34
	Non-PE	6.37	20.39	15.78	57.46

Notes: Classification based on NACE two-digit industry code. Manufacturing, hightech: 24, 29, 31, 33- 35; Manufatcturing, lowtech: 15-23, 25-27, 30, 32, 36, 37 knowledge intensive services: 40, 41, 61, 62, 64, 70-74 other services: 45, 50-52, 55, 60, 63, 90, 92, 93

Table 4: Number of firms and observations

France					
	Firms	Observations	PE=1	EF=1	BO=1
3	2096	6288	384	207	183
4	3694	14776	500	296	228
5	2043	10215	435	255	200
6	1504	9024	384	192	204
7	4337	30359	518	252	287
8	4411	35288	576	232	352
all	18085	105950	2797	1434	1454
UK					
	Firms	Observations	PE=1	EF=1	BO=1
3	1502	4,506	252	65	190
4	1753	7,012	338	132	206
5	1176	5,880	339	100	244
6	828	4,968	324	54	270
7	1609	11,263	658	133	532
8	675	5,400	328	80	248
all	7543	39029	2239	564	1690

Table 5: Probit models for acquisition by Private Equity investors, British firms

	UK *PE*	UK *EF*	UK *BO*
Δy_{t-2}	0.2452***	0.3265***	0.1431***
	(0.041)	(0.053)	(0.053)
I_{t-2} / K_{t-3}	0.0758***	0.1506***	-0.0025
	(0.026)	(0.033)	(0.035)
CF_{t-2} / K_{t-3}	-0.0314***	-0.1048***	0.0278***
	(0.008)	(0.011)	(0.010)
Own_{t-2}	-0.4021***	-0.5436***	-0.2777***
	(0.073)	(0.107)	(0.091)
ITA_{t-2} / K_{t-3}	0.7307***	1.0963***	0.4114***
	(0.111)	(0.149)	(0.145)
B_{t-2} / K_{t-3}	0.0060*	0.0049	0.0018
	(0.003)	(0.004)	(0.005)
N	39029	39029	39029
LogLikelihood	-3211	-1290	-2209
LR-Test	0.000	0.000	0.000

Notes: ***, **, * denotes significance at the 1%, 5%, 10% level. Robust standard errors, clustered at the firm level, are shown in parantheses. In all colums time dummies are included.

Table 6: Probit models for acquisition by Private Equity investors, French firms

	France *PE*	France *EF*	France *BO*
Δy_{t-2}	0.4741***	0.7171***	0.1576
	(0.082)	(0.098)	(0.114)
I_{t-2} / K_{t-3}	0.0443*	0.0538	0.0290
	(0.025)	(0.033)	(0.033)
CF_{t-2} / K_{t-3}	0.0356***	-0.0262*	0.0890***
	(0.011)	(0.015)	(0.014)
Own_{t-2}	-0.3681***	-0.5027***	-0.2045**
	(0.071)	(0.097)	(0.091)
ITA_{t-2} / K_{t-3}	0.4377***	0.7494***	0.1403
	(0.123)	(0.158)	(0.164)
B_{t-2} / K_{t-3}	0.0049	0.0144***	-0.0144
	(0.005)	(0.005)	(0.010)
N	105950	105950	105950
LogLikelihood	-2102	-1092	-1255
LR-Test	0.000	0.000	0.000

Notes: ***, **, * denotes significance at the 1%, 5%, 10% level. Robust standard errors, clustered at the firm level, are shown in parantheses. In all colums time dummies are included.

Table 7: OLS and fixed effects regressions

	UK	UK	France	France
	OLS	FE	OLS	FE
	(1)	(2)	(3)	(4)
I_{t-1}/K_{t-2}	0.0853***	-0.1361***	0.0375***	-0.0932***
	(0.005)	(0.006)	(0.003)	(0.003)
C_t/K_{t-1}	0.0926***	0.0905***	0.0498***	0.1022***
	(0.002)	(0.003)	(0.001)	(0.002)
Δy_t	0.2178***	0.1609***	0.3248***	0.1701***
	(0.008)	(0.009)	(0.009)	(0.010)
Δy_{t-1}	0.0799***	0.0588***	0.1954***	0.1512***
	(0.009)	(0.009)	(0.009)	(0.010)
PE_t	0.0757***	0.0818***	0.0682***	0.1206***
	(0.013)	(0.027)	(0.017)	(0.036)
$PE_t \cdot C_t/K_{t-1}$	-0.0665***	-0.0617***	-0.0276***	-0.0573***
	(0.007)	(0.009)	(0.006)	(0.009)
ITA_{t-1}/K_{t-1}	-0.0968***	0.0832	-0.0000	0.0018***
	(0.023)	(0.061)	(0.000)	(0.000)
B_{t-1}/K_{t-1}	0.0039***	0.0216***	-0.0006	0.0075
	(0.001)	(0.002)	(0.004)	(0.005)
N	39029	39029	105950	105950
F-test	0.000	0.000	0.000	0.000
R-squared	0.0899	0.0701	0.0568	0.0709

Notes: ***, **, * denotes significance at the 1%, 5%, 10% level. Robust standard errors, clustered at the firm level, are shown in parantheses. In all colums time dummies are included.

Table 8: GMM first differences – British firms

	UK	UK	UK	UK
	(1)	(2)	(3)	(4)
I_{t-1}/K_{t-2}	0.0348***	0.0357***	0.0364***	0.0341***
	(0.009)	(0.009)	(0.009)	(0.009)
C_t/K_{t-1}	0.2462***	0.2466***	0.2340***	0.2253***
	(0.026)	(0.026)	(0.025)	(0.024)
Δy_t	0.1315***	0.1343***	0.1458***	0.1415***
	(0.020)	(0.020)	(0.019)	(0.018)
Δy_{t-1}	0.0210*	0.0224*	0.0267**	0.0266**
	(0.012)	(0.012)	(0.012)	(0.012)
PE_t	0.2506***	0.3777**	0.3819**	0.3173**
	(0.058)	(0.148)	(0.173)	(0.156)
$PE_t \cdot C_t/K_{t-1}$	-0.1898***	-0.1866***	-0.1877***	-0.2488***
	(0.049)	(0.049)	(0.066)	(0.062)
ITA_{t-1}/K_{t-1}	0.0505	0.0552	0.1696	0.0385
	(0.289)	(0.289)	(0.275)	(0.269)
B_{t-1}/K_{t-1}	0.0168*	0.0171**	0.0170**	0.0158*
	(0.009)	(0.009)	(0.008)	(0.008)
N	39029	39029	39029	39029
m1	0.000	0.000	0.000	0.000
m2	0.562	0.498	0.485	0.588
Hansen	0.224	0.236	0.276	0.169
Diff-Hansen	0.298	0.236	0.514	0.660
IV for ΔPE_t	ΔPE_t	$PE_t(2,5)$	Own_{t-2}	$\hat{Pr}(\Delta PE_t = 1)$

Notes: ***, **, * denotes significance at the 1%, 5%, 10% level. Robust standard errors are shown in parantheses. m1 (m2) is a test of the null hypothesis of no first (second) order serial correlation. Hansen is a test on the overidentifying restrictions based on the two-step GMM estimator. Diff-Hansen is a tests of the validity of the moment restrictions based on the instruments used in addition to the lagged levels of the regressors. For all test statistics, p-values are reported.

Table 9: GMM first differences – French firms

	France	France	France	France
	(1)	(2)	(3)	(4)
I_{t-1}/K_{t-2}	0.0480*	0.0519*	0.0592**	0.0530*
	(0.029)	(0.029)	(0.028)	(0.027)
C_t/K_{t-1}	0.1831***	0.1792***	0.1754***	0.1793***
	(0.015)	(0.015)	(0.015)	(0.015)
Δy_t	0.3886***	0.3593***	0.3393***	0.3673***
	(0.109)	(0.109)	(0.116)	(0.114)
Δy_{t-1}	0.0453**	0.0444**	0.0399**	0.0463**
	(0.019)	(0.019)	(0.020)	(0.019)
PE_t	0.2533***	0.3163**	0.2803**	0.2740**
	(0.055)	(0.158)	(0.132)	(0.127)
$PE_t \cdot C_t/K_{t-1}$	-0.1904***	-0.1868***	-0.1850***	-0.1860***
	(0.027)	(0.029)	(0.049)	(0.051)
ITA_{t-1}/K_{t-1}	0.0011***	0.0011***	0.0011***	0.0011***
	(0.000)	(0.000)	(0.000)	(0.000)
B_{t-1}/K_{t-1}	-0.0079	-0.0084	-0.0080	-0.0073
	(0.008)	(0.009)	(0.008)	(0.008)
N	105950	105950	105950	105950
m1	0.000	0.000	0.000	0.000
m2	0.979	0.880	0.678	0.841
Hansen	0.241	0.250	0.151	0.143
Diff-Hansen	0.193	0.728	0.564	0.358
additional IV	ΔPE_t	$PE_t(2,5)$	Own_{t-2}	$\hat{Pr}(\Delta PE_t = 1)$

Notes: ***, **, * denotes significance at the 1%, 5%, 10% level. Robust standard errors are shown in parantheses. m1 (m2) is a test of the null hypothesis of no first (second) order serial correlation. Hansen is a test on the overidentifying restrictions based on the two-step GMM estimator. Diff-Hansen are tests of the overidentifying restrictions of the instrument subsets. For all test statistics, p-values are reported.

Table 10: GMM first differences (Buyouts and Expansion financing), British firms

	UK	UK	UK
	all firms	small firms	large firms
	(1)	(2)	(3)
I_{t-1}/K_{t-2}	0.0311***	0.0282***	0.0456*
	(0.0113)	-0.01	-0.0243
C_t/K_{t-1}	0.2479***	0.2503***	0.1526***
	(0.0269)	(0.0266)	(0.0466)
Δy_t	0.1310***	0.1231***	0.1936***
	(0.0217)	(0.0203)	(0.0415)
Δy_{t-1}	0.0243*	0.0285**	0.0180
	(0.0129)	(0.0139)	(0.0237)
EF_t	0.3043**	0.3444**	0.2518
	(0.1456)	(0.1700)	(0.1553)
$EF_t \cdot C_t/K_{t-1}$	-0.2300***	-0.2670***	-0.0617
	(0.0706)	(0.0477)	(0.1236)
BO_t	0.1487**	0.2636***	-0.1384
	(0.0683)	(0.0823)	(0.1179)
$BO_t \cdot C_t/K_{t-1}$	-0.1581***	-0.2084***	0.1529
	(0.0451)	(0.0448)	(0.0937)
ITA_{t-1}/K_{t-1}	-0.1572	-0.3403	0.0421
	(0.3419)	(0.3456)	(0.5678)
B_{t-1}/K_{t-1}	0.0215	0.0241***	0.0082
	(0.0170)	(0.0090)	(0.0161)
N	39029	33818	5211
m1	0.000	0.000	0.000
m2	0.666	0.429	0.175
Hansen	0.512	0.668	0.878
Diff-Hansen	0.233	0.393	0.934

Notes: ***, **, * denotes significance at the 1%, 5%, 10% level. Robust standard errors are shown in parantheses. m1 (m2) is a test of the null hypothesis of no first (second) order serial correlation. Hansen is a test on the overidentifying restrictions based on the two-step GMM estimator. Diff-Hansen are tests of the validity of the moment restrictions generated by the assumption of exogeneity of BO and EF. For all test statistics, p-values are reported.

Table 11: GMM first differences (Buyouts and Expansion financing), French firms

	France	France	France
	all firms	small firms	large firms
	(1)	(2)	(3)
I_{t-1}/K_{t-2}	0.0395	0.0359	0.0366
	(0.030)	(0.031)	(0.028)
C_t/K_{t-1}	0.1721***	0.1760***	0.0499
	(0.016)	(0.016)	(0.031)
Δy_t	0.4820***	0.5082***	0.2775***
	(0.121)	(0.122)	(0.080)
Δy_{t-1}	0.0632***	0.0629***	0.0629
	(0.021)	(0.023)	(0.052)
EF_t	0.2358***	0.2390***	-0.0180
	(0.074)	(0.087)	(0.115)
$EF_t \cdot C_t/K_{t-1}$	-0.1834***	-0.1952***	-0.0677
	(0.033)	(0.036)	(0.047)
BO_t	-0.0818	-0.2304	-0.1265
	(0.128)	(0.227)	(0.082)
$BO_t \cdot C_t/K_{t-1}$	-0.0239	0.0462	-0.0134
	(0.067)	(0.092)	(0.042)
ITA_{t-1}/K_{t-1}	0.0012***	0.0012***	0.0061
	(0.000)	(0.000)	(0.005)
B_{t-1}/K_{t-1}	-0.0095	-0.0059	-0.0007
	(0.009)	(0.009)	(0.026)
N	105950	101657	4293
m1	0.000	0.000	0.000
m2	0.805	0.748	0.112
Hansen	0.259	0.364	0.856
Diff-Hansen	0.912	0.542	0.728

Notes: ***, **, * denotes significance at the 1%, 5%, 10% level. Robust standard errors are shown in parantheses. m1 (m2) is a test of the null hypothesis of no first (second) order serial correlation. Hansen is a test on the overidentifying restrictions based on the two-step GMM estimator. Diff-Hansen are tests of the validity of the moment restrictions generated by the assumption of exogeneity of BO and EF. For all test statistics, p-values are reported.

Table 12: Private Equity backed firms before the acquisition

	UK (1)		France (2)	
I_{t-1} / K_{t-2}	0.0329***	(0.010)	0.0762***	(0.028)
C_t / K_{t-1}	0.2374***	(0.027)	0.1914***	(0.016)
Δy_t	0.1250***	(0.019)	0.2674**	(0.123)
Δy_{t-1}	0.0155	(0.012)	0.0231	(0.020)
$PREPE_t \cdot C_t / K_{t-1}$	-0.0587	(0.080)	-0.0773	(0.116)
ITA_{t-1} / K_{t-1}	0.3839	(0.304)	0.0011***	(0.000)
B_{t-1} / K_{t-1}	0.0110	(0.009)	-0.0125	(0.009)
N	37209		103827	
m1	0.000		0.000	
m2	0.475		0.337	
Hansen	0.180		0.139	

Notes: ***, **, * denotes significance at the 1%, 5%, 10% level. Robust standard errors are shown in parantheses. m1 (m2) is a test of the null hypothesis of no first (second) order serial correlation. Hansen is a test on the overidentifying restrictions based on the two-step GMM estimator. Diff-Hansen are tests of the overidentifying restrictions of the instrument subsets. For all test statistics, p-values are reported.

Table 13: Forecasting future cash flow

	UK		France	
C_t / K_{t-1}	0.6315***	(0.002)	0.7018***	(0.002)
PE_t	-0.0179	(0.034)	0.1046***	(0.033)
$PE_t \cdot C_t / K_{t-1}$	-0.0017	(0.013)	-0.0199*	(0.011)
I_t / K_{t-1}	-0.2051***	(0.008)	-0.3339***	(0.004)
Δy_t	-0.0121	(0.013)	0.0382***	(0.012)
Δy_{t-1}	0.0298***	(0.011)	0.0573***	(0.011)
ITA_t / K_{t-1}	0.2198***	(0.037)	0.0016***	(0.000)
B_t / K_{t-1}	0.0220***	(0.001)	-0.0159***	(0.005)
F-Test	0.000		0.000	
R-squared	0.353		0.452	

Notes: ***, **, * denotes significance at the 1%, 5%, 10% level.
Robust standard errors are shown in parantheses. In all colums time dummies are included.

Data Appendix

Data cleaning and sample selection

Firms with missing information on key variables like cash flow, investment or sales growth were deleted from the sample. A few observations had to be dropped because of implausible values such as negative values for sales or the capital stock or a value of fixed assets greater than total assets. Further, the upper and lower 1%-quantile of sales growth and the investment to capital ratio as well as the upper 1%-quantile of the long term debt to total assets ratio were deleted. Values of the cash flow to capital ratio above 5 were deleted from the sample to eliminate coding errors and outliers. All monetary variables are measured in 1000 € and in prices of the year 2000. We excluded firms that were subject to a merger or acquisition or a management buyout that did not involve a private equity firm or were part of an industrial corporate group at the beginning of our sample period. Firms from the primary sector (NACE two-digit industry 01-14), holding companies (NACE 7415), financial companies (NACE 65-67), firms from public sectors (NACE75, 80, 91) as well as firms with a legal form that is not public or private limited were excluded. Further we only kept firms with a median value of annual sales and total assets above 2 million €, based on all available firm-year observations, to ensure a minimum of comparability of portfolio firms and our comparison group.

Classification of private equity backed transactions

To identify private equity transactions, three steps where performed. The first was to define potential private equity firms by the business description. In particular the business description had to include spelling variants of at least one of the following words: private equity, venture capital, venture partner, risk capital, seed capital, seed fund, private fund, corporate venturing, angel investment or buyout fund. The NACE classification is not appropriate for the classification of private equity investors, because in many cases it is not possible to differentiate private equity investors from pension funds or holding companies by the industry code. In the second step we used information about the financing of a deal. We classified transactions as private equity backed if the description of the financing of the deal included one of the words development capital, private equity, venture capital, angel investment or leveraged buyout. For a private equity backed transaction either the business description or the financing of the deal had to indicate the involvement of private equity. However, we deleted targets of transactions with unknown deal financing, or a deal financing that indicated seed financing. Similarly we dropped targets from the sample if we could not classify the final stake of the acquirer as minority or majority. In the third step we classified

buyouts as private equity backed transactions in which the deal description included the word buyout and the acquirer acquired a majority stake. We classified transactions as expansion financing if they involved the acquisition of a minority stake and the financing of the deal did not indicate buyout activity. We dropped targets of transactions that did not fit into this profile, e.g. buyouts with a minority stake, expansion financing with a majority stake or cases in which the description of the deal type indicated a buyout, but the description of the financing of the deal indicated the use of development capital.