

THE CERTIFICATION ROLE OF PRIVATE EQUITY INVESTORS: EVIDENCE FROM INITIAL PUBLIC OFFERINGS ON THE NOUVEAU MARCHÉ AND THE NEUER MARKT

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Abstract

This paper presents an empirical analysis of whether independent and dependent private equity investors affect the underpricing of firms which went public on the Nouveau Marché and on the Neuer Markt between 1997 and 2000. In the sample of the Neuer Markt, the involvement of private equity investors reduces the underpricing of the firms' shares only if private equity investors sell a part of their pre-flotation shares at the initial public offering (IPO). By contrast, in the sample of Nouveau Marché, private equity investors have no significant impact on the underpricing. Moreover, this paper presents an empirical analysis of whether dependent and independent private equity investors behave differently when the firms that they have financed go public. While the two groups of private equity investors do not differ with respect to their effect on underpricing, they do differ with respect to changes in their number of shares and thus with respect to their divestment behaviour. Independent private equity investors sell significantly more shares when their firms go public than their dependent counterparts do.

Keywords: private equity, underpricing, initial public offerings, Neuer Markt, Nouveau Marché.

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1. INTRODUCTION

Empirical analyses suggest that venture capitalists' involvement reduces underpricing of initial public offerings (IPOs) in the United States (Megginson and Weiss 1991, Barry et al. 1990). Reducing underpricing is in the interest of old shareholders because underpricing transfers wealth from old shareholders to new ones (Gompers 1996). The recent literature discusses two sources of advantages that venture capitalists' involvement has for firms going public (Ljungqvist 1999). First, venture capitalists may reduce the asymmetric distribution of information between uninformed outside investors and the firms going public. Second, they may reduce the asymmetric distribution of information between underwriters, i.e., investment banks, and the firms going public.

This paper deals with the first source of advantages which venture capitalists' involvement can generate, i.e., with the certification role of venture capitalists. Several empirical studies have analysed this role in the United States. Megginson and Weiss (1991) match a sample of venture-capital-backed firms with non-venture-capital-backed firms and find that venture-capital-backed firms are significantly less underpriced. Barry et al. (1990) find evidence that venture-capital-backed IPOs experience lower underpricing than non-venture-capital-backed IPOs. Venture capitalists' involvement is captured by several proxies such as the number of venture capitalists with equity stakes before the IPO, their fraction of shares before the IPO, and the cumulative number of prior IPOs in which the lead venture capitalist has participated. Brav and Gompers (1997) find evidence that venture-capital-backed firms outperform non-venture-capital-backed ones even after the IPO.

The certification role of venture capitalists has also been analysed for IPOs outside the United States. Bergström et al. (1995) replicate the analysis of Barry et al. (1990) for a sample of Swedish IPOs. In their sample, the cumulative number of prior IPOs in which the lead venture capitalist has participated is the only significant variable which negatively affects the underpricing. Franzke (2001) analyses a sample of firms which went public on the Neuer Markt between 1997 and March 2000. She finds evidence that firms which are backed by high-ranked private equity investors are underpriced less than the other firms which are either not private-equity-backed or firms which are backed by low-ranked private equity investors.

In this paper, I use a sample of firms which went public on the Neuer Markt in Frankfurt and on the Nouveau Marché in Paris between 1997 and 2000 in order to determine whether private equity investors certify the quality of the firms going public and thus reduce underpricing. Underpricing is defined as the opening price of the first trading day minus the offer price, scaled

by the offer price. The term private equity is used here instead of venture capital because some French and German investors are legally connected to their capital providers such as private banks and corporations, while the venture capital investors in the United States are most often independent of their capital providers (for a detailed discussion of the differences, see Schertler 2001).

The results of the empirical analysis do not support the view that private equity investors per se reduce the underpricing of firms going public. None of the proxies used for private equity investors' involvement is statistically significant in the sample of the Nouveau Marché. In the sample of the Neuer Markt, private equity investors' involvement has a significant impact on the underpricing only if private equity investors' selling behaviour is taken into account. The private equity investors' involvement per se even increases underpricing, while the selling of private equity investors' shares reduces the underpricing. In combination, underpricing is lower for private-equity-backed firms if the private equity investors sell some of their shares at the IPO.

Moreover, I focus on the differences between dependent and independent private equity investors in a sample of private-equity-backed firms of the Neuer Markt. Distinguishing several types of venture capitalists and private equity investors is not uncommon in the recent literature. Gompers (1996) examines whether inexperienced venture capitalists behave differently from experienced ones. He finds that firms backed by inexperienced venture capitalists go public earlier, with higher underpricing, than firms backed by experienced venture capitalists. Hamao et al. (2000) analyse a sample of Japanese IPOs and differentiate between dependent and independent private equity investors. They find evidence that the long-run performance of firms backed by independent private equity investors is better than the performance of firms backed by dependent private equity investors.

I expect to find differences between dependent and independent private equity investors with respect to their behaviour in the IPO process because the IPO process plays a potentially important role for independent private equity investors, but not so much for dependent private equity investors. IPOs are important for independent private equity investors to refinance a part of their participations successfully. Thus, I expect that independent private equity investors care more about the underpricing of firms' shares than their dependent counterparts do, and that independent private equity investors sell more shares in the IPO than their dependent counterparts do.

The findings of this empirical analysis suggest that the dependent and independent private equity investors indeed behave differently when the firms that they have financed go public. While the dependent and independent private equity investors affect the underpricing of firms

going public in a similar manner, they do differ with respect to the change in the number of their shares and thus with respect to their divestment behaviour. The independent private equity investors sell significantly more shares at the IPOs than their dependent counterparts do.

The paper is organised as follows. Section 2 formulates the testable hypotheses presented in the paper. Section 3 presents the results of empirically analysing the impact of private equity investors' involvement on underpricing of firms which have gone public on the Neuer Markt and the Nouveau Marché. Section 4 presents the results of empirically analysing the differences between dependent and independent private equity investors. Section 5 concludes.

2. PRIVATE EQUITY INVESTORS AND THE IPO PROCESS

2.1 Certification by Private Equity Investors

Private equity investors may reduce the underpricing by reducing the asymmetric distribution of information between the uninformed outside investors and the firms going public. As argued by Megginson and Weiss (1991), private equity investors can certify price accuracy, i.e., they can certify that the offer price of the firms' shares reflects all available information. Private equity investors can take on this certification role because they fulfil all the requirements which are necessary for the certification to be credible.

Three requirements seem necessary for the certification to be credible (Megginson and Weiss 1991). First, private equity investors have reputational capital at stake which would be forfeited by certifying falsely. Second, the increase in wealth obtained by private equity investors by certifying falsely must necessarily always be smaller than the value of private equity investors' reputational capital. And third, signalling per se must be possible, i.e., the cost structure of using private equity investor certification must be such that low- and high-information firms can be identified.

Since all three requirements seem to be fulfilled in the case of private equity investors, private equity investors seem to be capable of certifying the quality of the firms which they have financed. Thus, one would expect that private equity investors' involvement would reduce the underpricing of the firms' shares at the IPO.

When the certification role of private equity investors is analysed empirically, it is important to control for the private equity investors' incentives to influence the offer price because of the private equity investors' individual selling behaviour. As argued by Ljungqvist (1999), a positive impact of private equity investors' involvement need not be the result of a certification by private equity investors because private equity investors often sell their own firms' shares at the IPO. The more shares private equity investors sell at the IPO, the more direct monetary incentives the private equity investors have to favour a high offer price.

2.2 Differences between Independent and Dependent Private Equity Investors

Differences between dependent and independent private equity investors exist with respect to their capital providers. Dependent private equity investors raise their capital from capital providers with which they are legally connected. Independent private equity investors by contrast have to raise their capital from uninformed capital providers. The uninformed capital

providers will give their capital to independent private equity investors only if they believe in high returns on the investments. This difference in capital provision does not only affect the investment but also the divestment strategies of private equity investors.

Dependent private equity investors, such as subsidiaries of private banks, insurances and corporations often receive their capital from a single capital provider, and sometimes from a consortium of capital providers. The single capital provider or the consortium of capital providers is often the 'founder' of the private equity investor and therefore it often affects the investment strategy of the private equity investor fundamentally. For example, dependent private equity investors which are subsidiaries of private banks are required to concentrate their investments on the later stages of enterprises' development, which are less risky than the early stages, while subsidiaries of corporations focus their investments on technological innovations in which their capital providers are interested (Lessat et al. 1999).

The capital providers can also affect the divestment behaviour of dependent private equity investors. Dependent private equity investors neither have to divest their participations in order to receive capital for further investments (because they usually receive additional capital from their capital providers on request) nor do they have to re-pay the money to the capital providers at a particular point in time. Thus, dependent private equity investors have soft budget constraints. In addition, the necessity to divest in order to obtain a high short-term performance of the portfolio is low because the capital providers of dependent private equity investors are not primarily interested in the short-term performance of the portfolio, but in several other goals such as building long-term cooperative relationships and keeping an eye on new technological developments.

Independent private equity investors, by contrast, have to raise capital for their investment activity from uninformed capital providers, such as pension funds and insurances. Independent private equity investors must not only maximize the long-term performance but also the short-term performance of their portfolios because their capital providers will not provide additional capital if the short-term performance is low. In addition, if the short-term portfolio performance is low, uninformed capital providers may remove their capital from the private equity market. Thus, the budget constraint of independent private equity investors is more restrictive than that of dependent private equity investors. Moreover, since most independent private equity investors participate in the returns of their investment company (Zemke 1995), they have an individual incentive to care about long-term and short-term performance because increasing the returns of the portfolio increases their income as well.

Independent private equity investors' pursuit of high short-term performance and the existence of a hard budget constraint leads to particular divestment behaviour which is different from the

divestment behaviour of the dependent private equity investors. In particular, I expect that independent private equity investors reduce underpricing more than their dependent counterparts because independent private equity investors have more incentives to do so than their dependent counterparts who often do not participate in the returns of the portfolios (Zemke 1995). Moreover, I expect that independent private equity investors sell more of their share in the IPO than their dependent counterparts in order to realize a part of their returns and in order to improve their liquidity.

3. DO PRIVATE EQUITY INVESTORS AFFECT UNDERPRICING?

3.1 Descriptive Statistics

The samples used here contain 256 firms that went public on the Neuer Markt in Frankfurt between 1997 and 2000 and 71 firms that went public on the Nouveau Marché in Paris between 1997 and 2000. The sample sizes differs from the total number of firms that went public because only those firms are considered which used the book-building method to sell their shares. Moreover, firms are excluded for which the IPO prospectus was not available. In addition, some firms are excluded because the IPO prospectus does not offer the necessary information on the shareholders and the share allocation before and after the IPO.

The Deutsche Börse provided the data on the all-share performance index of the Neuer Markt. The Institut für Entscheidungstheorie und Unternehmensforschung, Karlsruhe, provided the share prices of the firms which went public on the Neuer Markt. The Bourse de Paris provided data on the all-share performance index of the Nouveau Marché and on the share prices of the firms which went public on the Nouveau Marché. Firm-specific data was collected from the Internet sites of the firms, their annual reports and their IPO prospectuses. The IPO prospectuses were used to identify the private equity investors that financed the firms and the number of primary (new) and secondary (old) shares. In order to categorise the private equity investors in two groups, dependent and independent ones, I used Hugot (2000), who presents the main characteristics of the French private equity investors, the Internet page of the German Venture Capital Association (BVK), on which German private equity investors offer information about their capital providers, the yearbook of the European Venture Capital Association (EVCA 2000), and, in case the necessary information could not be collected by using these three sources, I used the Internet pages of the particular private equity investor.

Table 1 depicts the number of total IPOs on the Neuer Markt and on the Nouveau Marché between 1996 and 2000 and the number of IPOs in the samples used here for the empirical analysis. 161 firms went public on the Nouveau Marché between 1996 and 2000, while 316 firms went public on the Neuer Markt between 1997 and 2000. There were more private-equity-backed firms on the Nouveau Marché than on the Neuer Markt during these periods. About 45 per cent of the firms on the Neuer Markt were private-equity-backed at the time of their IPO. By contrast, more than 60 per cent of the firms on the Nouveau Marché were private-equity-backed.

The percentage of private-equity-backed firms which are biotechnology- and health-related is higher in the Neuer Markt sample than in the Nouveau Marché sample, while the percentage of

firms which are information- and communications-related is lower in the Neuer Markt sample than in the Nouveau Marché sample (Table 2). About 15 per cent of the private-equity-backed firms in the Neuer Markt sample were biotechnology- and health-related, while the respective percentage of the Nouveau Marché sample was only about 7 per cent, and about 66 per cent of the private-equity-backed firms in the Neuer Markt sample were information- and communications-related, while the share of these firms is comparably higher in the Nouveau Marché sample, namely 80 per cent.

Table 1: Frequency Distribution of Private Equity and Non-Private-Equity-Backed IPOs

	Number of IPOs	Number of IPOs in the sample	Private-equity-backed (number)	Private-equity-backed (per cent)
Neuer Markt				
1997	11	3	2	66.6
1998	40	22	11	50.0
1999	132	107	43	40.2
2000	133	125	61	48.8
Total	316	257	118	45.5
Nouveau Marché				
1996	18	0	Na	Na
1997	19	1	0	0.0
1998	43	16	8	50.0
1999	31	21	15	71.4
2000	50	33	21	63.6
Total	161	71	44	62.0

Biotechnology and health-related firms are most often private-equity-backed in both samples, while this is not the case for information- and communications-related firms. About 15 (7) per cent of the private-equity-backed firms in the Neuer Markt sample (Nouveau Marché sample) are biotechnology- and health-related, while only 5 (3) per cent of the non-private-equity-backed firms are biotechnology- and health-related. The opposite holds for the information- and communications-related firms. While 78 per cent of the non-private-equity-backed firms in the Neuer Markt sample are information- and communications-related, only 66 per cent of the private-equity-backed firms are information- and communications-related.

The private-equity-backed firms in the sample of the Neuer Markt are younger and less established than the non-private-equity-backed firms. The private-equity-backed firms are nine years old on average and have 257 employees on average (Table 3). Their non-private-equity-backed counterparts are more than one year older on average and have an additional of 100 employees on average. These differences do not only exist in the average values but also in median values. The youngest and smallest firm in the sample of the Neuer Markt, a non-private-equity-backed

one, is about one year old and has only five employees. The firms in the Neuer Markt sample are, however, not only young and small firms. There are several firms which are well established in terms of their age and of the number of employees. The oldest firm is almost 80 years old. The most established firm in terms of employees has almost 2,700 employees.

Table 2: Sector Focus of Private-Equity and Non-Private-Equity-Backed Firms

	Neuer Markt		Nouveau Marché	
	Private-equity-backed	Non-private-equity-backed	Private-equity-backed	Non-private-equity-backed
Biotechnology- and health-related (per cent)	15.3	5.0	6.7	3.2
Information- and communications-related (per cent)	66.1	78.0	80.0	80.7
Number of IPOs in sample	118	139	44	26

The private-equity-backed firms differ from their non-private-equity-backed counterparts with respect to offering characteristics in the Neuer Markt sample. The non-private-equity-backed firms have an average underpricing of about 49 per cent, while private-equity-backed firms have an average underpricing of about 52 per cent (Table 3). Moreover, the mean and median value of gross proceeds (in million euros) indicate that the private-equity-backed firms raise less money at the IPO than their non-private-equity-backed counterparts. These differences might be driven by the fact that the private-equity-backed firms are, on average, younger and less established in terms of employees than non-private-equity-backed firms. Interestingly, the aftermarket standard deviation of the log returns from day 2 to 15, which I use as a proxy for ex ante uncertainty (for a discussion of this variable see Ritter 1984), is lower for the private-equity-backed firms than for the non-private-equity-backed firms. Thus, the private-equity-firms have lower ex ante uncertainty than their non-private-equity-backed counterparts.

The private-equity-backed firms in the Nouveau Marché sample are more established than their non-private-equity-backed counterparts (Table 3). Both, the median and mean age are higher for private-equity-backed firms than for non-private-equity-backed firms. Moreover, private-equity-backed firms have more employees than their non-private-equity-backed counterparts. But this does not hold for the median value indicating that some of the private-equity-backed firms have a higher number of employees.

The firms in the Nouveau Marché sample also differ with respect to their offering characteristics (Table 3). The private-equity-backed firms have a higher average underpricing than their non-private-equity-backed counterparts. However, this does not hold for the median value, which is

lower for private-equity-backed firms than for non-private-equity-backed ones. The private-equity-backed firms raise more capital on average than their non-private-equity-backed counterparts. Again this does not hold for the median value. With respect to the aftermarket standard deviation of log returns from day 2 to 16 after the IPO, the private-equity-backed firms have both a higher average and a higher median value, indicating that the ex ante uncertainty is higher for private-equity-backed firms.

Table 3: Differences between Private-Equity and Non-Private-Equity-Backed IPOs

	Mean	Median	Standard deviation
Neuer Markt			
Non-private-equity-backed IPOs			
<i>Firms' characteristics</i>			
Age at IPO	10.3	8.2	10.1
Number of employees	355.3	182.0	454.2
<i>Offering characteristics</i>			
Underpricing (per cent)	49.3	18.4	77.9
Gross proceeds (million euros)	103.9	44.0	287.7
Aftermarket standard deviation	8.7	7.2	6.1
Private-equity-backed IPOs			
<i>Firms' characteristics</i>			
Age at IPO	9.1	7.5	7.4
Number of employees	257.4	154.0	357.5
<i>Offering characteristics</i>			
Underpricing (per cent)	52.0	19.0	67.9
Gross proceeds (million euros)	51.8	38.3	41.4
Aftermarket standard deviation	8.2	6.9	5.6
Nouveau Marché			
Non-private-equity-backed IPOs			
<i>Firms' characteristics</i>			
Age at IPO	8.5	6.8	5.4
Number of employees	194.0	162.0	137.3
<i>Offering characteristics</i>			
Underpricing (per cent)	9.2	1.3	17.0
Gross proceeds (million euros)	17.7	13.5	17.0
Aftermarket standard deviation	6.2	5.9	4.6
Private-equity-backed IPOs			
<i>Firms' characteristics</i>			
Age at IPO	9.0	8.3	5.6
Number of employees	214.4	115.5	287.3
<i>Offering characteristics</i>			
Underpricing (per cent)	16.0	0.3	45.7
Gross proceeds (million euros)	22.4	12.3	22.3
Aftermarket standard deviation	9.8	6.4	14.4

As documented in Table 3, the firms in the Neuer Markt sample and the Nouveau Marché sample differ substantially. Most noticeable is the difference in underpricing. While the firms in the Nouveau Marché sample have, on average, an underpricing of 14 per cent, the respective number for firms in the Neuer Markt sample is about 50 per cent. Thus, the underpricing of the firms in the Neuer Markt sample is about three times as high as the underpricing of the firms in the Nouveau Marché sample.

Table 4 indicates the important role of private equity investors as source of funding for high-technology firms. Private equity investors own about 27 per cent of the firms' shares before the IPOs in the Neuer Markt sample. Private equity investors even own more than 36 per cent the firms' shares before the IPOs in the Nouveau Marché sample.

The old shareholders of the firms in the Neuer Markt sample sell more of their shares than the old shareholders of the firms in the Nouveau Marché sample (Table 4). On the Neuer Markt, the old shares sold relative to the pre-flotation share number account for about 9 per cent, and private equity investors make 6.5 per cent available. In the Nouveau Marché sample, firms sell only about 8 per cent of the old shares at the IPO, and private equity investors make about four per cent available. Thus, private equity investors are the main provider of secondary shares at the IPOs of firms in the Neuer Markt sample and one main provider in the Nouveau Marché sample.

Table 4: Private Equity Investors' Involvement in the Neuer Markt and Nouveau Marché Sample

	Neuer Markt	Nouveau Marché
Shares of private equity investors prior to the IPO relative to pre-flotation share number (average)	27.2 (21.9)	36.2 (24.0)
Share number sold relative to the pre-flotation share number (average)	9.1 (9.6)	7.9 (9.5)
Share number sold by private equity investors relative to the pre-flotation share number (average)	6.5 (13.4)	3.8 (4.8)
Shares sold by private equity investors relative to their pre-flotation number (average)	22.2 (21.9)	10.7 (10.7)
Number of private equity investors that does not sell at IPO (average percentage)	16.1	38.6

The number in parentheses are standard deviations.

There are two further measures that offer information on the selling behaviour of private equity investors (Table 4). The shares sold by private equity investors relative to their pre-flotation share number indicates that private equity investors of firms in the Neuer Markt sample sell about double as much of their shares as private equity investors of firms in the Nouveau Marché sample. This particular selling behaviour of private equity investors of firms in the Neuer Markt sample is also suggested by the number of private equity investors that do not sell any shares. While about 39 per cent of the private equity investors do not sell any shares in the Nouveau Marché sample, only 16 per cent of the private equity investors do not sell shares in the Neuer Markt sample.

Private-equity-backed firms in the Neuer Markt sample are underwritten by less prestigious underwriters than their non-private-equity-backed counterparts, while private-equity-backed firms in the Nouveau Marché sample are not underwritten by less prestigious underwriters, as suggested by the rank of the underwriter presented in Table 5. Thus, unlike the venture-capital-backed firms in the sample of Barry et al. (1990), the private-equity-backed firms are not underwritten by more prestigious underwriters.

Table 5: Underwriter Reputation

	Neuer Markt		Nouveau Marché	
	Private-equity-backed	Non-private-equity-backed	Private-equity-backed	Non-private-equity-backed
Average underwriter rank	1.8 (0.8)	2.1 (0.8)	1.9 (0.8)	1.9 (0.8)
Average number of IPOs underwritten by the underwriter	15.0 (12.7)	16.8 (13.3)	6.7 (3.72)	7.5 (4.5)
Average gross proceeds of IPOs underwritten by the underwriter (million euros)	132.2 (110.7)	189.0 (267.8)	55.2 (51.4)	41.6 (27.9)

The number in parentheses are standard deviations.

The underwriters are ranked as follows. Underwriters are ranked high (equal to 3) if they have a high number of previous IPOs and a high volume of average gross proceeds relatively to their competitors. The number of previous IPOs is the number of IPOs which the underwriter has underwritten before the IPO of a particular firm on the particular stock market. The average gross proceeds are the respective volumes of these IPOs. Underwriters are ranked low (equal to one) if they have a comparatively low number of IPOs and low average gross proceeds.

Underwriters are ranked medium (equal to 2) if they are in a middle position compared to other underwriters.

3.2 Regression Results

Regressions are performed on the underpricing of the two samples of firms that went public on the Neuer Markt between 1997 and 2000 and on the Nouveau Marché between 1997 and 2000. In the regressions, I use the aftermarket standard deviation of log returns from day 2 to day 16 after the IPO, the log of gross proceeds in million euros, stock market performance, and the rank of the underwriter as control variables.

The aftermarket standard deviation of log returns from day 2 to day 16 after the IPO captures the ex ante uncertainty of firms going public. The higher the ex ante uncertainty, the higher the volatility of the share prices after the IPO is, i.e., the higher the aftermarket standard deviation. It is expected that higher ex ante uncertainty leads to higher underpricing.

The log of gross proceeds can capture price pressure and ex ante uncertainty. Price pressure exists if investors buy a firm's additional shares only at a reduced price. The firm's proceeds seem more appropriate for capturing price pressure than the number of primary shares offered. The reason for this is that two firms which offer each 10,000 primary shares may have different price pressures only because the value of the shares are different. I expect that price pressure leads to a positive sign of the coefficient of log gross proceeds. By contrast, if the log of gross proceeds captures the ex ante uncertainty of the firms, I expect negative sign of its coefficient. The higher the gross proceeds, the more established a firm (because it has a higher capital demand), and the lower the ex ante uncertainty is.

A further control variable which I use in the regressions is the stock market performance measured by the 10 day average growth rate prior the IPOs. As noted by Keasy and McGuinness (1995), the adjustment of the stock market may have a 'non-trivial effect' on underpricing. There are two explanations for this. First, since other already listed shares probably increase in value between the offering day and the first trading day of a firm's shares, investors demand compensation for this expected increase. Second, high stock market performance attracts additional investors and this can push the opening price on the first trading day. Thus, I expect stock market performance to have a positive and significant impact on underpricing.

The rank of the underwriter is used as exogenous variable because underwriters can certify the quality of firms to uninformed outside investors and by doing so they reduce the underpricing of firms' shares. Carter and Manaster (1990) argue that underwriters build a reputation for accurate pricing of IPOs and that prestigious underwriters use their reputation to set a higher offer price, which, ceteris paribus, reduces the underpricing. If underwriters care about their reputation,

prestigious underwriters have incentives to attract higher quality firms (Titman and Trueman 1986). Thus, I expect, as a many authors before me, that underpricing is lower for firms which are underwritten by prestigious underwriters.

In addition to these control variables, I use sector and year dummies. I distinguish four industries. Firms are either information- and communications-related, or biotechnology- and health-related, or industry- and services-related or financial-service-related.

Moreover, I construct the variable IPODAY to capture the time pattern within a particular year. IPODAY measures the number of days between the particular IPO day and 31 December of the IPO year. A positive significant coefficient of this variable indicates that firms going public at the beginning of a year are more underpriced than firms going public at the end of the respective year.

Table 6 presents the regression results of the Neuer Markt sample and Table 7 presents the regression results of the Nouveau Marché sample. I estimate the samples separately because a Chow breakpoint test indicates significant differences between the two samples. The F-statistic of the Chow test is about 3.5 which is highly significant. Thus, a dummy variable which is equal to one for the firms in the Neuer Markt sample is not sufficient to capture the fundamental differences between the two samples.

The involvement of private equity investors is captured by several variables. In Model 1, I only use a dummy variable equal to one if the firm is backed by a private equity investor. Thus, Model 1 ignores the argument by Linnqvist (1999) that private equity investors affect the underpricing because they sell their own shares. In Model 2, in addition to the dummy variable for private equity-backing, I use a second dummy variable which is equal to one if the private equity investors sell shares at the IPO. In Model 3, instead of the second dummy variable, I use the selling intensity of the private equity investor or of the consortium of private equity investors, which is defined as the number of secondary shares sold by the private equity investors relative to the pre-flotation share number. In Model 4, I only use the participation intensity of private equity investors, which is defined as the number of private equity investors' shares prior the IPO divided by the pre-flotation share number.

The only significant impact of private equity investors' involvement can be observed in Model 2. The dummy variable which is equal to one if the firm is private-equity-backed is positive and statistically significant at the 10 per cent level. The dummy variable which is equal to one if the private equity investors sell shares at the IPO is negative and statistically significant at the 5 per cent level. This indicates that private equity per se has a positive impact on underpricing. Only if the private equity investors sell shares at the IPO, they reduce the underpricing. Private equity investors' involvement per se increases the underpricing by about

34 per cent, and the selling of shares by private equity investors reduces the underpricing by about 42 per cent.

Table 6: Ordinary Least Square Regressions of the Neuer Markt Sample

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>
Intercept	0.180 (0.277)	0.215 (0.275)	0.185 (0.277)	0.198 (0.258)
Dummy for 1997	-0.061 (0.194)	-0.025 (0.184)	-0.058 (0.202)	-0.058 (0.203)
Dummy for 1998	0.380** (0.149)	0.381** (0.154)	0.392*** (0.149)	0.387** (0.149)
Dummy for 1999	0.053 (0.099)	0.061 (0.097)	0.037 (0.098)	0.036 (0.099)
IPODAY	0.003*** (0.001)	0.003*** (0.001)	0.003*** (0.001)	0.003*** (0.001)
Dummy for information- and communications-related firms	-0.071 (0.195)	-0.078 (0.191)	-0.076 (0.196)	-0.082 (0.195)
Dummy for biotechnology- and health-related firms	0.012 (0.220)	0.018 (0.217)	0.003 (0.221)	0.012 (0.220)
Dummy for industry- and service-related firms	-0.164 (0.202)	-0.159 (0.198)	-0.163 (0.203)	-0.165 (0.201)
Aftermarket standard deviation	1.770*** (0.645)	1.500** (0.680)	1.730*** (0.654)	1.751*** (0.645)
Stock market performance prior the IPO	22.241*** (5.652)	22.758*** (5.588)	22.503*** (5.730)	22.424*** (5.629)
Log of gross proceeds	-0.036 (0.048)	-0.042 (0.047)	-0.037 (0.047)	-0.039 (0.046)
Underwriter rank	-0.089 (0.062)	-0.084 (0.062)	-0.089 (0.062)	-0.087 (0.059)
Dummy for private-equity-backing	-0.021 (0.087)	0.337* (0.196)	0.003 (0.093)	
Dummy equal to one if private equity investors sell shares		-0.423** (0.193)		
Private equity investors' selling intensity			-0.295 (0.375)	
Private equity investors' participation intensity				-0.178 (0.168)
Number of observations	256	256	256	256
Adjusted R ² (per cent)	24.985	26.545	24.779	25.178
F-Statistic	8.078***	8.089***	7.462***	8.151***

Dependent variable is underpricing defined as the opening price on the first trading day minus the offer price, scaled by the offer price. IPODAY is the number of days between the IPO date and 31 December. Aftermarket standard deviation denotes the standard deviation of the log returns from day two to day 16 after the IPO. The stock market performance prior the IPO is the average of the daily growth rates of the all-share performance index of the 10 days prior the IPO. Gross proceeds are in million euros. Selling intensity is defined as the share number sold by the private equity investors divided by the number of pre-flotation shares. Participation intensity is defined as share number of the private equity investors before the IPO divided by the pre-flotation share number. White's (1980) heteroscedasticity-consistent least-square standard errors are given under the coefficients. ***, **, * denotes significant at the 1, 5 and 10 per cent level.

Table 7: Ordinary Least Square Regressions of the Nouveau Marché Sample

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>
Intercept	-0.229 (0.402)	-0.237 (0.403)	-0.190 (0.425)	-0.212 (0.390)
Dummy for 1997	0.253 (0.273)	0.252 (0.276)	0.235 (0.282)	0.241 (0.263)
Dummy for 1998	-0.143 (0.093)	-0.145 (0.095)	-0.139 (0.095)	-0.147 (0.092)
Dummy for 1999	-0.108 (0.127)	-0.110 (0.130)	-0.121 (0.124)	-0.103 (0.127)
IPODAY	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Dummy for information- and communications-related firms	-0.094 (0.139)	-0.085 (0.139)	-0.115 (0.154)	-0.101 (0.148)
Dummy for biotechnology- and health-related firms	-0.227 (0.196)	-0.210 (0.210)	-0.261 (0.212)	-0.233 (0.221)
Dummy for industry- and service-related firms	-0.133 (0.161)	-0.119 (0.166)	-0.1601 (0.173)	-0.136 (0.170)
Aftermarket standard deviation	0.421 (0.435)	0.431 (0.443)	0.274 (0.454)	0.427 (0.432)
Stock market performance prior the IPO	26.186** (12.107)	26.278** (12.229)	25.943** (12.176)	26.280** (12.294)
Log of gross proceeds	0.099 (0.048)	0.097 (0.074)	0.103 (0.073)	0.100 (0.074)
Underwriter rank	0.118** (0.059)	0.119* (0.060)	0.111* (0.060)	0.117** (0.058)
Dummy for private-equity-backing	0.044 (0.073)	0.062 (0.113)	0.012 (0.087)	
Dummy if private equity investors sell shares		-0.026 (0.120)		
Private equity investors' selling intensity			1.028 (1.097)	
Private equity investors' participation intensity				0.051 (0.188)
Number of observations	71	71	71	71
Adjusted R ² (per cent)	30.291	29.134	29.985	30.068
F-Statistic	3.535***	3.214***	3.306***	3.508***

Dependent variable is underpricing defined as the opening price on the first trading day minus the offer price, scaled by the offer price. IPODAY is the number of days between the IPO date and 31 December. Aftermarket standard deviation denotes the standard deviation of the log returns from day two to day 16 after the IPO. The stock market performance prior the IPO is the average of the daily growth rates of the all-share performance index of the 10 days prior the IPO. Gross proceeds are in million euros. Selling intensity is defined as the share number sold by the private equity investors divided by the number of pre-flotation shares. Participation intensity is defined as share number of the private equity investors before the IPO divided by the pre-flotation share number. White's (1980) heteroscedasticity-consistent least-square standard errors are given under the coefficients. ***, **, * denotes significant at the 1, 5 and 10 per cent level.

Franzke (2001) who also uses a sample of firms which went public on the Neuer Markt between 1997 and March 2000 find a positive significant coefficient of a dummy variable which is equal

to one if the private equity investor is high ranked. Since she defines underpricing as "the spread between the initial offering price and the opening price on the first day of trading" (Franzke 2001: 0), high-ranked private equity investors seem to reduce the underpricing of the firms' shares. However, I am not sure whether she uses the above definition of underpricing in her regression analysis. I am sceptical about the definition of underpricing because the aftermarket standard deviation of log returns from day 2 to day 20 and the performance of the stock market twenty days before the IPO have positive and significant coefficients in her regressions and in my regressions.¹

The coefficient of the control variables measuring the stock market performance and the aftermarket standard deviation have the expected signs and are statistically significant, while the rank of the underwriter and the gross proceeds are not statistically significant. It is important to note that these control variables, except the rank of the underwriter, neither change their signs nor their significance when the involvement of the private equity investor is not taken into account. The coefficient of the rank of the underwriter is statistically significant at the 5 per cent level without using any variable that captures private equity investors' involvement.

In the sample of the Nouveau Marché, private equity investors' involvement has no significant impact on underpricing (Table 7). As for the German sample, I test whether a dummy variable indicating private equity-backing, a dummy variable equal to one if the private equity investor sells shares, the selling intensity of private equity investors, and the private equity investors' participation intensity affect the underpricing of firms' shares. All coefficients of the variables capturing private equity investor's involvement are highly insignificant.

With respect to the control variables, the stock market performance and the rank of the underwriter are statistically significant, the aftermarket standard deviation is insignificant, and the log of gross proceeds is statistically significant at the 20 per cent level. The coefficient of the stock market performance has the expected positive sign, while the coefficient of the underwriter rank has a positive sign and is thus contrary to the expected sign. The higher the underwriter rank, the more underpriced the shares of a firm are. Thus, French underwriters do not seem to certify the quality of the firms going public. The positive sign of the coefficient of the gross proceeds is in line with price pressure, which means the more shares a firm sells, the higher the price reduction must be in order to attract additional outside investors.

The sample of the Nouveau Marché might be biased and this bias can affect the regression results significantly. There are two sources for a bias in the sample. First, the firms which went

¹ Moreover, Franzke (2001) uses a dummy variable equal to one if private equity investors do not sell shares. The coefficient of this variable is positive and statistically significant. Thus, in her regressions, underpricing is reduced if private equity investors do not sell shares at the IPO, which is contrary to my results.

public in 1996 and 1997 are not included in the sample because prospectuses were often not available for these firms on the Internet. Second, and this source for a bias is more important than the first one, there is the possibility that unsuccessful firms are not included because IPO prospectuses were not available for firms which ran into insolvency in 2001. In order to understand the bias problem suppose that IPOs which are not in my sample are not private-equity-backed. If these IPOs have a high underpricing, which cannot be explained by the firms' characteristics and offering characteristics this can cause the insignificance of the Dummy for private-equity-backing.

In order to assess whether such a bias might be relevant for my study, I estimate whether the sample used here differs significantly from the sample of firms which are not included. 139 firms went public on the Nouveau Marché and used the book-building method. Using this 139 observations, I estimate an ordinary least square regression with a constant, the year dummies, the IPODAY variable, the aftermarket standard deviation, the stock market performance, the sector dummies, the log of gross proceeds and the underwriter rank as exogenous variables. A Chow's breakpoint test indicates that there is no significant difference between the firms in the sample used here and the rest of the overall sample of firms which went public on the Nouveau Marché. Thus, with respect to the control variables, the sample used here does not differ from the sample of firms which went public on the Nouveau Marché and which are not used here.

As in the total sample of firms which went public on the Nouveau Marché, which Schertler (2002) analyses with respect to the determinants of underpricing, the explanatory power of the regression is driven by few outliers. Estimating Model 1 without the firm which has the highest underpricing (which is 247 per cent) gives an adjusted R^2 of about 8 per cent and a F-Statistic of the regression equation of 1.55, which is only significant at the 15 per cent level.

4. DEPENDENT AND INDEPENDENT PRIVATE EQUITY INVESTORS: DO THEY DIFFER?

4.1 Descriptive Statistics

In order to analyse whether dependent and independent private equity investors affect the underpricing of firms going public differently, I use the sample of the Neuer Markt because of the larger number of observations. In this sample, 118 firms are private-equity-backed, 34 firms are solely backed by dependent private equity investors, 55 firms are solely backed by independent ones, and 28 firms are backed by dependent and independent private equity investors.

I distinguish two types of private equity investors because they differ with respect to fund-raising practises. Dependent private equity investors, such as subsidiaries of private banks, insurance and corporations, do not have to raise capital from uninformed capital providers because the capital provider is often the parent company which usually provides money for the investment activity of the private equity investor. Independent private equity investors by contrast are not legally connected to a parent company. Therefore, they have to raise capital from uninformed capital providers. Thus, I expect that these two types of private equity investors affect the underpricing of firms going public differently because building reputation seems more important for independent than for dependent private equity investors.

Table 8 reports descriptive statistics on firms' characteristics and offering characteristics. The firms backed by independent investors are younger and less established in terms of employees than their counterparts backed by dependent investors. The firms backed by independent investors are, on average, 8.7 years old, while their counterparts backed by dependent investors are 9.5 years old. Moreover, firms backed by dependent investors have, on average, about 430 employees, while their counterparts backed by independent investors have only about 166 employees. These differences also hold for the median values. Thus, the firms backed by independent private equity investors go public earlier than the firms backed by dependent private equity investors.

Table 8: Differences between Private-Equity-Backed IPOs

	<i>Mean</i>	<i>Median</i>	<i>Standard deviation</i>
IPOs backed by dependent private equity investors			
<i>Firms' characteristics</i>			
Age at IPO	9.5	7.5	7.4
Number of employees	434.9	214.5	537.4
<i>Offering characteristics</i>			
Underpricing (per cent)	51.0	10.6	80.5
Gross proceeds (million euros)	43.5	33.8	31.9
Private equity investors' participation intensity	23.4	18.8	17.3
Private equity investors' selling intensity	5.7	2.3	6.9
Shares sold by private equity investors relative to their shares prior IPO	21.8	18.4	19.4
Number of private equity investors	1.3	1.0	0.7
IPOs backed by independent private equity investors			
<i>Firms' characteristics</i>			
Age at IPO	8.7	6.6	7.8
Number of employees	165.7	109.0	173.1
<i>Offering characteristics</i>			
Underpricing (per cent)	52.3	24.0	63.8
Gross proceeds (million euros)	45.9	32.7	35.2
Private equity investors' participation intensity	26.4	20.0	25.3
Private equity investors' selling intensity	8.7	3.4	16.2
Shares sold by private equity investors relative to their shares prior IPO	25.3	18.8	25.9
Number of private equity investors	1.4	1.0	0.9
IPOs backed by dependent and independent private equity investors			
<i>Firms' characteristics</i>			
Age at IPO	9.5	8.3	6.4
Number of employees	222.1	153.0	261.8
<i>Offering characteristics</i>			
Underpricing (per cent)	52.6	31.1	58.5
Gross proceeds (million euros)	73.5	61.4	53.5
Private equity investors' participation intensity	33.3	31.5	18.3
Private equity investors' selling intensity	5.4	3.2	5.4
Shares sold by private equity investors relative to their shares prior IPO	16.4	15.6	13.4
Number of private equity investors	3.4	3.0	1.7
Number of independent private equity investors	1.9	1.5	1.1

Underpricing is defined as the opening price on the first trading day minus the offer price, scaled by the offer price. Selling intensity is defined as the share number sold by the private equity investors divided by the pre-flotation share number. Participation intensity is defined as the share number of the private equity investors before the IPO divided by the pre-flotation share number

With respect to underpricing, and gross proceeds, the differences between firms backed by dependent and independent investors look rather small. The firms backed by dependent

investors have an average underpricing of about 51 per cent, the underpricing of the firms backed by independent investors is about one per cent higher. The gross proceeds are about 46 million euros in the case of independent private equity investors, while they are about 44 million in the case of dependent investors.

Differences between firms backed by independent and dependent investors exist with respect to the number of secondary shares sold at the IPO. The old shareholders of firms backed by independent investors sell more secondary shares at the IPO than the old shareholders of firms backed by dependent investors. This difference in secondary shares sold stems from the private equity investors' behaviour. Independent investors sell more shares relative to the total number of pre-flotation shares as well as relative to their number of pre-flotation shares, than dependent investors do. Dependent investors sell 22 per cent of their shares at the IPO on average, while independent investors sell more than 25 per cent of their shares at the IPO. Thus, independent investors use the IPO process more intensively to liquidate a part of their participation than their dependent counterparts do.

Table 9: Underwriter Reputation by Type of Private Equity Investor

	Firms backed by dependent private equity investors	Firms backed by independent private equity investors	Firms backed by independent and dependent private equity investors
Average underwriter rank	1.8 (0.7)	1.8 (0.8)	2.1 (0.8)
Average number of IPOs underwritten by the underwriter	14.2 (10.9)	13.6 (11.6)	18.5 (15.9)
Average gross proceeds of IPOs underwritten by the underwriter (million euros)	124.2 (80.5)	114.4 (107.0)	177.1 (134.5)

The numbers in parentheses are standard deviations.

A further difference which should be noticed is the average number of private equity investors and the private equity investors' participation intensity. Independent private equity investors have a higher participation intensity than their dependent counterparts. The participation intensity, which is defined as the share number of the private equity investors prior the IPO divided by the pre-flotation share number, is 26 per cent for the independent investors and 23 per cent for their dependent counterparts. A firm backed by a dependent private equity investor is financed, on average, by 1.3 investors, while a firm backed by an independent investor is financed by 1.4 independent investors. This implies that independent private equity investors syndicate their investments more often than their dependent counterparts.

Table 9 suggests that the underwriter rank of a firm in the Neuer Markt sample backed by dependent private equity investors does not differ from the underwriter rank of a firm backed by independent private equity investors. However, the underwriters of firms backed simultaneously by dependent and independent private equity investors are more prestigious than the underwriters of firms which are backed by only one type of private equity investor.

4.2 Regression Results

Table 10 presents the regression results for the underpricing of private-equity-backed firms in the Neuer Markt sample. As control variables, I use, as in the regressions above, the year dummies, the IPODAY variable, the sector dummies, the aftermarket standard deviation, the stock market performance, the gross proceeds and the rank of the underwriter.

The involvement of private equity investors is captured by the private equity investors' selling intensity, the private equity investors' participation intensity, and two groups of dummy variables. The selling intensity is defined as the share number sold by the private equity investors divided by the number of pre-flotation shares. The participation intensity is the share number of the private equity investors before the IPO divided by the pre-flotation share number. In the first group of dummy variables, which consists of two dummies, the first dummy is equal to one if the firm is backed by a dependent private equity investor, while the second dummy is equal to one if the firm is backed by an independent private equity investor. Thus, I interpret the firms backed by dependent and independent private equity investors as backed by dependent private equity investors if I use the dummy equal to one for all firms backed by dependent private equity investors. The second group of dummy variables has three dummies. The first dummy is equal to one if dependent private equity investors are the only private equity investors. The second dummy is equal to one if the firm is backed solely by an independent private equity investors. The third dummy is equal to one if the firm is backed simultaneously by dependent and independent private equity investors.

As the coefficients of the two groups of dummy variables presented in Table 10 indicate, the underpricing of the firms does not depend on the type of private equity investors. I also use the Chow breakpoint tests for the four models reported in Table 10 in order to test whether dependent and independent private equity investors differ with respect to underpricing. The F-Statistic of this test indicates that there are no significant differences between these two types of private equity investors.

In Model 1, the results of a regression are presented in which a dummy variable of the first group of dummy variables is used, while in Model 2, two dummies of the second group of dummy variables are used. The dummy variables of the first group which are equal to one if the firm is backed either by a dependent (Model 1) or by an independent private equity investor (the

results are not reported) are statistically insignificant. In addition, the coefficients of the second group of dummy variables (Model 2) are also statistically insignificant. Thus, dependent and independent private equity investors do not differ with respect to the effect on the underpricing of the firms' shares.

The dummy variable which is equal to one if the private equity investors sell shares at the IPO is negative and statistically significant (Model 3), as in the regression of the total Neuer Markt sample. If the private equity investor sells shares at the IPO, the underpricing is reduced by about 49 per cent, while in the full sample the effect is about 42 per cent (see Table 6 above). The private equity investors' selling intensity, which is defined as the number of secondary shares sold by the private equity investors divided by the pre-flotation share number, does not affect significantly the underpricing of firms (results are not reported).

Interestingly, the private equity investors' participation intensity has a negative significant impact on underpricing in the sample of private-equity-backed firms (Model 4), while it has no significant impact in the full sample of firms which have gone public on the Neuer Markt (see Table 6). In the sub-sample of private-equity-backed firms, the private equity investors' participation intensity always affects the underpricing negatively, independent of whether dummy variables for the type of private equity investor are included. Thus, private equity investors have more incentives to influence the underpricing of firms' shares when they have larger equity stakes prior the IPO.

The significant control variables of the full sample retain their signs and significance in the sub-sample of private-equity-backed firms. As Table 10 indicates, the firms that went public in 1998 have a higher underpricing. Furthermore, the firms that went public at the beginning of a particular year have a higher underpricing than firms that went public at the end of a particular year. Moreover, the underpricing of firms' shares increases with the stock market performance prior to the IPO. The coefficient of the aftermarket standard deviation of log returns between 2 to 16 loses a part of its significance. In Model 1 (Model 2), the coefficient is only significant at the 10 (11) per cent level.

Summing up, the findings presented in Table 10 indicate that there is no significant difference between dependent and independent private equity investors with respect to their certification role: dependent and independent private investors affect the underpricing in a similar way. Put alternatively, the firms backed by a dependent private equity investor are as much underpriced as the firms which are backed by an independent private equity investor.

Table 10: Ordinary Least Square Regressions of Underpricing of Private-Equity-Backed Firms on the Neuer Markt

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>
Intercept	-0.162 (0.278)	-0.240 (0.314)	0.241 (0.381)	-0.153 (0.325)
Dummy for 1997	-0.153 (0.220)	-0.156 (0.226)	-0.057 (0.187)	-0.141 (0.270)
Dummy for 1998	0.412* (0.239)	0.414* (0.240)	0.403 (0.256)	0.449* (0.247)
Dummy for 1999	0.032 (0.134)	0.033 (0.135)	0.100 (0.125)	0.052 (0.136)
IPODAY	0.003*** (0.001)	0.003*** (0.001)	0.003*** (0.001)	0.003*** (0.001)
Dummy for information- and communications-related firms	0.089 (0.152)	0.093 (0.161)	0.111 (0.165)	0.013 (0.188)
Dummy for biotechnology- and health-related firms	0.218 (0.206)	0.223 (0.213)	0.293 (0.236)	0.244 (0.243)
Dummy for industry- and service-related firms	0.140 (0.176)	0.144 (0.187)	0.195 (0.189)	0.126 (0.209)
Aftermarket standard deviation	1.420 (0.880)	1.414 (0.881)	0.744 (0.880)	1.349 (0.940)
Stock market performance prior to the IPO	20.242** (7.783)	20.198*** (7.689)	22.463*** (7.364)	21.218*** (7.510)
Log of gross proceeds	-0.019 (0.074)	-0.017 (0.071)	-0.032 (0.075)	-0.010 (0.070)
Rank of the underwriter	-0.004 (0.079)	-0.004 (0.079)	0.011 (0.079)	0.018 (0.079)
Dummy equal one if dependent investors are involved	-0.053 (0.116)			
Dummy equal one if only a dependent investor is involved		0.017 (0.147)	-0.012 (0.142)	-0.007 (0.144)
Dummy equal one if only independent investors are involved		0.069 (0.134)	0.034 (0.139)	0.053 (0.131)
Dummy equal one if private equity investors sell shares			-0.486** (0.216)	
Private equity investor's participation intensity				-0.004* (0.003)
Number of observations	118	118	118	118
Adjusted R ² (per cent)	20.529	19.821	25.278	20.781
F-Statistic	3.519***	3.225***	3.827***	3.192***

Dependent variable is underpricing defined as the opening price on the first trading day minus the offer price, scaled by the offer price. IPODAY is the number of days between the IPO date and 31 December. Aftermarket standard deviation denotes the standard deviation of the log returns from day two to day 16 after the IPO. The stock market performance prior the IPO is the average of the daily growth rates of the all-share performance index of the 10 days prior the IPO. Gross proceeds are in million euros. Participation intensity is defined as share number of the private equity investors before the IPO divided by the pre-flotation share number. White's (1980) heteroscedasticity-consistent least-square standard errors are given under the coefficients. ***, **, * denotes significant at the 1, 5 and 10 per cent level.

However, the my analysis is limited in several ways and these limits can have a considerable impact on the findings of the regression analysis. First, private equity investors do not only differ with respect to their legal connections to their capital providers but also with respect to their reputational capital. Franzke (2001) finds evidence that firms which have gone public on the Neuer Markt are less underpriced if the involved private equity investor is high-ranked. The approximation of reputational capital of private equity investors may be important to identify the differences between dependent and independent private equity investors because the differences between independent private equity investors with respect to their reputational capital can be substantial (see Schertler (2001) for a discussion of the different types of private equity investors in Germany).

A second factor which is not considered in this analysis, nor in the analysis by Franzke (2001), is the interaction between the private equity investor and the underwriter in general. As argued by Gompers and Lerner (1997), private equity investors can mitigate the asymmetric distribution of information between the underwriter and firms going public. The underwriter rank and the rank of the private equity investors can interdependent. High-ranked underwriters probably accept only those private-equity-backed firms whose private equity investors are also highly qualified. And highly qualified private equity investors probably prefer and select only highly qualified underwriters.

In order to obtain some further insights into whether dependent private equity investors differ from their independent counterparts, I estimate whether these two groups differ with respect to the change in the share number at the IPO. The change in the share number is defined as the change in the share number of the private equity investors at the IPO divided by the number of pre-flotation shares of the private equity investors. The change can be either positive or negative. In the case of a positive number, the private equity investors sell shares, while in the case of a negative number the private equity investors receive additional shares in the IPO.

As mentioned in Section 2, I expect that the change in the number of the independent private equity investors' shares divided by their number of pre-flotation shares is larger than the respective change in the share number of dependent private equity investors. The reason for this is the different role of the IPO process for the two types of private equity investors. The IPO process is more important for independent private equity investors than for dependent private equity investors because for the former it is necessary to refinance participations successfully for further investment activity, while the latter have not necessarily to refinance the participations because of their legal connections to their capital providers.

Table 11 presents the results of ordinary least square regressions which are performed on the private equity investors' change in the share number. As control variables, I use several

measures for the ex ante uncertainty (aftermarket standard deviation of log returns, the age of the firm, and the log of the number of employees), the stock market performance, the rank of the underwriter, and the gross proceeds.

These control variables are included because they probably affect the selling decision of the private equity investors. For example, if the ex ante uncertainty of the firm is high, we expect high underpricing, that is, a low offer price. Thus, if the ex ante uncertainty is high, private equity investors are not interested in selling their shares because of the low offer price. Moreover, if stock market performance is very good, many outside investors are interested in buying shares. This can lead to a high offer price relative to the intrinsic value of the shares because the risk of overpricing is comparably low, so that investors have incentives to sell their shares at the IPO. As argued by Lin and Smith (1998), the likelihood of selling at the IPO depends positively on the potential for overvaluation. Overvaluation is more likely if the stock market performance is high. The gross proceeds of the firm may have an impact on the private equity investors' change in share number because of possible price pressure which makes it unattractive for private equity investors to sell their shares.

The types of private equity investors are captured by the two groups of dummy variables which have been discussed above. Both the dummy variable which is equal to one if the firm is backed by dependent private equity investors (Model 1), and the combination of dummy variables of which the first one is equal to one if the firm is backed solely by dependent private equity investors, while the second one is equal to one if the firm is backed simultaneously by dependent and independent private equity investors (Model 2) are statistically significant.

Model 1 indicates that the change in the share number of dependent private equity investors or a consortium of dependent and independent investors is about 10 per cent lower than the change in the share number of independent private equity investors. Moreover, as Model 2 indicates, dependent private equity investors sell about 11 per cent less of their shares than independent private equity investors, while the consortium of dependent and independent private equity investors sells about 8.4 per cent less than independent private equity investors. These findings are consistent with the discussion given in Section 2.

Table 11: Ordinary Least Square Regressions of Private Equity Investors' Change in the Share Number

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>
Intercept	34.447*** (11.602)	34.999*** (11.326)	23.193 (18.301)	43.139** (16.428)
Dummy for 1997	7.747 (13.242)	7.564 (13.623)	32.592*** (8.273)	-3.016 (11.485)
Dummy for 1998	3.856 (11.523)	3.284 (11.427)	-11.042 (16.733)	10.967 (12.779)
Dummy for 1999	13.769*** (4.491)	13.710*** (4.442)	16.031*** (5.691)	6.365 (7.779)
IPODAY	0.023 (0.026)	0.022 (0.026)	0.060* (0.033)	-0.000 (0.038)
Aftermarket standard deviation	-72.112** (32.899)	-70.259** (32.691)	-18.109 (47.482)	-132.749** (57.756)
Age	0.370 (0.316)	0.369 (0.316)	0.281 (0.445)	0.945** (0.430)
Log of the number of employees	3.136 (2.086)	3.521 (2.464)	0.413 (2.772)	5.513* (2.990)
Stock market performance prior the IPO	372.726 (238.206)	382.814 (236.714)	-56.683 (296.411)	1358.579*** (422.585)
Underwriter rank	-4.416 (3.009)	-4.590 (3.083)	-2.162 (2.959)	-6.941 (4.816)
Log of gross proceeds	-6.118** (2.868)	-6.664** (2.882)	-5.883* (3.430)	-8.344* (4.768)
Dummy equal one if a dependent investor is involved	-9.726** (4.597)			
Dummy equal one if only a dependent investor is involved		-11.042* (6.061)		
Dummy equal one if dependent and independent investors are involved		-8.389* (5.038)		
Number of observations	118	118	62	56
Adjusted R ² (per cent)	14.945	14.262	13.903	28.385
F-Statistic	2.869***	2.622***	1.985*	3.180***

Dependent variable is the private equity investors' selling intensity defined as the change in the share number the private equity investors divided by the share number prior the IPO. IPODAY is the number of days between the IPO date and 31 December. Aftermarket standard deviation denotes the standard deviation of the log returns from day two to day 16 after the IPO. The stock market performance prior the IPO is the average of the daily growth rates of the all-share performance index of the 10 days prior the IPO. Gross proceeds are in million euros. Model 2 includes only firms which are solely backed by independent private equity investors. Model 3 includes all firms which are backed by dependent private equity investors. White's (1980) heteroscedasticity-consistent least-square standard errors are given under the coefficients. ***, **, * denotes significant at the 1, 5 and 10 per cent level.

A Chow breakpoint test indicates that the differences between the dependent private equity investors and the consortium of dependent and independent private equity investors on the one hand and the independent private equity investors on the other hand cannot be captured by using solely dummy variables of the kind used in Model 1 and Model 2. Thus, I estimate the two samples separately. The results are presented in Model 3 for the dependent private equity investors and the consortiums of dependent and independent private equity investors, and in Model 4 for the independent private equity investors.

As suggested by Model 3 and Model 4, the two groups of private equity investors behave differently. Interestingly, dependent private equity investors (Model 3) do not sell more shares when the ex ante uncertainty of the firm is high, while independent private equity investors do, as suggested by the negative significant coefficient of the aftermarket standard deviation, and the positive coefficients of the age and log of the number of employees. Moreover, independent private equity investors sell more shares when the stock market performance is high, while their dependent counterparts do not.

The coefficients of the control variables of Model 3 and Model 4 suggest that the independent private equity investors behave more sensitively as regards market conditions, such as the individual characteristics of the firms going public and the general climate of stock markets, than their dependent counterparts do. This divestment behaviour of independent private equity investors is in line with the discussion that these investors must more care about their returns and liquidity than dependent private equity investors because only if their returns are appropriate they can raise new funds from outside investors.

5. CONCLUSIONS

This paper has presented an analysing of the impact of private equity investors' involvement on the underpricing in a sample of firms which went public on the Neuer Markt and the Nouveau Marché between 1997 and 2000. Neither in the sample of the Neuer Markt nor in the sample of the Nouveau Marché private-equity-backing per se has a significant impact on underpricing. Only if the incentives of private equity investors to influence the offer price, since they sell some of their shares at the IPO, are taken into account, I find significant effects of private-equity-backing in the Neuer Markt sample. If private equity investors' incentives to influence the offer price are taken into account, private-equity-backing has two effects: First, private equity investors' involvement per se increases underpricing, while the selling of private equity investors' shares reduces underpricing. Thus, private-equity-backed IPOs are only less underpriced if the private equity investors sell shares at the IPO.

Moreover, I have analysed the differences between dependent and independent private equity investors. These differences are expected to exist because independent private equity investors have greater incentives to refinance their participation successfully than their dependent counterparts. As argued by Gompers (1996), young venture capitalists use the IPO process to establish a track record and to raise new capital. Establishing a track record in order to be capable of raising new funds is only important for independent private equity investors, since their dependent counterparts often receive their capital for investments on request from their parent company.

With respect to the impact of private-equity-backing on underpricing, I do not find any significant differences between firms backed by a dependent and independent private equity investors in a sample of private-equity-backed firms on the Neuer Markt. As in the total sample of the Neuer Markt, the underpricing is reduced if the private equity investors sell shares at the IPO. Moreover, I find a significant impact of private equity investors' participation intensity: the more shares the private equity investors hold before the IPO, the lower the underpricing is.

While dependent and independent private equity investors do not affect the underpricing differently, they differ with respect to the fraction of their shares which they sell at the IPOs. Significantly more shares of the firms backed by independent private equity investors are sold at the IPO than shares of the firms backed by dependent private equity investors and by a consortium of dependent and independent private equity investors. Firms backed by independent private equity investors sell about 11 per cent more of the private equity investors'

shares than their counterparts backed by dependent investors and about 8 per cent more than the firms backed by a consortium of dependent and independent investors.

Although independent private equity investors have more incentives to affect the offer price and thus the underpricing of the firms going public, since they sell more shares at the IPO, I cannot observe any difference between these two types of investors with respect to their effects on underpricing. One reason for this can be that some of the German independent private equity investors may be relatively inexperienced. As the evidence found by Gompers (1996) for the United States indicates, firms backed by venture capitalists who have less than six years experience have a higher underpricing than firms backed by venture capitalists with more experience. Thus, it can be that experienced independent private equity investors reduce underpricing more than dependent private equity investors who in turn reduce underpricing more than inexperienced independent private equity investors. Unfortunately, the sample used here is rather small to test simultaneously the differences between dependent, experienced independent, and inexperienced independent private equity investors.

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