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Alessandra Tanda, Luisa Anderloni

*Department of Economics, Management
and Quantitative Methods*

University of Milan

**THE ROLE OF VENTURE CAPITAL (VC)
IN THE UNDERPRICING OF EUROPEAN
LIFE SCIENCE COMPANIES**

Abstract

This study evaluates the underpricing of the European companies operating in the life science industries at IPO. Results show a positive and high underpricing for the IPOs occurred between 2002 and 2007. Moreover, when differentiating between VC backed and non VC backed firms, we find that the first exhibit a lower underpricing both for the first day of trading and the first week after the IPO, and evidence support the idea of a positive contribution of venture capitalists to the performance of the listing firms. Moreover, VC backed firms appear less risky, registering a lower volatility of returns in the days following the IPO date.

Keywords: *venture capital, IPO, VC backed, life science companies, Europe.*

JEL Classification: *G14, G24.*

Introduction

The empirical literature commonly finds that firms are underpriced at the time of IPO, generating a positive return after the first day of trading. The underpricing is explained, among other theories, by the asymmetries of information characterising the debuting firms. Despite this holds in general, the literature often finds that VC backed companies have a lower underpricing at IPO, thanks to the “certification” role of the venture capitalists.

This study evaluates the performance at IPO of a sample of European firms operating in the life science industry that were listed in the period 2002-2007. We focus on the life science industry because it represents an important source of investment opportunities for venture capitalists given the strong and relevant innovative content of their activity, which is, however, also characterized by potential risks and threats for the investors, as the functioning of the sector is severely affected by regulation and ethical concerns. In fact, according to the EVCA data (EVCA, 2013), life science business attracted around 25% of investments in 2007 and this figure has been growing considerably in the latest years (in 2013 it reached 37.1%). The same holds in terms of number of firms receiving VC in this industry, which represented the 19.2% of the total VC backed firms in 2007 (22.9% as at end 2013).

Besides, we limit the sample at 2007 to eliminate possible effects of the financial crisis that hit the markets after 2008.

Empirical evidence shows a strong statistical difference in the performance of VC backed and non VC backed companies. Both groups of firms exhibit underpricing for the first day and for the first week of trading, but VC backed firms outperform the other companies.

This research contributes to the literature providing further insight on the underpricing phenomenon for a relevant and innovative industry, such as the life science business; additionally, it delivers further evidence on the role of venture capital at the time of IPO for European firms.

The rest of the paper is structured as follows: Section 1 discusses the previous contributions provided by the literature; Section 2 presents the methodology; Section 3 analyses the results and the last section concludes.

1. Theoretical background

Empirical literature finds that on average the offering price at the time of IPO for a firm is below the price that prevails on the first trading day (Ibbotson and Ritter, 1995). This phenomenon is called underpricing and might generate positive large returns not only in the first days, but also in the first weeks of trading.

The explanation of these large positive returns is linked to the asymmetry of information affecting the listing firm, which generally is not well known to the public of investors (see Ibbotson and Ritter, 1995, for a complete survey of the theories explaining underpricing).

Part of the wide literature on underpricing acknowledges that the contribution of VC can soften this phenomenon: VC backed firms present a lower underpricing if compared to other companies, thanks to the presence of specialized investors (Megginson and Weiss, 1991), as the latter have the ability to reduce the asymmetries of information in young debuting companies (Gompers, 1996; Jain and Kini, 2000). In fact, venture capitalists perform screening and monitoring activities that enable them to select only the best business ideas and to constantly improve the management of the firm, boosting its performance (Kaplan and Stromberg, 2001). The relevance of the screening and monitoring phases implemented by the venture capitalists is confirmed by Chemmanur and Loutskina (2006) who also suggest that VC backed IPOs have a lower underpricing because the venture capitalists are able to attract more and better investors in the market, such as institutional investors. Despite the strong theoretical argument, a number of studies finds contrasting evidence: according to Brau et al. (2004) and da Silva Rosa et al. (2003) (among others) underpricing differences between

VC backed and non VC backed companies are not statistically significant, meaning that venture capitalists' knowledge of the firm and their monitoring activity is not sufficient to limit the underpricing; this holds especially during some economic or market periods, such as market bubbles, as suggested by Coackley et al. (2004) and Coackley et al. (2009) or economic downturns (Lerner, 2003). Finally, other studies, such as Lee and Wahal (2004) find that VC backed IPOs experience a higher underpricing compared to other IPOs.

2. Methods

To perform the analysis, we select the IPOs that occurred between 2002 and 2007 on European stock exchanges and individuate the life science companies, comprising healthcare equipment and services, healthcare providers, medical equipment, medical supplies, pharmaceuticals, pharmaceuticals and biotechnology, and specialty chemicals. We select these industries because they are highly innovative and can be characterized by strong asymmetries of information; moreover, the firms operating in life sciences are often targets of venture capitalists. In fact, VC is considered a suitable form of financing for developing and introducing innovations (Dobloug, 2008), as it significantly increases the rate of patenting (Kortum and Lerner, 2000). Both of these characteristics can be found in the life science industry. We disregard the IPOs occurred after 2007 to exclude the effects of the latest crisis on the markets.

The final sample is made of 103 life science firms listed on European stock exchanges. Using information available on ThomsonOne, we identify 41 VC backed companies in the sample that received venture capital between 1997 and 2007. IPO details are obtained from the relative stock exchanges statistics and issue prospectuses and complemented with information available on Zephyr, while the time series for the share prices are downloaded from Datastream. Information on countries is obtained through the World Bank website.

IPO underpricing is computed using the returns of the first day of trading ($P_{i,1}$), as the percentage change from the offering price ($P_{i,IPO}$) (1). We also compute the underpricing for the first week of trading (wgr) (2).

$$dgr_i = \frac{P_{i,1} - P_{i,IPO}}{P_{i,IPO}} \quad (1)$$

$$wgr_i = \frac{P_{i,6} - P_{i,IPO}}{P_{i,IPO}} \quad (2)$$

Net returns are calculated by deducting the return of the related market index from dgr_i and wgr_i .

$$dnet_i = \frac{P_{i,1} - P_{i,IPO}}{P_{i,IPO}} - \frac{P_{m,1} - P_{m,0}}{P_{m,0}} \quad (3)$$

$$wnet_i = \frac{P_{i,6} - P_{i,IPO}}{P_{i,IPO}} - \frac{P_{m,6} - P_{m,0}}{P_{m,0}} \quad (4)$$

Additionally, we compute the standard deviation of the returns of the first days of trading to evaluate the volatility of returns of the newly issued shares and the embedded risk. The standard deviation is computed for several time periods, starting from 2 days of trading to 30 days of trading after the IPO.

Finally, to better understand the contribution of VC in the underpricing of life science companies, and to isolate country and time effects, we perform a multivariate analysis according to the following equation (5).

$$Per_i = a_0 + a_1 VC_i + a_2 Country_i + a_3 Year_i + a_4 X_i + a_5 Y_{it} + e_{i,t} \quad (5)$$

where:

- Per_i is the performance registered by the firm i ,
- a_0 is the constant,
- VC_i is a dummy variable equal to 1 if the firm has received venture capital and 0 otherwise,
- $Country$ contains the dummy variables identifying the country where the firm operates,
- $Year$ relates to the year of the IPO,
- X_{it} is a matrix that includes firm's characteristics at time of the IPO,
- Y_{it} includes country characteristics in the year of the IPO,
- e_i represents the errors.

3. Results

3.1. Descriptive statistics

The sample is made of 103 European firms, mainly located in the United Kingdom (53 firms), although also French and Swedish firms are numerous, with respectively 17 and 9 companies (Table 1). Of these, 41 firms have received venture capital. Most of the IPOs have occurred between 2004 and 2007.

Fifty three firms in the sample have been listed on the main market, while the remaining are listed on alternative markets, such as UK Aim or Alternext and this might be attributable to the size of the firms. In fact, the average total asset at the IPO year is around 54.3 million Euros (the data on assets is available only for 84 firms). The VC backed firms are smaller, with an average total assets of 35 million Euros, while the non VC backed have a larger size (on average 70.9 million Euros). VC backed firms appear smaller at time of IPO also in terms of number of employees, with an average of 91 employees, compared to non VC backed which have an average of 548 employees (although we do not have complete data information on employees for 42% of non VC backed companies). With explicit reference to VC backed firms, these have received their first VC injection between 1997 and 2007. The firms had an average age at financing of 41 months, although six of them had an age equal to zero (they had not been incorporated under their name yet) and one firm received VC at 846 months after its incorporation. Two firms received VC by a corporate venture capitalist and one by a VC backed by a governmental institution. Only one Swedish firm was still held in portfolio at the time of analysis, while all the other venture capitalists had sold or transferred their participation in the target firms to third parties. Furthermore, only two firms were financed by a syndicate of venture capitalists.

Table 1. Sample description by country

Country	Number of IPOs
Austria	1
Belgium	8
Denmark	2
France	17
Germany	8
Italy	1
Poland	3
Spain	1
Sweden	9
United Kingdom	53
Total	103
<i>Of which</i>	
VC	41
nVC	62

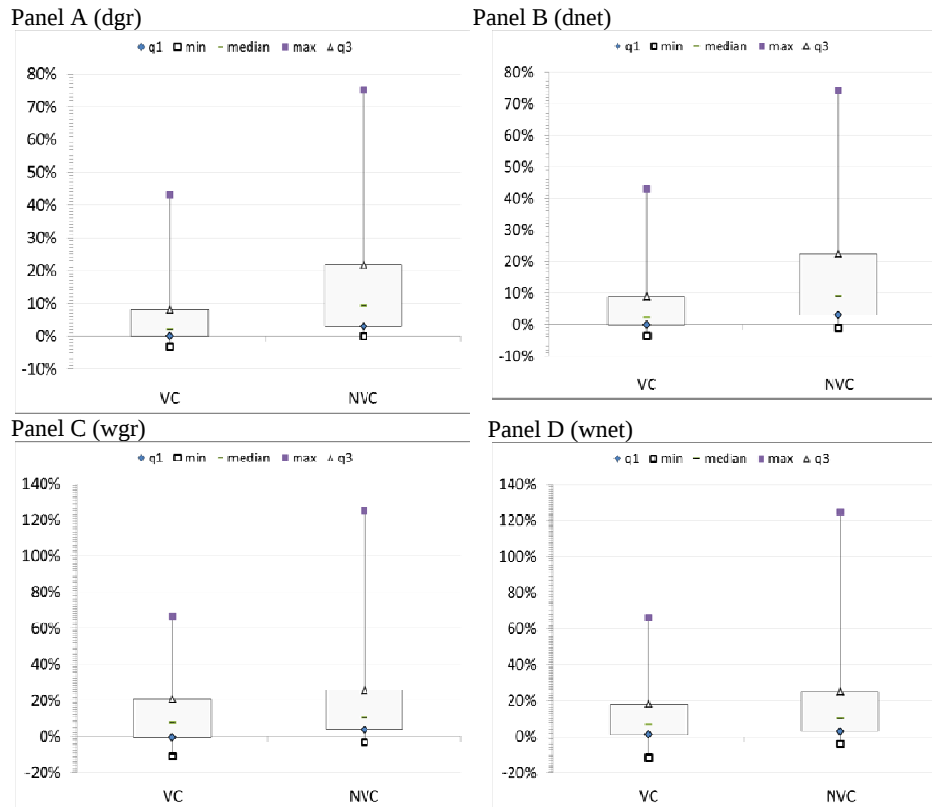
Source: Authors' calculations.

3.2. IPO underpricing

In line with the literature, the whole sample presents a positive underpricing of around 12% for the first day and 16.76% for the first week after the IPO. Also

when considering the net performance of IPOs, the underpricing remains positive at 11.93% for the first day and 16.41% for the first week of trading. Figure 1 presents the distribution of the first day and first week returns differentiating between VC backed and non VC backed firms.

Figure 1. Gross and net underpricing for one day and one week of trading



Source: Authors' calculations.

As found by Gompers (1996) and Jain and Kini (2000), VC backed firms in the sample show a lower underpricing according to all the measure used and in all the cases the relative differences are statistically significant, as confirmed by the T test for mean equalities (Table 2). More in detail, the differences are around 7% for the first day of trading gross performance measure and the weekly returns, and it is slightly below 8.50% for the first day net return (dnet).

Table 2. One day and one week underpricing

	dgr	dnet	wgr	wnet
full sample	12.09%	11.93%	16.76%	16.41%
VC	6.88%	6.82%	12.41%	12.13%
nVC	15.54%	15.3%	19.64%	19.24%
difference	7.11%*	8.48%*	7.23%**	7.11%**
t stat	-3.005	-2.943	-1.784	-1.769
p value	0.003	0.003	0.074	0.077

* Indicates significance at 1% level.

** At 10%.

Source: Ibid.

To further investigate the behavior of European life science companies at the time of the IPO, we evaluate the volatility of returns during the first days of trading.

The standard deviation of returns for the first days of trading is around 5% for the full sample. VC backed IPO firms show systematically a lower volatility of returns in the first days of trading if compared to the other firms in the sample (Table 3*). The differences are statistically significant at 10% level, with the exception of the volatility of the first 2 days of trading. Empirical evidence therefore suggests that VC backed firms have a lower volatility after the IPO and subsequently can be considered less risky.

Table 3. Volatility of returns after the IPO

	vol2	vol5	vol7	vol10	vol14	vol20	vol25	vol30
VC	4.61%	4.42%	4.14%	3.82%	3.52%	3.24%	3.09%	2.98%
NVC	6.25%	6.54%	5.93%	5.34%	5.02%	4.46%	4.12%	3.91%
difference	1.64%	2.12%*	1.79%*	1.52%*	1.49%**	1.22%*	1.03%*	0.93%*
t stat	—	-1.784	-1.736	-1.710	-1.980	-1.868	-1.717	-1.691
	1.418							
p value	0.254	0.075	0.083	0.087	0.048	0.062	0.086	0.091

* At 10%.

** At 5% and

Source: Ibid.

* The Table presents statistics for first two (vol2), five (vol5), seven (vol7), ten (vol10), fourteen (vol14), twenty (vol20), twenty-five (vol25) and thirty (vol30) days of trading. Additional statistics for the other sub periods from two to thirty days of trading are reported in the Appendix.

3.3. Underpricing determinants

To shed additional insight on the phenomenon of the underpricing and the contribution of VC in limiting this effect of IPOs, we perform a multivariate analysis on the various measures of underpricing computed, analysing the effects of country characteristics and macroeconomic conditions prevailing at the time of the IPO, summarized by a series of dummies for the countries, but also by market characteristics, such as the market capitalization at the time of IPO for each company. The latter is taken both as a percentage of GDP and as the logarithm of the US \$ absolute value.

Overall, when analysing the underpricing for the first day of trading, the VC dummy takes a negative and statistically significant coefficient in most of the specifications (Table 4 and 5); it loses its statistical significance only when controlling for the country, using the dummy variables, but the R^2 and the adjusted R^2 in the latter case have a very low value, suggesting that this model has a low predictive power. We therefore develop other specifications to take into consideration other country and firm characteristics. To consider the prevailing economic conditions, we use the variable year, which has a negative sign, but it takes a significant value only in specification b of the dgr determinants (other specifications which include the year also as dummies have been tested and provide a non significant coefficient; results are therefore omitted). The market capitalization measured as the percentage of GDP has always a negative and statistical significant sign, suggesting that in more developed financial markets, underpricing appears lower. The country dummy variables become significant only when controlling also for the market country specific characteristics. We take the UK as the benchmark. Only Belgium appears to have a positive and significant coefficient. With reference to the sub industries present in our sample, “health care equipment and services” and “pharmaceuticals and biotechnology” businesses show on average a higher dgr if compared to other companies.

Table 4. Determinants of dgr

	a	b	c	d	e	f	g
1	2	3	4	5	6	7	8
(Intercept)	0.155*	49.767**	0.168*	0.045	0.145	-5.267	-4.929
VC	-0.087*	-0.067*	-0.066	-0.069**	-0.079**	-0.093**	-0.102**
year		-0.025**					
market capitalization (as % of GDP)				-0.002*	-0.002*	-0.003*	-0.003*
market capitalization (US \$)				0.011	0.005	0.199***	0.185
Health Care Equipment and Services					0.091**		0.099**

table 4 cont.

	1	2	3	4	5	6	7	8
Healthcare Providers						0.02		-0.076
Medical Equipment						0.027		0.027
Medical Supplies						0.014		-0.006
Pharmaceuticals						-0.045		-0.027
Pharmaceuticals and Biotechnology						0.079**		0.084**
Specialty Chemicals						0.056		0.048
Country dummies	No	No	Yes	No	No	No	Yes	Yes
R squared	0.071	0.101	0.106	0.193	0.271	0.245	0.245	0.326
Adj R squared	0.062	0.083	0.008	0.168	0.191	0.145	0.145	0.171

* Indicates significance at 1% level.

** At 5%.

*** At 10%.

Source: Ibid.

Table 5. Determinants of wgr

	a	b	c	d	e	f	g
(Intercept)	0.196*	20.788	0.214*	-0.248	-0.168	-9.417**	-9.551**
VC	-0.072***	-0.064	-0.062	-0.05	-0.063	-0.099***	-0.106***
year		-0.01					
market capitalization (as % of GDP)				-0.002**	-0.001**	-0.003*	-0.003*
market capitalization (US \$)				0.022	0.016	0.346**	0.348**
Health Care Equipment and Services					0.097***		0.116***
Healthcare Providers					0.069		-0.163
Medical Equipment					-0.086		-0.086
Medical Supplies					-0.025		-0.071
Pharmaceuticals					0.006		0.093
Pharmaceuticals and Biotechnology					0.122		0.141**
Specialty Chemicals					0.13		0.125
Country dummies	No	No	Yes	No	No	Yes	Yes
R squared	0.027	0.03	0.056	0.089	0.156	0.149	0.237
Adj R squared	0.017	0.01	-0.047	0.062	0.065	0.036	0.062

* Indicates significance at 1% level.

** At 5%.

*** At 10%.

Source: Ibid.

When analysing wgr, result remain overall similar. In fact, VC has a negative sign, although in some specification is not statistically significant. Various country dummies show positive and significant sign if compared to UK that can be considered a developed and efficient market. In this case, however, the Ad-

justed R^2 is lower than what obtained for the regressions on dgr , suggesting that other variables may determine the first week return after the IPO.

Results for net measures of underpricing are similar and are reported in the appendix.

Conclusions

The empirical investigation has highlighted that the life science companies operating in Europe suffered an underpricing at IPO between 2002 and 2007. Nevertheless, we find a significant difference in the performance of VC backed and non VC backed firms, both after the first day and the first week of trading: VC backed IPOs systemically exhibit a lower underpricing compared to other firms. These results confirm the hypothesis that VC investors' presence plays a role at IPO, possibly lowering the asymmetries of information and therefore reducing the effect of underpricing for VC backed firms. Additionally, VC backed companies have a lower volatility of returns, suggesting that these firms might be less risky on the first days of trading. The contribution of venture capital is confirmed by the multivariate analysis, although other country and market characteristics seem to have an impact on the underpricing. Further researches can provide additional insight on the determinants of underpricing and on the contributions of VC in overcoming the asymmetries of information at the time of IPO for firms operating in particularly innovative industries, such as the life science.

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Appendix

Table A.1. Average volatility from two days to thirty days after the IPO

full sample VC NVC difference t stat p value		vol2	vol3	vol4	vol5	vol6	vol7	vol8	vol9	vol10
		5.595%	6.045%	5.934%	5.696%	5.443%	5.219%	5.064%	4.891%	4.733%
		4.609%	4.694%	4.541%	4.420%	4.268%	4.142%	4.078%	3.911%	3.819%
		6.246%	6.938%	6.855%	6.540%	6.220%	5.931%	5.716%	5.540%	5.338%
		1.637%	2.243%	2.315%	2.120%	1.952%	1.789%	1.638%	1.628%	1.518%
		-1.418	-1.610	-1.790	-1.784	-1.767	-1.736	-1.683	-1.753	-1.710
		0.254	0.107	0.074	0.075	0.077	0.083	0.092	0.080	0.087
	vol11	vol12	vol13	vol14	vol15	vol16	vol17	vol18	vol19	vol20
full sample VC NVC difference t stat p value		4.497%	4.426%	4.423%	4.329%	4.254%	4.178%	4.098%	4.052%	3.978%
		3.647%	3.566%	3.524%	3.475%	3.449%	3.381%	3.313%	3.290%	3.242%
		5.060%	4.995%	5.018%	4.894%	4.787%	4.705%	4.617%	4.555%	4.464%
		1.413%	1.429%	1.494%	1.419%	1.338%	1.324%	1.304%	1.265%	1.222%
	-1.731	-1.745	-1.837	-1.980	-1.946	-1.889	-1.909	-1.930	-1.889	-1.868
	0.083	0.081	0.066	0.048	0.052	0.059	0.056	0.054	0.059	0.062
	vol21	vol22	vol23	vol24	vol25	vol26	vol27	vol28	vol29	vol30
full sample VC NVC difference t stat p value		3.915%	3.850%	3.792%	3.751%	3.709%	3.662%	3.601%	3.582%	3.541%
		3.208%	3.163%	3.130%	3.115%	3.091%	3.055%	3.031%	3.018%	2.982%
		4.383%	4.304%	4.229%	4.172%	4.117%	4.064%	4.019%	3.985%	3.911%
		1.175%	1.141%	1.099%	1.057%	1.027%	1.009%	0.989%	0.966%	0.936%
	-1.816	-1.803	-1.772	-1.737	-1.717	-1.714	-1.708	-1.701	-1.676	-1.691
	0.069	0.071	0.076	0.082	0.086	0.086	0.088	0.089	0.094	0.091

Source: Authors' calculations.

Table A.2. Determinants of dnet

	a	b	c	d	e	f	g
(Intercept)	0.153*	51.899**	0.166*	0.051	0.147	-5.239	-4.933
VC	-0.085*	-0.064**	-0.062	-0.067***	-0.077***	-0.089***	-0.098***
year		-0.026**					
market capitalization (as % of GDP)				-0.002*	-0.002*	-0.003*	-0.003*
market capitalization (US \$)				0.010	0.005	0.198**	0.185
Health Care Equipment and Services					0.091***		0.100***
Healthcare Providers					0.003		-0.089
Medical Equipment					0.027		0.027
Medical Supplies					0.020		0.002
Pharmaceuticals					-0.046		-0.027
Pharmaceuticals and Biotechnology					0.080***		0.087***
Specialty Chemicals					0.058		0.051
Country dummies	No	No	Yes	No	No	Yes	yes
R squared	0.068	0.102	0.108	0.196	0.277	0.249	0.333
Adj R squared	0.059	0.084	0.011	0.171	0.198	0.149	0.180

* Indicates significance at 1% level.

** At 5%.

*** At 10%.

Source: Ibid.

Table A.3. Determinants of wnet

	a	b	c	d	e	f	g
(Intercept)	0.192*	28.808	0.212*	-0.204	-0.146	-9.229**	-9.372***
VC	-0.071	-0.060	-0.061	-0.048	-0.061	-0.098**	-0.105**
year		-0.014					
market capitalization (as % of GDP)				-0.002*	-0.002***	-0.003*	-0.003*
market capitalization (US \$)				0.021	0.016	0.340**	0.342***
Health Care Equipment and Services					0.091		0.112**
Healthcare Providers					0.053		-0.188
Medical Equipment					-0.082		-0.083
Medical Supplies					-0.011		-0.052
Pharmaceuticals					0.002		0.031
Pharmaceuticals and Biotechnology					0.126***		0.148**
Specialty Chemicals					0.125		0.124
Country dummies	No	No	Yes	No	No	Yes	Yes
R squared	0.026	0.032	0.062	0.098	0.165	0.162	0.256
Adj R squared	0.016	0.012	-0.040	0.070	0.075	0.051	0.085

* Indicates significance at 1% level.

** At 5%.

*** At 10%.

Source: Ibid.