
Country-of-origin effect of VC investment in biotechnology companies

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Abstract

Biotechnology companies can access financial and management resources through venture capitalist (VC) firms. An analysis of 1,490 VC investments shows that country-of-origin (CO) of biotech companies has an effect on the participation by VC firms in various biotech subsectors. Specifically, it is found that US biotech companies tend to have higher amount received per VC firm, greater number of VC firms investing in them and greater biotech investment experience of the investing VC firms. Asia-Pacific biotech companies have consistently less VC firms investing in them and these investing VC firms tend to have less biotech investment experience. VC firms with greater biotech investment experience are also investing in European biotech companies more than those from the Americas less US. CO also correlates with outcomes in the four of the six key biotech subsectors studied. These findings suggest a strong CO effect of VC investment in biotech companies.

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INTRODUCTION

According to Ernst & Young's 2005 Annual Global Biotechnology Report, the biotechnology sector is one of the fastest growing sectors, with revenue growth of 17 per cent from 2003 to 2004. The United States remains the global biotech leader by a significant margin, raising 80 per cent of venture capital (VC) funding in that period. Meanwhile, the biotech sectors in Europe and the Asia-Pacific region are also developing rapidly, partially as a result of increasing governmental focus and improved regulatory regimes and infrastructure.¹

Biotech companies often create sophisticated products that take an extraordinarily long time to develop and hence the need for huge capital to fuel product development cycles.^{2–4} They also generally lack experience, effective organisational design and established relationships with customers and suppliers and are characterised by high default risk derived from a combination of factors such as uncertainty about future market acceptance and limited managerial capacities. Consequently, financing through traditional financing sources such as banks, government funds, private investors and large pharmaceutical firms is difficult as investors inevitably assume high levels of risk when they invest in biotech ventures.^{5,6} Thus, VC firms become an important source of funding for high-risk biotech companies.²

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VC firms have a comparative advantage over other investors working in environments with high information asymmetry and uncertainties as they have the ability to reduce the cost of information asymmetries.⁷ They act as agencies to coordinate the transfer of investment capital from private investors such as pension funds and financial firms to the selected new venture companies. They also differ from the typical hands-off investors in that they also play a role in the management of their portfolio companies.⁸ When choosing portfolio companies, VC firms often look out for the management skills and experience of the management team, the proprietary technology and its range of applications, and the market potential of the product, and assess these against the risks involved.⁹ For companies with relatively little track records, partnering with reputable associates¹⁰ and/or trust based on other observable attributes such as country-of-origin (CO)¹¹ becomes important as signals for the potential of the company.

Research in CO effects is concerned with buyers' perception of a product/service in various countries, including both consumer¹¹⁻¹³ and industrial products/services.¹⁴⁻¹⁶ CO represents an external cue in circumstances where buyers are less familiar with foreign products¹⁷ or when internal cues are not available.¹⁸ Favourable perceptions of a particular country can also lead to more favourable judgments about that country's products and services.^{15,19,20} Owing to the uncertain nature of the product development processes that make it difficult for investors to properly assess the value of biotech companies (such as intellectual property, promising products and other unrealised value)⁶ and the specialised technical knowledge possessed by the biotech companies, it is often difficult even for the VC firms to accurately assess their potential. Hence, there is a tendency for VC firms to fund new venture companies in industries or technologies where they have experience or are familiar with.²¹ In the process of funding, each additional investment also extends the VC firms' network as they establish important contacts specific to the industry.²² Such industry-specific knowledge is an important distinctive competence of the VC firms that enables them to provide managerial

advice or engage in the activities of the biotech company to which they invest.²³

In the absence of a reputation and the ability to establish an association, CO may represent the best chance of portrayal of the quality of the firm.²⁴ If there is a CO effect in biotech, then we should observe patterns in behaviour in VC participation in biotech companies from different COs. Based on a sample of 1,490 VC investments in biotech companies, this exploratory study investigates whether there is such a pattern, which has implications for both biotech companies and policy makers.

DATA AND METHODOLOGY

Data used for this research is collected from the database VentureXpert by Venture Economics. It provides comprehensive and up-to-date information of VC investments in biotech companies around the world, including the composition of VC investment, the CO and sector of these biotech companies, and the details of VC firms' involvement in these biotech companies at different stages and financing rounds.

The outcome of the biotech companies is indicated by whether at the time of updating the company has been acquired, gone public, bankrupt or is still active as a private entity. An acquisition occurs when the VC firms sell their shares in the biotech company to a third-party. Acquisition of biotech companies are often done by large pharmaceutical firms for complementary technological capabilities, which is cheaper than developing them in-house.^{25,26} An initial public offering (IPO) occurs when the VC firms sell their shares in the biotech company to the market through the stock exchange. New venture companies that go public have been found to be the ones that yield the highest return for VC firms.² IPO is not only seen as a natural end state for VC firms to generate returns on providing the financial and management support to the new venture companies, it is also a vehicle to finance growth or cash out following the new venture company's development.^{4,27} IPO also provides the venture company with an increased level of legitimacy in the business community, which improves its access to debt financing and

creates a mean for expansion of operations.²⁸ Bankruptcy involves a write-off exit for the VC firms involved in the syndication, when they determine that there is little or no prospect of ever recovering the initial investments. VC firms that are better at assessing and assisting their portfolio companies usually have more successful exits and fewer portfolio companies that go bankrupt.²⁹ Bankruptcy is normally not an option for VC firms as this may reflect their inability to create value in the biotech company and may ultimately impede their ability to raise new funds from investors in the future.³⁰

In order to examine the extent of CO effects, three critical factors of VC firms' involvement in biotech companies are included. These factors are the amount of investment received per VC firm, the number of investing VC firms and the biotech investment experience of the investing VC firms. The average amount of investment from VC firms is an indication of the level of risk that the VC firm is willing to undertake at the biotech company. Like the number of investing VC firms, it also reflects the assessment of the potential of the biotech company by the VC firms. The greater the biotech investment experiences of the VC

firms, the greater their ability to assess the quality of the biotech company and hence a sign of the potential of the biotech company. As VC firms have limited time and effort to allocate among their portfolio venture companies,³¹ the larger the values of these factors, the higher the expectations they have on the biotech companies.

One limitation of the data is the measurement of experience. Experience is a multidimensional construct and can also be reflected by other measures such as the number of years that the VC firms have been involved in the biotech sector or the number of portfolio companies that the VC firms have taken to IPO successfully in the past. Another issue pertains to the fact that active investment was treated as a biotech outcome. While a biotech company at the stage of active investment is an indication of its viability, it is an ongoing concern and is not a biotech outcome for the VC firms involved. Its inclusion merely forms a basis of comparison for the stage of development of the biotech companies.

FINDINGS

The sample includes 1,490 biotech companies. As shown in Table 1, 919 (61.68 per cent) of

Table 1: Country-of-origin and sector of biotech companies

	Biotech– Human	Biotech– Agriculture	Biotech– Industrial	Biosensors	Biotech equipment	Biotech research	Total	%
United States (US)	544	87	47	17	101	123	919	61.7
United Kingdom (UK)	50	9	8	1	6	19	93	6.2
Germany (GER)	86	4	13	4	18	19	144	9.7
Other America (AMER)	34	7	9	1	6	6	63	4.2
Other Europe (EUR)	78	22	9	4	15	33	161	10.8
Asia-Pacific (ASIA)	54	21	15	0	5	15	110	7.4
Total	846	150	101	27	151	215	1,490	100
%	56.8	10.1	6.8	1.8	10.1	14.4	100	
<i>Goodman and Kruskal's Tau test results</i>								
Dependent variable	Coefficient							
Country-of-origin	0.009***							
Sector	0.008***							

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; † $p < 0.10$.

Table 2: Outcomes and sector of biotech companies

	Active investment	Acquisition	IPO	Bankrupt	Total	%
Biotech–Human	569	35	227	15	846	56.8
Biotech–Agriculture	110	9	24	7	150	10.1
Biotech–Industrial	84	1	11	5	101	6.8
Biosensors	21	0	3	3	27	1.8
Biotech equipment	118	6	24	3	151	10.1
Biotech research	179	1	31	4	215	14.4
Total	1,081	52	320	37	1,490	100
%	72.5	3.5	21.5	2.5	100	
<i>Goodman and Kruskal's Tau test results</i>						
Dependent variable	Coefficient					
Sector	0.015***					
Outcome	0.021***					

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; † $p < 0.10$.

Table 3: Outcomes and country-of-origin of biotech companies

	Active investment	Acquisition	IPO	Bankrupt	Total	%
US	575	52	261	31	919	61.7
UK	79	0	13	1	93	6.2
GER	138	0	4	2	144	9.7
AMER	50	0	12	1	63	4.2
EUR	147	0	14	0	161	10.8
ASIA	92	0	16	2	110	7.4
Total	1,081	52	320	37	1,490	100
%	72.5	3.5	21.5	2.5	100	
<i>Goodman and Kruskal's Tau test results</i>						
Dependent variable	Coefficient					
Country-of-origin	0.044***					
Outcome	0.063***					

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; † $p < 0.10$.

these are from the US and that 56.78 per cent of all companies are in the biotech–human subsector. The Goodman & Kruskal's Tau test shows a CO effect on the participation in various biotech subsectors, that is, some nationalities of biotech companies have preference to participate in some subsectors. The Goodman & Kruskal's Tau test is used to test the independence of two nominal variables. This test is used because the data violates the Chi-square Test of Independence assumption of having expected frequency of ≥ 5 for at least 75 per cent of the cells.

Table 2 shows that among the outcomes of biotech companies, 320 (21.5 per cent) have gone IPO, 52 (3.5 per cent) have been acquired and 37 (2.5 per cent) went bankrupt. Table 2 also shows the result of the Goodman & Kruskal's Tau Test of biotech subsectors with outcomes. The finding suggests that the composition pattern of outcomes differs across the subsectors. Table 3 shows that biotech outcomes differ across different COs. To further our understanding, the relationship between CO and outcome is tested within each biotech subsector. Table 4 shows the summary result, which suggests that the CO

Table 4: Outcomes, country-of-origin and sector of biotech companies

	Biotech– Human	Biotech– Agriculture	Biotech– Industrial	Biosensors	Biotech equipment	Biotech research
Country-of- origin	0.051***	0.044**	0.064**	0.094	0.033†	0.024*
Outcome	0.078***	0.061*	0.108**	0.118	0.049	0.042*

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; † $p < 0.10$.

Table 5: Differences in mean in amount received per VC firm across country-of-origin

Variable	Value	N	US	UK	GER	AMER	EUR
US	3.72	919					
UK	3.03	93	0.69				
GER	2.50	144	1.22*	0.53			
AMER	3.94	63	-0.22	-0.91	-1.44		
EUR	4.76	161	-1.04	-1.73	-2.26	-0.82	
ASIA	2.17	110	1.55*	0.86	0.33	1.77	2.59

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; † $p < 0.10$.

Table 6: Differences in mean in number of VC firms invested across country-of-origin

Variable	Value	N	US	UK	GER	AMER	EUR
US	5.35	919					
UK	3.00	93	2.35***				
GER	2.85	144	2.50***	0.15			
AMER	3.17	63	2.18***	-0.17	-0.32		
EUR	3.37	161	1.98***	-0.37	-0.52	-0.20	
ASIA	1.94	110	3.41***	1.06***	0.91**	1.23***	1.43***

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; † $p < 0.10$.

Table 7: Differences in mean in VC firms' biotech investment experience across country-of-origin

Variable	Value	N	US	UK	GER	AMER	EUR
US	69.62	919					
UK	34.99	93	34.63***				
GER	29.53	144	40.09***	5.46			
AMER	10.75	63	58.87***	24.24**	18.78*		
EUR	29.51	161	40.11***	5.48	0.02	-18.76**	
ASIA	4.95	110	64.67***	30.04***	24.58***	5.80*	24.56***

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; † $p < 0.10$.

effect on outcome is evident in four of the six biotech subsectors. It is also important to note that these four subsectors represent the majority (88.1 per cent) of the sample. This finding lends further support to the CO effect.

Tables 5–7 show the *t*-tests of difference in means for the amount of investment received per VC firm, the number of investing VC

firms and the biotech investment experience of the investing VC firms, respectively, across different COs. Table 5 shows that the average amount of investment that US biotech companies received is higher than those of German (difference = 1.22, significant at 5 per cent) and Asia-Pacific (difference = 1.55, significant at 5 per cent) biotech companies. The rest of the pair-wise comparisons are not

Table 8: Differences in mean in amount received per VC firm across outcomes

Variable	Value	N	AI	ACQ	IPO
Active investment (AI)	3.18	1,081			
Acquisition (ACQ)	2.34	52	0.84*		
IPO	5.13	320	-1.95**	-2.79***	
Bankrupt (BKT)	3.21	37	-0.03	0.87	0.33

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; † $p < 0.10$.**Table 9:** Differences in mean in number of VC firms invested across outcomes

Variable	Value	N	AI	ACQ	IPO
Active investment	3.59	1,081			
Acquisition	8.88	52	-5.29***		
IPO	6.41	320	-2.82***	2.47**	
Bankrupt	4.46	37	-0.87	4.42***	1.95*

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; † $p < 0.10$.**Table 10:** Differences in mean in VC firms' biotech investment experience across outcomes

Variable	Value	N	AI	ACQ	IPO
Active investment	42.31	1,081			
Acquisition	75.25	52	-32.94**		
IPO	82.09	320	-39.78***	-6.84	
Bankrupt	41.86	37	0.45	33.39†	40.23**

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; † $p < 0.10$.

significant. Table 6 shows that US biotech companies have consistently greater number of investing VC firms as compared to companies of other COs. It is also clear in Table 6 that Asia-Pacific biotech companies have consistently fewer investing VC firms. Other pair-wise comparisons are insignificant. Likewise, in Table 7, US biotech companies are found to have investing VC firms that have greater biotech investment experience than those that invest in biotech companies from other COs, while Asia-Pacific biotech companies have consistently less experienced investing VC firms. Another prominent result in Table 7 is that biotech companies from other countries in the Americas have less experienced investing VC firms than all European countries, including both UK and Germany.

Tables 8–10 show the t -tests of difference in means for the amount of investment received per VC firm, the number of investing VC firms and the biotech investment

experience of the investing VC firms, respectively, across various outcomes. Table 8 shows that while active investments received more amounts on average from VC firms than those that are acquired, both received significantly lower amounts of investment as compared to those that went IPO. There is no pattern of the amount received per VC firm with the likelihood of bankruptcy. In Table 9, it can be seen that biotech companies that tend to have higher number of investing VC firms are acquired. This is followed by IPO. While active investments tend to have fewer investing VC firms than those what went bankrupt, this result is not significant. The patterns observed in Table 10 on VC firms' biotech investment experience are similar to those in Table 9.

DISCUSSION AND CONCLUSION

The findings clearly show that CO has an effect on the participation in various biotech

subsectors and outcomes. Specifically, it is found that there is a CO effect on outcomes in the four main subsectors. These findings that show that biotech companies from different COs have a preference over their involvement in various biotech subsectors may indicate a potential element of national comparative advantage, that is, some countries possess resources and networks that allow their biotech companies to specialise in particular subsectors. This provides further support to previous studies that have addressed this issue in the context of trade.⁵ It is also possible that this observed behaviour is a result of mimetic isomorphism, that is, biotech companies of a particular country tend to follow their predecessors from the same country that have engaged in particular subsectors effectively as these are perceived to be less uncertain.

The findings also show that US biotech companies tend to have larger amount of investment received per VC firm, larger number of investing VC firms and greater biotech investment experience of the investing VC firms. Asia-Pacific biotech companies have consistently fewer investing VC firms and these investors tend to have less biotech investment experience. VC firms with greater biotech specificity are also investing in European biotech companies more than those from the Americas, excluding the US. It can be argued that US biotech companies have the advantage in terms of their ability to attract more, and experienced, VC firms and at the same time greater amount of investments. The lesser familiarity with Asia-Pacific biotech companies leads to less engagement from VC firms. Hence, Asia-Pacific biotech companies have to contend with not only fewer but less experienced VC firms as well. Again, this illustrates that CO may have played a part in such investments. Given the difficulty to make judgments on the potential quality of many biotech companies and the high level of uncertainties associated with biotech projects, CO may have provided a simple heuristics to which VC firms can make investment decisions.

These findings have implications for both biotech companies and policy makers. Previous research has shown that VC firms

assess the potential of biotech companies by looking at the management skills and experience of the biotech company's management team, the proprietary technology it possesses and potential range of applications, and the market potential of the product, and assess these against the risks involved.⁹ This study shows that CO may be another essential factor that influences VC firms' assessment. Thus, biotech companies should capitalise on the advantage of CO image as some countries are better known in some areas of biotech than others. It is also evident that VC firms syndicate to invest in particular subsectors and biotech companies of particular COs due to perceived greater familiarity. Thus, it may be important to utilise this tendency to increase the likelihood of investment. Further, partnerships can also be established to enhance this CO effect, especially for those biotech companies that do not come from the more recognised COs. This is essential to lower the likelihood of bankruptcy. Even for those with good CO image, partnering may further boost the trust of VC firms. Biotech companies may also consider their inception location, as this may have implication for potential VC financing.

Policy makers should be aware of the existence of such CO advantages. When new biotech products finally prove to be successful, they usually reach global markets and are very profitable.⁹ This will also help build the country's image. Thus, further government supporting mechanisms and initiatives can be directed to these specific biotech areas that are targeted by the VC firms. For those countries in which the biotech industry is relatively less developed, policy makers may consider a more aggressive government-in-business approach to assist this development, for example, initiatives to encourage investments in biotech industry and government-led partnerships with local biotech companies and VC firms. This will certainly aid the perceptions towards the home-grown biotech companies and enhance their success rates. More specific targets towards financial support provided by experienced VC firms from countries in which there is a strong public market for biotech companies in the chosen subsector

can further enhance the success of local biotech companies.

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