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ABSTRACT

Do Locational Spillovers Pay? Empirical Evidence from German IPO Data*

This study examines the impact locational spillovers have on firm performance. Based on a uniquely created dataset consisting of high-technology start-ups publicly listed in Germany, this paper tests the proposition of locational spillovers positively affecting firm performance, as measured by abnormally high profits on the stock market. The results provide evidence that geographic proximity and university spillovers are complementary determinants of firm performance. While neither geographic proximity nor academic research spillovers alone can explain firm performance, a combination of both factors results in significant higher stock market performance. The results also show academic spillovers are heterogeneous in their impact depending on the type. In particular, spillovers from social sciences have a different impact on firm performance than do spillovers from natural science.

JEL Classification: L20, M13 and R30
Keywords: firm performance, university spillover and university-firm collaboration

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Introduction

"Munich was the only city which offered us a location on the Campus of the University"[1]

It has long been thought that when people work in close geographic proximity, the likelihood that they will collaborate together increases dramatically (Olson and Olson 2003 for a survey; Finholt, 2003; Audretsch, Keilbach, and Lehmann, 2005). Such forms of collaboration – interacting with colleagues, accessing instrumentation, exchange of students and graduates, sharing data and computational resources among others – have been to be among the most important mechanisms transmitting the spillover of knowledge. However, depending upon the specific kind of knowledge, geographic proximity matters for accessing such spillovers. An important empirical result that has consistently emerged in the literature on the geography of knowledge spillovers is that, while geographic proximity seems to be less important for codified knowledge, it seems to be more important for tacit knowledge. For example, Audretsch and Stephan (1996 and 1998) found that the importance of spatial proximity between scientists and biotechnology firms depended on whether the scientist was involved in the transfer of codified or tacit knowledge.

While a huge amount of empirical studies tried to analyze the determinants of spillover effects, this paper addresses the question of how firm performance is shaped by the spillover of knowledge from universities. In particular, we analyze whether firm performance on the stock market of newly listed and high tech firms is shaped by both

[1] Armin Pfoh, Head of the Global Research Center of General Electric, to the question why General Electric decided to build up the Global Research Center in Munich, cited in Focus, October 2004, No. 41, p. 118)

geographical proximity to universities as well as the magnitude and quality of the university research output. The production, acquisition, absorption, reproduction and disseminating of knowledge is seen as the fundamental characteristic of contemporary competitive dynamics and in fostering innovative activity (Sorensen and Audia 2000; Baum and Sorensen 2003; Varga 2000; Stuart and Shane 2002; Anselin *et al.*, 1997, 2000; Santoro and Chakrabarti 2002). However, little is known about how exactly and why geographic proximity to universities influences firm performance.

Thus, the purpose of this paper is to address these questions focusing on whether knowledge spillovers and geographic proximity actually influence firm performance, and if so, what is the exact nature of the impact of knowledge spillovers and geographic proximity on firm performance. We do this by linking the stock market performance of firms in terms of abnormal profits to the proximity to a university along with the different elements of university research and educational outputs.

The remainder of the paper is organized as follows: section 2 summarizes the literature and introduces the testable hypotheses raised in this paper. Section 3 contains the description of the database, and the estimation techniques. The empirical results are presented in section 4. In section 5 a summary and conclusions are presented. In particular, we find compelling evidence suggesting that performance is shaped by both geographic proximity and university research. However, the impacts of these two factors are complementary, in that both are required to generate high levels of firm profitability.

2. University spillovers, geographical proximity and firm performance

Although the importance of spillovers on firms have entered mainstream economics only recently, their important productivity effects have been recognized for a long time (see Romer 1986 or Grossman and Helpman 1991). There is an ongoing debate on fostering university spillovers to enhance economic growth. University spillovers could be defined as an externality accessed by firms, for which the university is the source of the spillover but not fully compensated (Harris, 2001). Because firms access external knowledge at a cost that is lower than the cost of producing this value internally, or of acquiring it externally from a larger geographic distance (Harhoff 2000), they will exhibit higher expected profits. The cost of transferring such knowledge is a function of geographic distance and gives rise to localized externalities (Siegel *et al.* 2003).

However, less is known about the actual mechanisms transmitting the spillover of knowledge. Studies have identified that knowledge spillovers may arise from personal networks of academic and industrial researchers (Liebeskind *et al.* 1996; MacPherson 1998; Feldman and Desroche 2003), participation in conferences and presentations, or pre-employment possibilities with students as an important channel for disseminating the latest knowledge from academia to high-technology industry (Varga 2000). University research, as the source of such spillovers, is typically measured by the amount of money spent on Research and Development (R&D), the number of articles published in academic and scientific journals, the number of employees or patents (see Varga, 2000; Henderson *et al.* 1998; Hall *et al.* 2003; McWilliams and Siegel 2000). The overwhelming part of the empirical literature confirms the positive effects of university spillovers (Acs *et al.* 1992; 1994; Jaffe *et al.* 1993; Audretsch and Feldman 1996; Audretsch et al. 2004; Anselin *et al.* 1997; Varga 2000; Mowery and Ziedonis

2001), although there are barriers of partnering like unclear property rights (Hall *et al* 2001).

While there exists a huge amount of empirical work analyzing the existence of geographical proximity and university spillovers (see Audretsch et al. 2004, 2003), there is only scarce evidence on the effects of knowledge spillovers on firm performance. One way to measure performance is whether university spillovers reduce the cost of R&D for the firms (Harhoff 2000). Another method is introduced by Griliches (1979). He suggested using hedonic price functions to analyze whether the quality of new products increases due to spillovers relative to the old product. One branch of research analyzes the productivity effects of spillovers (see Nadiri 1997 for a survey). However, whether geographic proximity and access to knowledge spillovers improves firm performance remains relatively unexplored. This is the main question of this paper.

Perhaps the most prevalent and established finding in the spillover literature is that innovative output and growth is higher in the presence of knowledge inputs (Feldman, 2000). However, this literature has been established for the unit of observation of the region or city. As already emphasized, little is known about the impact of geographic proximity on the performance at the firm level. As Jaffe (1989) points out, geographical location is important in capturing the benefits of spillovers when the mechanism of knowledge is informal conversation, as is the case for tacit knowledge. Then, "....geographic proximity to the spillover source may be helpful or even necessary in capturing the spillover benefits" (Jaffe 1989, p.957). Thus, the limited geographic reach of such channels for the exchange of information and know-how is assumed to be one of the main reasons why geographic proximity promotes firm performance since it leads

to a competitive advantage over similar firms which are not located close to universities. During the innovation process firms are confronted with a wide range of possible problems and difficulties which may be beyond the firm's own problem solving capacity. Close location gives then support to both management capacity and technological input. Otherwise, spatial distance between firms and universities are likely to play the major barriers of interaction (Schartinger et al. 2001). Thus, our first hypothesis is that locational proximity positively influences firm performance. The closer the distance towards the nearest university, the higher is the likelihood that people will collaborate by personal interaction. Therefore, we would expect that firm performance decreases with the distance to the nearest university.

However, our analysis is based on the assumption that stock markets are not perfect. A number of studies, like (Ritter,1991) assume, agents are not able to evaluate every piece of information and thus stock market prices did not reflect full information in the prices. Like our paper, his analysis is based on IPO and the pricing of firms with different quality. Thus, the underlying null-hypothesis would be that there is no impact from geographic proximity on stock-market performance. If, however, geographic proximity towards universities is important for those firms, proximity would be priced in the IPO and thus would have no impact on abnormal returns.

While this first hypothesis suggests, that distance alone has an impact on firm performance, the second hypothesis states the research output of universities enhances firm performance, especially when high-skilled labor is a scarce resource and there is intense competition for human capital and other knowledge inputs (Porter and Stern 2001). Schartinger et al. (2001) conclude mobility of human capital is the main channel of knowledge transfers from universities to the business sector. This leads us to

formulate our second hypothesis, which is that research intensive universities and those with a high number of fresh graduates and students will enhance firm performance positively.

The third hypothesis is based on the distinction between codified and tacit knowledge (Kogut and Zander 1992). Elements of know-how and operations cannot be codified easily in a blueprint, a contractual document (Mowery and Ziedonis 2001), or a published article (Audretsch and Feldman 1996). Tacit knowledge needs oral communication and reciprocity which may be ineffective or infeasible over longer distances. Audretsch et al. (2004) and Audretsch and Stephan (1996, 1998) find that also the kind of science – codified or tacit knowledge – matters for spillover effects. While locating spatially close towards universities is not necessary to transmit and disseminate findings where knowledge is codified, it is important where knowledge is tacit. Knowledge in the natural sciences is characterized by a greater degree of codification. Strict adherence to the scientific method assures that academic research embodies a high component of codified and specific knowledge in the natural sciences (Stephan 1996). By contrast, the more limited applicability of the scientific method implies that research in the social sciences will embody less codified knowledge and is there more tacit in nature (Stephan 1996). Thus, the third hypothesis is firm performance will be positively related to geographic proximity for research in the social sciences but not necessarily in the natural sciences.

Finally, our fourth hypothesis states that neither the magnitude of research output nor geographical proximity to the university alone enhances firm performance significantly.

Only in combination will locational proximity and high research university output, positively effect firm performance.

3. Data Set and Descriptive Statistics

3.1 Measurement and Methodology

To test the hypothesis that firm performance depends on geographical proximity to a university, we use a unique dataset of high-technology German firms publicly listed on the *Neuer Markt*. The total number of German firms listed on the *Neuer Markt*, Germany's counterpart of the *NASDAQ*, was 295 between 1997 and 2002. From these firms we dropped all banks (5) and holding companies (9) since they differ in their production function significantly from the other firms.[2] The dataset is collected combining individual data from initial public offerings (IPO) prospectuses, along with publicly available information from on-line data sources including the *Deutsche Boerse AG (*www.deutsche-boerse.com). We pooled this dataset by adding university-specific variables, which are individually collected from the 73 universities in Germany. For each of those universities we collected the number of articles listed in the research database from the ISI (Information Sciences Institutes). Although this research database includes a small amount of all the journals in one field, it ensures that it only contains the high-quality research journals.

We take the log of abnormal profits as the dependent variable. This is a widespread measure of firm performance on the stock market. We calculated the abnormal annual log-rents on the stock market from IPO until the 30th of June in 2002. This time-period

[2] We dropped banks like Comdirect, Consors and holding companies like BB-Biotech.

captures both of the prominent and well-known effects, the so called internet bubble on the stock markets as well as the rapid decline in 2001 and 2002.

The abnormal annual log-profit is measured as:

$$[(\text{lnprice10.06.02} - \text{lnIPOprice}) - (\text{lnNEMAX30.06.02} - \text{lnNEMAXIPO})]\frac{52}{\text{number of weeks}}$$

LnIPOprice is the natural logarithm of the stock price at the first day when the firm was listed on the stock market and thus reveals the demand and supply for the firm's shares. Thus, this price is the market determined price on the first day of trading. lnNEMAXIPO is the logarithm of the market index at IPO. Lnprice(30.06.02) and lnNEMAX(30.June. 02) are the values taken from June, 30, in 2002. Capital increases and dividend payments are considered in the stock prices. The term is divided by the number of weeks from IPO to June, 30, 2002. Multiplying by 52 gives us the annual abnormal profit. The underlying performance measure of abnormal profits measures long time performance from IPO up to the first half of the year 2002. Although no new IPOs are observed in the years 2001 and 2002, we increased the time horizon until June 2002. This time horizon includes both, the dramatically ups - until March 2000 - and downs - from March 2000 until March 2002 - on the stock market

We take the *DISTANCE* to the closest university as the first exogenous variable. Since universities in Germany are more geographically concentrated compared to the U.S., we need a measure which is sensitive to small variations. The distance is measured in kilometers using the online database of the *German Automobile Club* (www.adac.de).

All firms located within a radius of 1.5 kilometers are classified as belonging to the distance category of 1 kilometer to capture "on campus" effects of tacit knowledge.

To capture effects of excellence in academic research, we rank German universities according to their published academic papers in highly ranked journals as included in the ISI database (*RankingSCI, RankingSSCI*). This ranking is published by the Center of University Evaluation (CHE, see Warning 2004).[3] In contrast to traditional rankings, the better the university the higher the ranking. Since Technical Universities with their focus on engineering and machinery differ from the traditional universities, we include a dummy variable to control for this special type of university (*TU*). We also control for the age of a firm (*AGE*) which is measured in years from foundation to IPO and the number of employees before IPO to control for size effects (*SIZE*).

Since the dependent variable is highly skewed, we apply median regression methods to test our hypothesis. Just as one can define the sample mean as the solution to the problem of minimizing a sum of squared residuals, one can define the median as the solution to the problem of minimizing a sum of absolute residuals. This semi-parametric technique provides a general class of models in which the conditional quantiles have a linear form. In its simplest form, the least absolute deviation estimator fits medians to a linear function of covariates. The method of quantile regression is potentially attractive for the same reason that the median or other quantiles are a better measure of location than the mean. Other useful features are the robustness against outliers and that the

[3] We experimented with both the number of articles published in the social and natural sciences. The results including the relative performance or excellence of universities, as summarized by the ranking in both fields, provides better results. Although, the bivariate correlation coefficients between the ranking

likelihood estimators are in general more efficient than least square estimators. Besides the technical features, quantile regressions allow that potentially different solutions at distinct quantiles may be interpreted as differences in the response of the dependent variable, namely the distance, to changes in the regressors at various points in the conditional distinction of the dependent variable. Thus, quantile regressions reveal asymmetries in the data, which could not be detected by simple OLS estimations (see Koenker/Hallock 2001; Fitzenberger 1999 for more details of Quantile regressions). Especially, we estimate three nested models to extract the influence of geographical distance and university spillovers on firm performance.

In the first model (Model 1), we estimate the following regression to test the first three hypotheses: Model I:

$$Performance = const. + \beta_1 distance + \beta_2 Rank\ SSCI + \beta_3 RankSCI + \beta_4 students\ SCI + \beta_5 students\ SSCI + \beta_6 technical\ university + \beta_7 firm\ age + \beta_8 firm\ size + \beta_{9-15} industry\ dummies + \beta_{16-18} IPO\ dummies + \varepsilon$$

To test the fourth hypothesis we estimate the following reduced form:

Model II:

$$\text{Performance} = const. + \beta_1 distance * RankSSCI + \beta_2 distance * RankSCI + \beta_3 distance * studentsSCI + \beta_4 distance * studentsSCI + \varepsilon$$

Finally, we estimate the third model

Model III:

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positions and the number of articles published in the natural science (social science) is 0.921 (0.951) (see table 2).

$$\text{Performance} = const. + \beta_1 distance * RankSSCI + \beta_2 distance * RankSCI + \beta_3 distance * studentsSCI + \beta_4 distance * studentsSSCI + \beta_5 firm\ age + \beta_6 firm\ size + \beta_7 technical\ university + \beta_{8-14} industry\ dummies + \beta_{15-17} IPO\ dummies + \varepsilon$$

3.2 Descriptive Statistics

Some descriptive statistics are depicted in Tables 1 and 2. The closest location between firms and universities is one kilometer and the maximum distance is 177 kilometers away from the nearest university. The skewed distribution of the data is reflected by the difference between the mean and median values. While the arithmetic mean distance is about 17 kilometers, the median shows that 50% of the firms are located within an area with the radius of 7 kilometers. Table 1 indicates that research activities and the number of students and fresh graduates vary considerably across universities. A comparison between the mean and median also exhibits the skewed number of articles in both the social sciences and natural sciences. On average, each university published about 250 papers in social sciences and more than 5,100 articles in natural sciences. However, the number of articles published by 50% of the universities is lower. Also the number of graduates differs across universities (see also table 1).

Interestingly, the number of articles and graduate students varies not only across universities but also across the two fields. While the mean university publishes twenty times more articles in the natural sciences compared to the social sciences, this difference increases with the number of published papers. However, articles in the natural sciences and those in social sciences differ in their length, number of co-authors and referee time, and are thus not comparable. While 50% of the universities publish about 200 articles in social sciences, there are more than 4,000 articles in the natural sciences. The opposite can be found for the number of students. On average, more than

20,300 students are studying social sciences, while only about a third, 7,300 are enrolled in the natural sciences.

The data presented in table 1 also demonstrate most of the firms are strikingly young. Half of the firms in our sample are eight years old or less. The firms also differ greatly in their size as measured by the number of employees before IPO. The median firm employs about 94 people while the mean firm is about twice as large with 253 employees.

Finally, the table shows that on average the abnormal annual log-profit is negative. This, however, is due to the fact that the benchmark, the NEMAX 50 Index, covers a sub sample of firms which are larger in size and are assumed to be of higher "quality", like Non-IPO's, firms from abroad, the excluded banks or holding companies.

Table 2 provides the correlation between the included variables. The high correlation between the articles published in SCI and SSCI demonstrates that universities are either research active - or not - independently from the academic field. Interestingly, there is a high correlation between the articles published in social sciences and the number of graduates in these fields, but not for natural science. While research in the social sciences seems to be not affected by the number of students in the natural sciences, there is a high correlation between the articles published in the natural sciences and the students in social sciences. One explanation may be that the natural sciences restrict the number of students. The high correlation between the number of students in the social sciences and the number of articles published in this field may also be due to size effects.

4. Empirical Evidence

The results of the median regressions are presented in table 3. In Model I, distance and university output enter the regression separately. As the coefficients show, neither geographic proximity nor university research rankings show any significant effect on firm performance. Most of the variance in firm performance is either explained by industry effects or the time to IPO. The latter indicates the phenomenon of the "window of opportunities": The longer the IPO period, the lower the quality of firms which are brought to the stock markets. The Pseudo R square is 0.334, which can be interpreted in the same way as the traditional R square in OLS regressions since it also shows the proportion of the explained variance about the specified quantile. Thus, about 33% of the variance of firm performance could be explained by our model.

In the second model (Model II), we only included the interaction terms. Although only about 4% of the variance could be explained by the four variables, three of them have a statistically significant coefficient. With a given level in the SSCI-Ranking, firm performance increases the closer the location to the university. The same also holds significantly for the amount of fresh graduates and students in the natural science. However, the opposite holds for research activities in the natural sciences. This result is in line with findings from Audretsch and Stephan (1996, 1998) and Schartinger et al. (2001). The latter study showed that the employment of high skilled, university educated personnel is the most important input for the innovation process of high tech firms. Codified knowledge, as embodied in academic articles in the natural science, did

not need short distance to enhance firm performance. In this case, firms could lower their costs and thus increase profits by choosing a location outside the inner circle of a city and thus lower costs of living and housing.

As shown in column 3, those results are also robust in the full model. By contrast, geographic proximity may be less important for accessing knowledge transmitted by recent graduates in the social sciences than in the natural sciences. This is because of the generic nature of university education in the social sciences in Germany. Social science programs are standardized throughout the country, which produces graduates with a relatively homogeneous degree of human capital. However, such standardization is not found in the natural sciences, so that geographic proximity is important to access knowledge embodied in recent graduates in the natural sciences. Therefore, the number of fresh graduates in social sciences would not really affect the firms' decision to locate close towards the next university and thus has no significant effect on firm performance. In the natural sciences, however, universities differ in their specific research specialization like life-science, biochemistry, physics, or engineering. Thus, the human capital of fresh graduates and students in the natural sciences is likely to be more "specific" than "general" (Audretsch et al. 2004).

The first important result of our study is that geographical proximity alone has no significant impact on firm performance. Thus, we reject hypothesis 1. We also reject hypothesis 2 that research intense universities and those with a high amount of students and graduates significantly enhance firm performance.

The second important result is that firm performance is significantly higher when both geographic proximity and a strong university research output are present. This suggests an interactive relationship between geographic proximity and university output, on the

one hand, and firm performance on the other.

Finally, the third important result involves the roles of tacit and codified knowledge. The negative and statistically significant coefficient of SSCI-Ranking in Models 2 and 3 suggests the contribution of geographic proximity to the university for firm performance will play a more important role in the social sciences than in the natural sciences. However, the regressions suffer from an endogenous problem since firms are locating close to universities to capture those spillovers and from spillover effects between those firms.

5. Conclusions

An important literature has emerged identifying the role that knowledge spillovers play in shaping the economic performance of cities and regions. A significant contribution of this literature is that, because of the localized nature of knowledge spillovers, geographically bounded regions with higher knowledge resources also tend to exhibit a stronger economic performance. However, a limitation of this literature is that the findings apply for spatial units of observation, such as cities and regions, while less is known about the impact of geographic proximity and knowledge spillovers at the firm level.

By utilizing a new and unique data set consisting of high-technology and knowledge firms in Germany, this paper has asked the question “Does the relationship between geographic proximity to knowledge sources and performance hold at the firm level?” The answer found in this paper is that it depends. In particular, the impact of geographic proximity on firm performance depends on the type of knowledge produced at a

particular university. If the spillover involves knowledge in the natural sciences geographic proximity is less important. By contrast, if the spillover involves knowledge in the social sciences, geographic proximity is seen to be a necessary condition for generating abnormally high profits. Thus, the results of this paper suggest that the relationship between geographic proximity to universities and economic performance at the firm level is more complicated than might appear from the literature at the more aggregated spatial levels and depends on the nature of the particular type of spillover involved.

An important limitation of this paper is that only two types of knowledge, and therefore knowledge spillovers – social science and natural science – are considered. The results show a different impact between the social and the natural sciences on stock market performance. However, this difference could also be that the spillover effects of the codified scientific knowledge is easier to anticipate by market participants and priced at the IPO than are spillover effects from social science knowledge.[4] Thus, the results show that spillovers matter for firm performance. However, it depends at least whether or not the impact of geographic proximity on firm performance is anticipated and priced in the IPOs.

Future research might be well served to further investigate the heterogeneous nature of cooperation and knowledge spillovers. Only then can progress continue to be made in disentangling the relationships between firm performance, location and collaboration.

[4] We are grateful to an anonymous referee fort his point. In fact, it seems that codified knowledge could be easier priced. If we use the IPO-returns (difference between the fixed price before IPO and the first market determined price), the results differ in that the coefficients of the interaction terms show the opposite signs. Another explanation is that firms overestimate their future returns from spillovers in the sciences which are then reflected by higher IPO prices.

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Table 1: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max	Median
Distance (km)	16.69	23.45	1	177	7
SCI articles	5,139.43	4,603.16	0	14,176	4,069
SSCI articles	253.86	220.01	0	659	204
Students SCI	20,321.17	15,409.63	0	47,112	15,741
Students SCI	7,304.89	3,988.45	0	20,570	7,725
SCI Rank	2.042	1.119	1.3	11.38	1.93
SSCI Rank	1.824	0.269	1.39	2.668	1.75
Firm size (#employees)	180.20	256.52	2	1,700	94
Firm age (years)	10.27	11.11	0.1	107	8
Abnormal Log-Rent	-1.70565	0.9431	-6.551	0.259	-1.615

Table 2: Correlation Matrix

Variable	Size	Age	SCI Grads	SSCI Grads	SCI-Rank	SSCI-Rank	SSCI Articles	SCI Articles
Age	0.328	1.000	-	-	-	-	-	-
SCI Grads	0.0352	0.1016	1.000	-	-	-	-	-
SSCI Grads	-0.0056	-0.0276	0.118	1.000	-	-	-	-
SCI-Rank	0.1267	0.0916	0.0767	-0.1924	1.000	-	-	-
SSCI-Rank	-0.0015	0.0835	-0.0756	0.1070	0.3469	1.000	-	-
SSCI Articles	-0.008	-0.0019	0.0690	0.8771	0.4019	0.9514	1.000	-
SCI Articles	0.024	-0.011	0.1807	0.8042	0.8771	0.1661	0.921	1.000
km	0.078	-0.1010	-0.0236	-0.0622	0.1939	0.0142	-0.0012	0.0011

Table 3: Geographic Proximity, university research and Performance

This table presents the result from median regression on firm performance. The endogenous variable is abnormal annual log-profits on the stock market.

	Model 1	Model 2	Model 3
Distance (km)	-0.0007[a] (0.36)[b]		
RankingSSCI	0.0514 (0.28)		
RankingSCI	0.1001 (0.37)		
Students SSCI	-0.000001 (0.36)		
Students SCI	0.00001 (0.86)		
RankingSSCI*Distance	-	-0.02084 (5.06)***	-0.0104 (2.79)**
RankingSCI*Distance	-	0.0270 (5.16)***	0.0136 (3.11)***
StudentsSSCI*Distance	-	-0.000001 (1.20)	-0.0000002 (0.29)
StudentsSCI*Distance	-	-0.000001 (2.43)**	-0.000001 (1.91)**
Technical University	-0.1236 (0.53)		0.096 (0.59)
Age	0.0066 (1.30)		0.0048 (1.26)
Size	0.00019 (1.03)		0.00019 (1.37)
Software	-0.0703 (1.71)*		-0.0766 (2.39)**
Service	-0.1712 (1.29)		-0.2171 (2.02)**
E-Commerce	-0.3214 (1.51)		-0.4096 (2.47)**
Telecommunication	-0.21016 (1.08)		-0.2474 (1.58)
Biotechnology	-0.20204 (0.91)		-0.1481 (0.80)
MedTec	0.21509 (0.92)		0.1833 (0.96)
Media & Entertainment	-0.3307 (1.94)*		-0.3256 (2.49)**
IPO 97	1.6175 (6.20)***		1.6709 (8.64)***
IPO 98	1.2307 (8.11)***		1.2243 (9.53)***
IPO 99	0.8052 (7.67)		0.7908 (9.53)***
Constant	-2.4214 (4.83)	-1.6231 (27.88)***	-2.0771 (20.08)***
Pseudo R2	0.334	0.0330	0.3375
N	259	259	259
Pseudo Median	-1.6032	-1.6032	-1.6032

[a] Estimated median regression coefficients
[b] Absolute t-values in parentheses
* Statistically significant at the 10 percent level
** Statistically significant at the 5 percent level
*** Statistically significant at the 1 percent level.