The Geography of Employment Growth: The Support Networks for Gazelle IPOs

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1. Introduction

Despite the formation of the Small Business Administration in 1953, up until the 1980s academic economic development research attention concentrated upon the largest Fortune 500 firms. This focus changed as the success and importance to both employment and the local tax base of new fast-growing firms became increasingly apparent, particularly in technology but also in other fields. David Birch was the first scholar to demonstrate the critical importance of small firms for employment and to single out the importance of new firms that were rapidly growing, or what he termed "gazelles" [1] (Birch and Medoff 1994).[2] It has now been well-established that the most significant employment creation has been by these fast-growing firms both in the U.S. and abroad (Acs and Mueller 2008; Audretsch and Dohse 2007; Bottazzi and Da Rin 2002; Henrekson and Johansson 2009). This study is confined to the firms making public stock offerings. Naturally, this is not the entire population of gazelles, i.e., the fast-growing, high-impact firms that account for the greatest growth in employment in the private sector. A unique but very important group of gazelles are those that make an initial public stock offering (IPO). These firms are particularly suited for research because in the process of filing for an IPO to the Securities and Exchange Commission (SEC) they are required to disclose a great deal of information about themselves to potential investors in the IPO. We propose to use these firm filings to obtain information about their law firm, venture capitalists, and lead investment bankers, or, what we have termed, their "entrepreneurial support network (ESN)" to address the following questions:

1) Are there differences in the proximity of these ESN members and the focal entrepreneurial firm going public by industry? This is a significant question for local policy-makers because it will suggest sectors where proximity to, for example, venture capital (VC) is not important. It also will show in which industries a local firm is going to be able to recruit directors nationally, thereby gaining visibility. Insight into the proximity of ESN members and their focal firms will assist in identifying industries in which non-VC funding is more likely to be sufficiently successful to lead to an IPO.

2) What is the employment growth of these firms over their lives following the IPO?

The initial literature on gazelles treated them as though they were formed by entrepreneurs in isolation (e.g., Birch 1981). Given the nature of the databases used, many researchers have focused only on the firm, as it was not possible to study the micro-institutional supports for these firms (Acs and Armington 2004; Sutton 1997). While the focus was limited, many have recognized that gazelles are not randomly distributed, but rather are concentrated in certain regions (Acs and Mueller 2008) and industrial sectors, but even here the regional data used for analysis has been quite high-level (e.g., Federal government research funding in region, presence of venture capital, etc.). The continuing increase in interest in the preconditions encouraging and supporting the spawning of gazelles has led to a consideration of other research variables. For

[1] Delmar et al. (2003) discuss the fact that there is no single agreed upon definition of what criteria should be used to identify a gazelle.

[2] Of course, the Congressional proponents of the SBA recognized the importance of new fast-growing firms even before the SBA was formed.

example, Markman and Gartner (2002) found that profit growth for gazelles was not correlated with employment growth, yet they did not control for geography or the organizational structure of the firm. The role of geography and the institutions supporting a fledgling firm's growth should be considered when analyzing new firm success, and it is here that the study of gazelles has interfaced with that of economic development and, most frequently, cluster studies (Porter 1998).

Building a new firm, and particularly a fast-growing gazelle, requires the recruitment of various resources including skilled labor, capital, customers, and suppliers, to name only a few (Aldrich and Fiol 1994; Hannan and Freeman 1987). The entrepreneur must knit together a network of agents that will provide them with resources, both financial and less tangible ones, such as legitimacy (Aldrich and Zimmer 1986; Kenney and Patton 2005; Sorensen and Sorenson 2003). We have termed this as the "entrepreneurial support network (Kenney and Patton 2005)." Studying the entrepreneurial support networks is most advanced in the case of biotechnology, where venture capital (VC) connections, downstream contracts with established corporations interested in licensing, and upstream relationships with research institutions have been mapped and studied in-depth (Higgins and Gulati 2003; Powell et al. 2005; Zucker et al. 1998). A number of scholars have noticed a marked tendency for spatial propinquity with other network actors such as VCs (e.g., Florida and Kenney 1988a; Powell et al. 2002; Samila and Sorenson 2010; Sorenson and Stuart 2001). While academic research on fast-growing firms has concentrated on the role of venture capital, there are a number of gazelles that have grown significantly large to undertake an IPO while never having received VC investment (Jain and Kini 1995; Florin 2005: 113). Remarkably little is known about them.

Despite this explosion of interest, outside of biotechnology and the location of venture capitalists undifferentiated by industry, little research has been conducted on the location of other members of the entrepreneurial support network, such as, the focal firm's outside counsel, and investment bankers. This is surprising because very often the first professional approached by a fledgling entrepreneur is legal counsel (Suchman 2000). For small firms an accomplished BoD is of great importance, and it has received some attention (e.g., Higgins and Gulati 2003), but also it has generally been understudied. Finally, since much of the research has focused on VC attributes, bootstrapped firms relying on financing other than VC have often been omitted. However, most U.S. regions either have small VC communities or none at all. For these regions, encouraging startups in sectors that do not require VC may be a wise policy. There is at this time, though, little data to indicate which industries these may be.

This research will have important implications for policy makers. For example, local and state jurisdictions are establishing public VC funds to support local startups, despite a long history of decidedly mixed outcomes (Lerner 2002). Our research will identify industry sectors generating gazelles that are not as spatially concentrated, thereby identifying for local policy makers industry sectors that are not handicapped by competing with dominant existing clusters. We will identify industry sectors that have more boot-strapped firms, i.e., no VCs on the Board of Directors and this will suggest industries where access to VC, which in some measure is locally constrained, is not a great an obstacle to success. Further, knowing the location of the individual VCs will show in which industries external VC is more likely to be attracted; thereby suggesting

that in such sectors gazelles may be so attractive for investment that local VC is not necessary.[3] It is possible to generate testable hypotheses such as those described below, but the descriptive results will be of equal or greater importance in bringing the attention of policy makers to the differing constitution of ESN in different industries.

2. Clusters, Innovation, and Entrepreneurial Support Networks

Today, entrepreneurship is understood as an embedded activity in which entrepreneurs mobilize other actors and resources to support their quest to establish a new organization, i.e., they create a new network (Aldrich 1999; Rocha 2004; Thornton 1999).[4] There is a proximity-related effect upon the networks entrepreneurs mobilize (Acs and Armington 2006; Florida and Kenney 1988a, 1988b; Malecki 1990; Romanelli and Schoonhoven 2001; Sorenson and Audia 2000; Suarez-Villa 1989). This research explores when and under what conditions specific actors that support successful entrepreneurship are proximate versus distant and their overall impact on employment growth.

The existence of clusters of entrepreneurial firms and their ESNs is well-established. More recent research and theorizing has suggested that firms in clusters are not self-sufficient (Malecki 2000; Oinas and Malecki 2002), but rather have important extra-local linkages. Bathelt et al. (2004) suggested that there was "local buzz" and "global pipelines." By pipelines, Owen-Smith and Powell (2002) meant the information transmission mechanism by which firms in a local cluster accessed knowledge (and other resources) from outside the region. Even in the highly clustered semiconductor industry, there are extra-local linkages. For example, Kenney and Patton (2005) found that there was a complex relationship between local and extra-local resource acquisition that differed by the location of the startup. In locations having munificent resources (on environmental munificence, see Freeman and Hannan (1983)) there was great clustering. But even in the most munificent clusters, extra-local support was in evidence particularly in regards to VCs. Interestingly, such concentrations did not preclude entrepreneurship in other regions, though there was less extra-local entrepreneurship in industries within which the ESN was highly clustered. Some entrepreneurs overcame their locational liability. Since we have the locations of more than one constituent it is possible to compare the local versus extra-local distinction for different support services thus providing insight into what support is more easily supplied through pipelines versus accessed locally.

The literature investigating clusters has found that both traded and untraded interdependency benefits are responsible for the success of these regional economic agglomerations (Storper 1995; Porter 1990). Michael Porter (1998), in conclusions not very different from those of economic geographers such as Walker (1985) and Storper and Walker (1989), identified three broad ways in which clusters affect competition. First, the externalities present in a cluster operate to increase the productivity of all member firms. Many of these are what Storper (1995)

[3] This is a very powerful advantage for our database as we have the name of the venture capitalists on the BoD. Nearly all of the scholarly work on venture capital location has depended upon the Thomson VentureExpert or PWC Moneytree database, which only identifies the headquarter's location of the VC firm. For multilocational VC firms, this can lead to misidentification of VC-startup locational distance and thus serious misestimation of spatial proximity effects.

[4] On social embeddedness, see Granovetter (1985). On the embeddedness of economic activity in a regional context, see Storper and Salais (1997). For a critique of the networks-and-embeddedness framework, see Peck (2005).

terms “untraded dependencies.” Second, the cluster accelerates the innovative capacity of its firms. Third, the concentration of specialized skills and knowledge within the cluster reduces the barriers to entry and facilitates new firm formation. Baptista and Swann (1998) found evidence to suggest that all of these factors are at work and that innovation, firm entry and growth are all stronger in clusters. In qualitative work directed at particular industrial clusters, Saxenian (1994) and Kenney and von Burg (1999) suggest that these benefits were significant contributors to the success of innovative regions such as Silicon Valley and Route 128.

Perhaps the most notable feature of these types of clusters is the degree of innovation associated with them. As early as Malecki (1980), it was observed that there was regional variation in R&D and as a result there were significant differences between the ability of regions to innovate. Cooke et al. (1997) among others, term these regional systems of innovation (see also Cooke and Morgan 1990). Focusing on entrepreneurship, Florida and Kenney (1988b) conceptualized these locations as hosting “social structures of innovation.” Feldman (1994), using data collected by the Small Business Administration, found that innovations in particular industries were highly concentrated in states such as California and Massachusetts for electronics and New Jersey and New York for medical instruments. Jaffe et al. (1993) found that patents will cite other patents originating in the same location more frequently than patents outside the location when controlled for the existing geography of related research. Audretsch and Feldman (1996) show that even after the geographical concentration of production is accounted for, innovations are found to cluster in industries where industry R&D, skilled labor, and university research are concentrated. Outside the myriad studies in the biotechnology industry (see, for example, Bagchi-Sen 2004; Cooke 2004; Powell et al. 1996, 2002; Zucker et al. 1998), the geography of ESN participants supporting entrepreneurship has received less attention. An important exception is Almeida and Kogut (1997) who in a study of the semiconductor industry found that patent citations are localized. These studies demonstrated that knowledge spillovers are geographically mediated.

ESN actors are service providers. The literature has clearly noted the importance of local business services, and that small firms are more likely to depend on local service providers (Porter 1998; Bennett et al. 1999; Muller and Zenker 2001; Scott 2002). Bennett and Smith (2002) found that nearly all business service firms catering to small firms were located within a 50-kilometer radius. All services are, of course, important to the small firm, but some service providers such as financial supporters can provide legitimacy beyond simply the funds to continue operations (Lounsbury and Glynn 2001; Florin et al. 2003).

All firms are embedded in social and business networks, both local and extra-local (Fritsch 2001) and the character of this embeddedness varies across and within industries (Hendry et al. 2000). The significance of the ESNs in Silicon Valley is illustrated by the fact that the region has the largest concentrations of high technology firms in both biotechnology (Kenney 1986; Powell et al. 2002; Zucker et al. 1998) and in a number of information technology sectors such as the Internet (Chang 2004; Zook 2002; Kenney 2002), hard disk drives (McKendrick et al. 2000; McKendrick 2004), and semiconductors (Almeida and Kogut 1999).

There is ample qualitative work that unambiguously argues that clustering benefits small startup firms, however there have been fewer studies attempting to map the ESNs in these clusters and

measure their impact quantitatively. In one attempt to quantify the benefits of location, Deeds et al. (1997) found that for a biotechnology firm not located in one of the eight regions with the highest concentration of biotechnology firms, relocation to San Francisco would have on average allowed it raise $6.3 million more capital at its IPO. In the case of biotechnology, location appears to have a concrete wealth effect. Eisenhardt and Schoonhoven (1990) found that Silicon Valley semiconductor startups that had received venture capital funding grew significantly more rapidly than those located in other regions.

This project maps the spatial aspects of the institutional infrastructure of the intermediaries involved in supporting entrepreneurial startups. In addition to advancing our knowledge of the geography of entrepreneurship, this project will have policy-relevant results. Local and regional governments today understand that smokestack-chasing is not the best economic development policy and are encouraging entrepreneurship and cluster formation. Unfortunately, not all regions have strong ESNs. The results obtained here will suggest fields within which successful firms can be created despite an absence of support actors, and identify industries within which extra-local ESNs may overcome the lack of local networks. To illustrate, in earlier research, we found that biotechnology firms going public that were from outside the traditional clusters were able to draw upon venture capitalists, investment bankers, and board members from outside their region suggesting that lack of ESN access were not binding constraints in biotechnology (Kenney and Patton 2005).

3. Data and Methodology

The database is comprised of all de novo initial public offerings (IPOs) on American stock exchanges and filed with the Securities and Exchange Commission (SEC) from June 1996 through December 2006. Every firm going public must file a prospectus with the U.S. Securities and Exchange Commission prior to its initial public stock offering. To achieve this end the 1933 Act requires companies going public to file disclosure documents with the Securities and Exchange Commission, the most important of which are the S-1 registration statement and the 424B prospectus. The database being used here is extracted from these filings. The funding for creating the database came from the National Science Foundation and an initial version of the firm portion of the database has been released for public use.

As Table 3.1 indicates, the original count of firms downloaded and parsed was 2,123. Each firm was examined as to whether it was a true de novo startup. In assembling the set of firms to be included we relied upon Thomson Financial to generate a list of all IPOs over this time period. From this list the following types of firms and filings were excluded: mutual funds, real estate investment trusts (REITs), asset acquisition or blank check companies, all small business (SB-2) IPOs with the exception of Internet firms, and all spin-offs and other firms that were not true de novo firms. For example, a firm that explicitly states that it is a subsidiary of another firm, or was once a division of another firm that was spun-off. In such cases it is clear that the company going public is not a de novo firm. In other cases, the following guidelines were used to determine de novo firm status:

1) Companies that are partnerships, such as an oil pipeline company, are considered de novo unless the partnership was formed by another company.

2) Companies that are the product of a merger are considered de novo if they have had some history of operation prior to the IPO. Similarly, companies that have made acquisitions of other firms are considered de novo unless the company is only a product of acquisitions assembled for the purpose of going public.
3) Companies that are simple reorganizations of existing firms are not considered de novo.
4) It was decided that firms formed before 1970 should be excluded because by the time they went public (1996-2006), they could no longer be considered entrepreneurial.
5) Firms whose founding date was indeterminate. Nearly all of these were roll-ups of existing firms so there was no entrepreneurial moment.
6) All firms that never had more than 10 employees.

Table 3.1: Firms Examined and Included in the SBA Database

Original count of firms	2123
Firms were excluded for the following reasons:	
Founded before 1970	166
Founding date indeterminant	54
Other reasons	61
Total excluded	281
Final SBA count of firms	1842

The SEC documents used for the database were found on the SEC EDGAR website. EDGAR has a complete record of all IPO documents going public from June 1996 onwards, and this was the starting point of the database.

The Database Variables

Company ID: The firm's Central Index Key (CIK) assigned by the SEC.
Company Name: Firm name at the time of the IPO.
Company Founding Date.
Number of Employees on Offering Date.
Filed Date: The filing date of the last 424B prospectus filed with the SEC.
State of Incorporation: State of incorporation at the time of the IPO.
Company Business Address: Street address, city, state, and zip code.
Stock Exchange and Symbol.
Shares Offered: The number of shares sold to the public in this offering.
Shares Outstanding: The number of shares outstanding after the offer.
Initial Share Price: The public offering price.
Offer Size: Offering size in dollars (the number of shares offered times the initial share price).

Company Auditor.
Primary SIC: 4 digit SIC the firm going public assigns to itself,
Company Legal Counsel: Counselor's name, name of law firm, and law firm's address.
Investment Banker's Legal Counsel: Counselor's name, name of law firm, and law firm's address.
Top Management Team
- Name
- Title
- Year Joined Firm
- Previous Position

Members of Board of Directors
- Venture capitalists
  - Name
  - Firm
  - Address (of individual VC, not VC firm headquarter)
- Other members of BoD
  - Name
  - Firm
  - Address (of individual VC, not IPO firm headquarter)

Firm Employment: Employment in each year after IPO
Firm Fate: Continuing Operation, Merger & Acquisition, and Bankruptcy

While initially, the contract called for the extraction of only Third and Fifth Year Employment, our analysis strategy required annual employment data so we extracted the data for every year.

A methodological note on Firm Employment in Third Year: A firm undertaking an IPO has three future states that it may reach: 1) It continues to operate as a going concern and we collect the data from the Annual Report; 2) It fails and its employment count is 0; 3) It is acquired. Though these states appear to be uncontroversially mutually exclusive, in some cases, there is the possibility for controversy. For example, operating firms can become shells that trade intermittently on the over-the-counter (OTC) markets. These must be identified and this requires a visual examination of SEC filings.

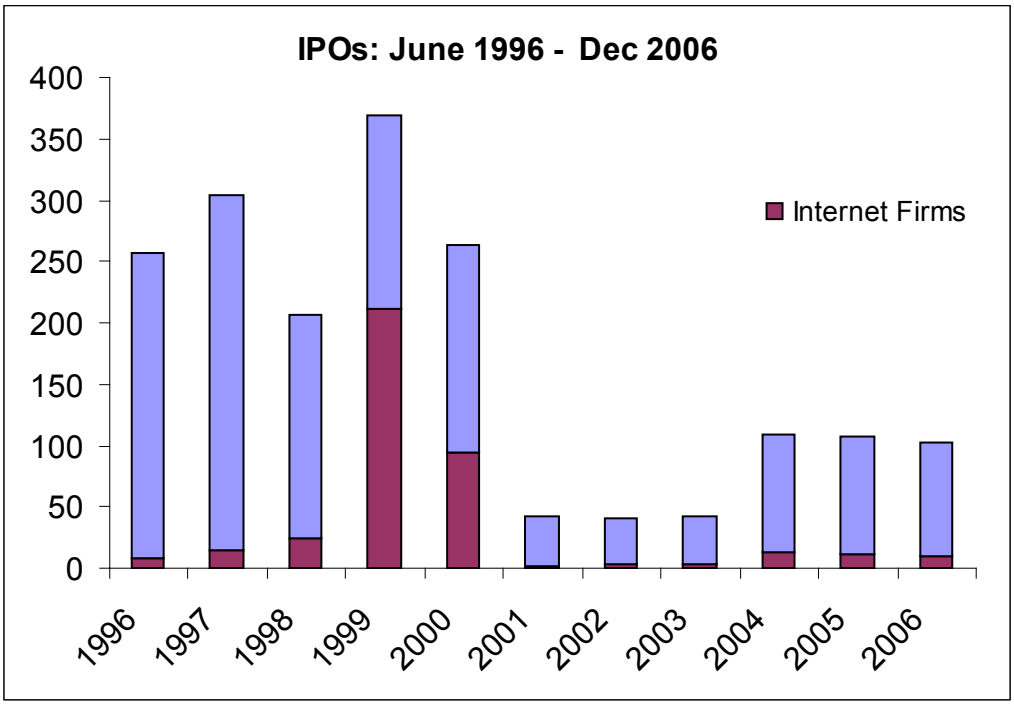
Address Search Methodology

The directors' addresses are occasionally given in the prospectus, but the remainder must be found through Internet searches. For the Venture Capitalists on the board of directors, the firm's law firm, and the investment banker's law firm our hit rate was 99.9% -- a remarkable improvement over previous research. The hit rate for the non-VC board of directors was approximately 95%, as opposed to our previous work where a precise address (city level) was found for 95.6%, 86.9%, and 81.9% of the non-VC directors in semiconductors, telecommunications equipment, and biotechnology, respectively.

Data Overview by Industrial Sector, Size, and Mean Time to IPO

During the period, there were dramatic shifts in the number of IPOs by year. As Figure 3.1 illustrates, 1997 through 2000 were very active, then after 2000 the number of IPOs decreases dramatically and by 2006 remained very depressed. In terms of the U.S. innovation system, which uses public stock markets to fund the growth of small firms this was a difficult period. It should be noted that the period from 2008 through 2010, which is not in this database, showed some improvement.

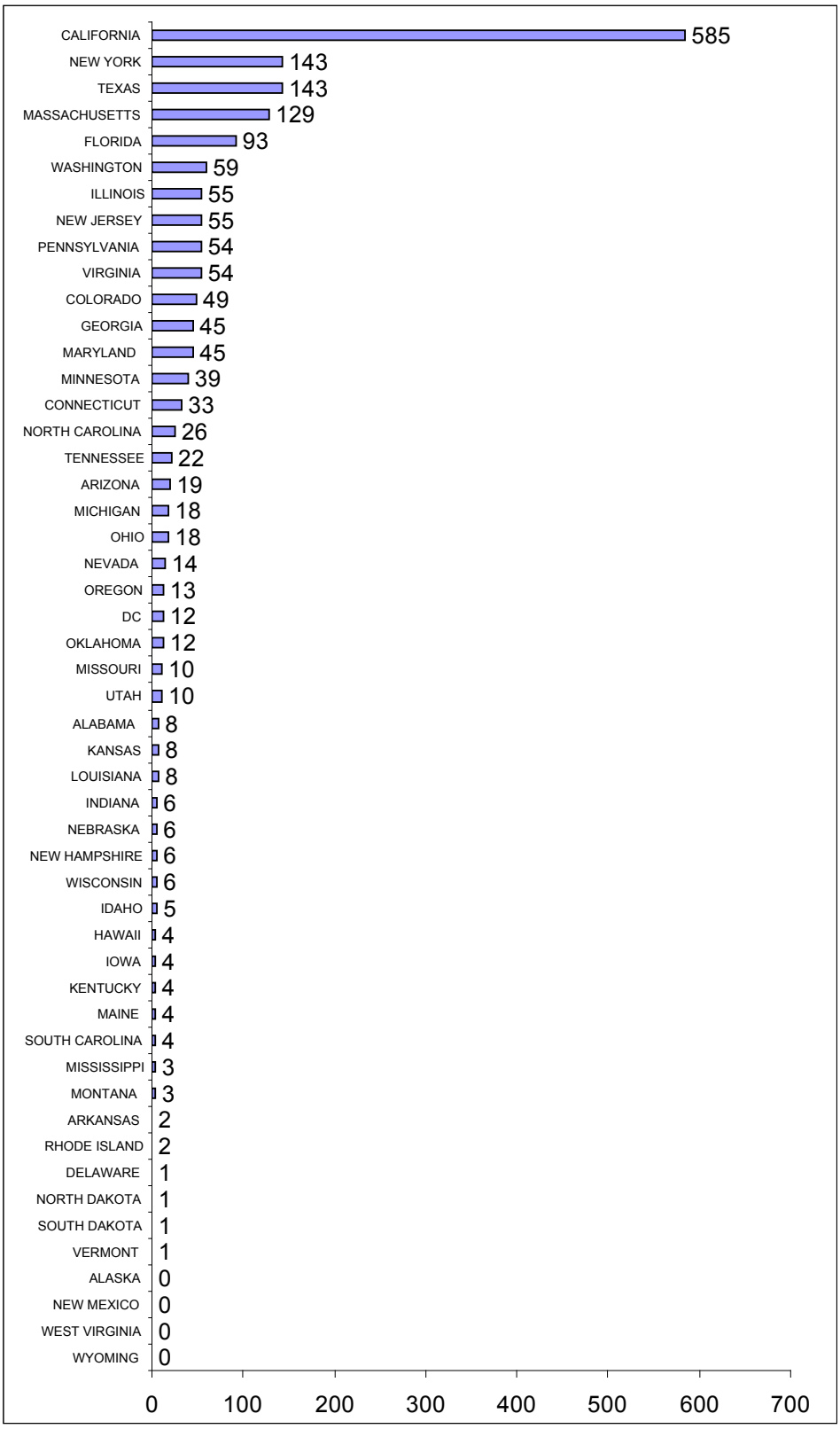
Figure 3.1: IPOs, June 1996-December 2006



It is well-known that some states have higher concentrations of firms undertaking IPOs than do others. While this paper does not control for the size or wealth of the state, these differences are significant. Figure 3.2 separates the IPOs into location by state. What is immediately apparent is that California is far and away the leader. California is a remarkable stand-out, it consists of approximately 12 percent of the U.S. population, but produces nearly 32 percent of all of the de novo firms undertaking an IPO. This suggests that, while much has been made of California's unhealthy business climate, for firms capable of reaching IPOs the climate appears to be far better. While we do not undertake a size- and industry-sector distribution analysis due to the limitations of time, it is our considered judgment that California firms on average would be smaller and concentrated in those considered high technology.

While California, New York, and Texas are very large states, in population terms, Massachusetts ranks 14th, but stands as fourth in numbers of IPOs. With slightly over 2 percent of the U.S. population, Massachusetts produces 7 percent of the IPOs, thereby out-performing California on a per capita basis. When considered on a per capita basis, while the U.S. over the decade under study had 5.46 IPOs per million, California had 15.7 IPOs per million and Massachusetts had 19.7 IPOs per million. While a number of the smaller southern, Midwestern, and Rocky Mountain states had few if any IPOs. These states with few IPOs also had few members of these firm's entrepreneurial support networks. Particularly worrisome is that large states, such as Michigan, Ohio, and Indiana, located in the heart of the Industrial Midwest were not producing firms that were sufficiently successful to undertake an IPO. Quite literally, they performed significantly below what one would expect from their population. The explanations for their under-performance is beyond the scope of what the data can answer, but certainly raises public policy concerns for these states.

Figure 3.2: Number of IPOs by State



The population of firms can be separated into a number of categories, however for the purpose of analysis the smaller categories will be combined into "other" during the remainder of the report (for a detailed list, see Table 3.2). Finally, because this period included the dot.com boom, we have created a separate and additional "Internet" category of 396 firms, which are drawn from a number of the categories below. So, for example, Amazon.com would be a retail firm, while E*TRADE would be drawn from finance. However, for analytical purposes treating Internet firms as a group is desirable.

Table 3.2: Industrial Sector of All IPOs

Industrial Area	Number
Advertising, Employment & Leasing	41
Agriculture	6
Biotechnology	129
Broadcasting & Services	34
Business Services	115
Communications Equipment	49
Computer Programming	61
Computer Services	87
Computer Systems	56
Computers	48
Construction	9
Education and Research	66
Electricity Gas and Sanitation	17
Electronic Equipment	36
Finance	79
Food and Tobacco	16
General Instruments	24
Health Services	45
Holding and Investment	4
Information Retrieval	44
Machinery	23
Manufactured Goods	81
Medical Instruments	78
Oil Gas and Mining	41
Retail Trade	111
Securities Insurance and Real Estate	61
Semiconductors	60
Services	86
Software	175
Telephone and Telegraph Utilities	78
Transportation and Services	25
Wholesale Trade	57
	1842
Internet	396

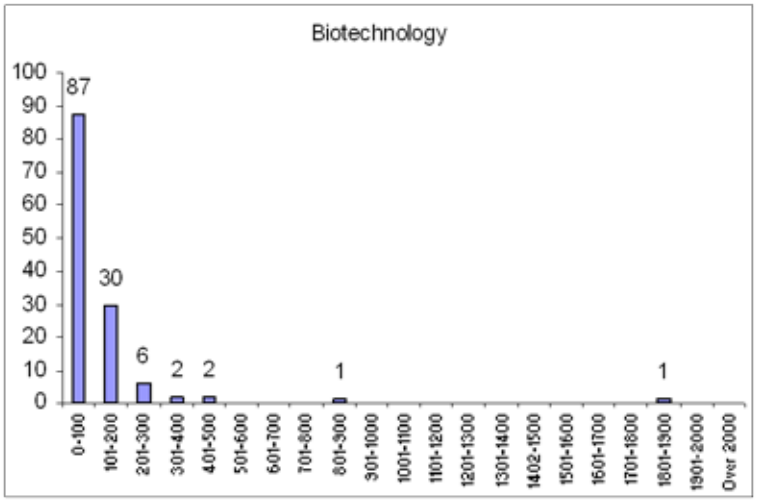
The de novo firms undertaking IPOs examined in this database fall into the categories normally understood as being small businesses at the time of their IPO (see Table 3.3). As the data shows, the stock market is providing support to small firms, as 1,076 firms had less than 200 employees at the time of the IPO and only 79 were larger than 2,000 employees.

Table 3.3: Number of Employees at the Time of the IPO by Category

Number of Employees	Number of Firms
1-100	600
101-200	476
301-400	113
401-500	61
501-1000	157
1001-2000	103
2001-5000	53
5001-10000	19
10001-20000+	7
Total	1842

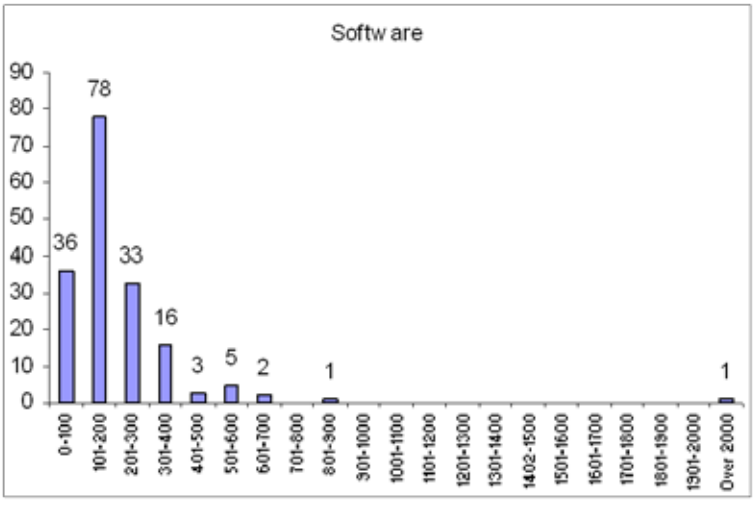
Interestingly, as the three charts below singling out specific industries indicate, sizes at IPO differ significantly by industry. Take, for example, biotechnology, which is the most science-intensive industry (as measured by Ph.D. scientists in the top-management team) in the database. Nearly the entire population is quite small having less than 200 employees at the time of the IPO (see Figure 3.3).

Figure 3.3: Number of Employees at Time of IPO of Biotechnology Firms



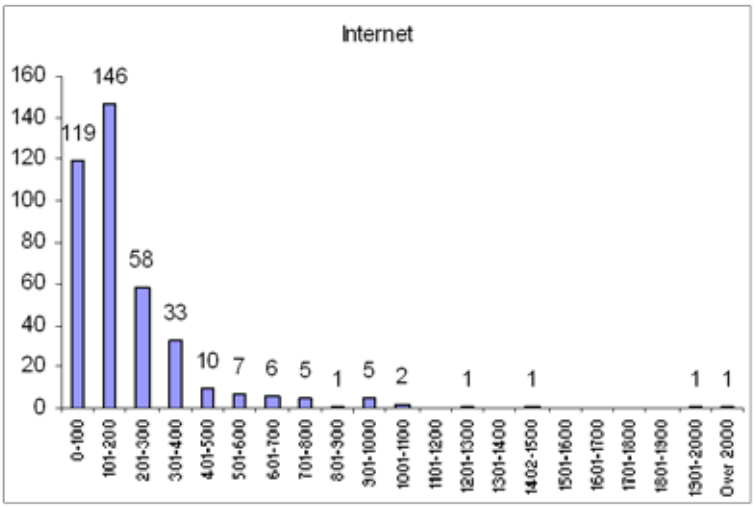
The other technology-intensive macroeconomic sector is what can be termed the information technologies, probably the most important sector of globally competitive new firm formation in the U.S. One of the purest indicators of this is software. As Figure 3.4 shows, the software firms were somewhat larger than the biotechnology firms with the modal category being 101-200 employees. Preliminary speculation would be that software firms require the larger tranches of capital that public markets can provide slightly later in their growth process than do biotechnology firms. While we have similarly fine-grained data available for other IT sectors including computers, telecommunications equipment, computer systems, and semiconductors, the only other sector examined in this section is the synthetic category of "Internet."

Figure 3.4: Number of Employees at Time of IPO of Software Firms



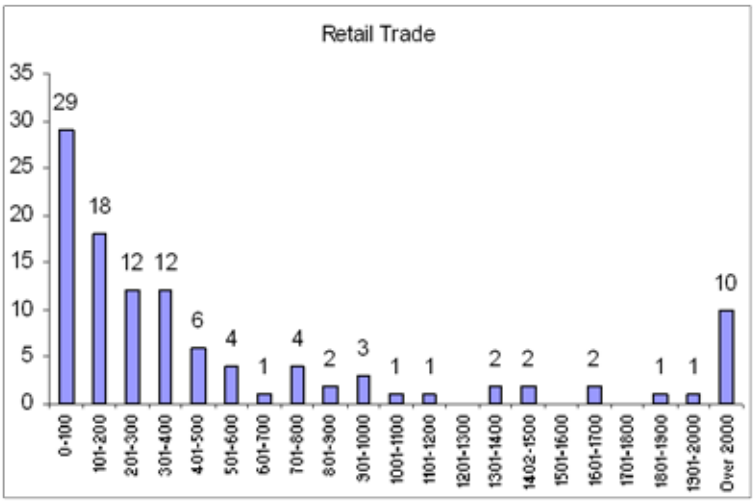
The Internet sector, as mentioned earlier, is composed of firms taken from a number of separate sectors (a number of which are from software). Since the Internet is, in essence, software it is not surprising that it has largely the same size distribution as software. Of great importance however is that this category captures firms such as Akamai, Amazon, eBay, Google, Priceline.com, Real Networks, and Yahoo! – firms that defined the U.S. national system of innovation over the last fifteen years. The Internet firms, though more mature than biotechnology firms, also were comparatively young (see Figure 3.5)

Figure 3.5: Number of Employees at Time of IPO of Internet Firms



In contrast, the retail sector had a very different size distribution (see Figure 3.6). While the modal category is 0-100 employees, the size is far more evenly distributed over the entire population. While not analyzed in this report (though collected in our research process), but of great importance in considering job formation, is the breakdown of employees by part-time or full-time. Presumably the part-time employees will be less desirable jobs than those of the full-time employees. This distinction was most marked in retail. Having said that, in terms of rapidity of growth in sheer numbers, Retail Trade is very significant.

Figure 3.6: Number of Employees at Time of IPO of Retail Trade Firms



The defining event for the firms in our database is the IPO. There has been limited research on the length of time from a firm's establishment to its IPO (but see Gompers 1996 and Ritter and Welch 2002 for a review) and none in terms of variation by industrial sector. The overall mean-time-to-IPO (MTI) was 7.76 years (one caveat to this data is that all firms that were formed prior to 1970 were excluded for reasons explained above). As Table 3.4 shows, there are noticeable differences by industrial sector. The sectors with the shortest gestation time were Information Retrieval, Telephone & Telegraph, the synthetic Internet category, and Advertising, Employment & Leasing (bolded). A number of quite varied and small sectors had means in excess of ten years old (see italicized sectors).

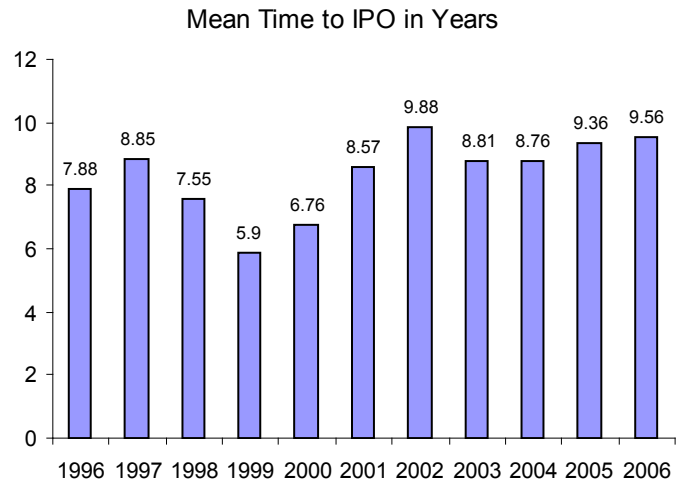
As previous literature has shown, IPOs are not equally distributed chronologically, but rather come in waves (Ritter and Welch 2002) and this is amply demonstrated in our data which captures the wave that culminated in the dot.com boom that ended abruptly in March 2000. While the data presented here is annual, in later versions we will analyze this by calendar months and by industry because it is possible that such bubbles or stock manias are confined to certain industrial sectors. The age is calculated by subtracting the year of the IPO from the establishment date. So it is the age of the firms going public in the IPO year.

This is interesting because it shows the effect that stock market frenzies can have on mean time to IPO and the years until the firm receives support from the market. As can be seen, during stock market frenzies the age of the firms conducting IPOs can drop precipitously as, presumably, they are being rushed to the market (see Figure 3.7). In the decade we examined this period was 1999 and 2000, and while we have collected the data on the fate of each firm, due to the limitations of time and space, we do not analyze this in the report.

Table 3.4: Mean Time to IPO in Years by Industry Sector

Years	Industrial Sector
5.1	Advertising, Employment & Leasing
10	Agriculture
6.9	Biotechnology
6.85	Broadcasting & Services
7.26	Business Services
7.45	Communications
7.87	Computer Programming
6.51	Computer Services
8.09	Computer Systems
7.33	Computers
10.78	Construction
7.23	Education and Research
10.65	Electricity Gas and Sanitation
9.25	Electronic Equipment
8.78	Finance
8.69	Food and Tobacco
11.63	General Instruments
7.16	Health Services
12	Holding and Investment
4.75	Information Retrieval
8.87	Machinery
10.25	Manufactured Goods
8.5	Medical Instruments
6.39	Oil Gas and Mining
7.92	Retail Trade
9.34	Securities Insurance and Real Estate
8.68	Semiconductors
8.35	Services
7.55	Software
5.58	Telephone and Telegraph
6.36	Transportation and Services
8.91	Wholesale Trade
5	Internet
7.76	All Firms

Figure 3.7: Mean Time to IPO in Years



The descriptive data presented in this section provides a broad overview of the firms in the database. It demonstrates the large number of variables that can cause variation in firms conducting IPOs. It also shows that a small and select number of small businesses (fewer than 200 employees) are using equity markets to raise more capital for growth. It also shows that there is a bias toward technology firms and those firms in California, New York, Texas and Massachusetts are especially aggressive in using public markets.

4. Mapping IPOs by Sector

The geography of IPOs by industry is important academically and for policy-makers because it provides an indication of where the most successful entrepreneurial hot spots may be. Also, very often after firms have made a public offering a cohort of successful managers wil be created with experience in the new firm life-cycle and, normally, significant personal capital. These individuals can become the "seeds" for another wave of new firm formation, thereby initiating the virtuous circles of entrepreneurship Joseph Schumpeter described.[5] The data below is reported at a comparatively aggregated SIC level, e.g., all medical instruments. It is also possible to classify firms even more narrowly, for example, surgical instruments versus other instruments. In this draft report, the mapping is crude, but this will be remedied in the final version.

In this report, our analysis concentrates on selected technology sectors, but for comparison purposes, we also analyze the Retail Trade sector because it is comparatively large and exhibits significant growth.

We begin with an industry that has attracted significant local economy policy attention – Biotechnology. Our map of IPOs agrees with the academic and policy literature, whether measuring VC-financed startups or total startups (Figure 4.1). The San Francisco Bay Area is

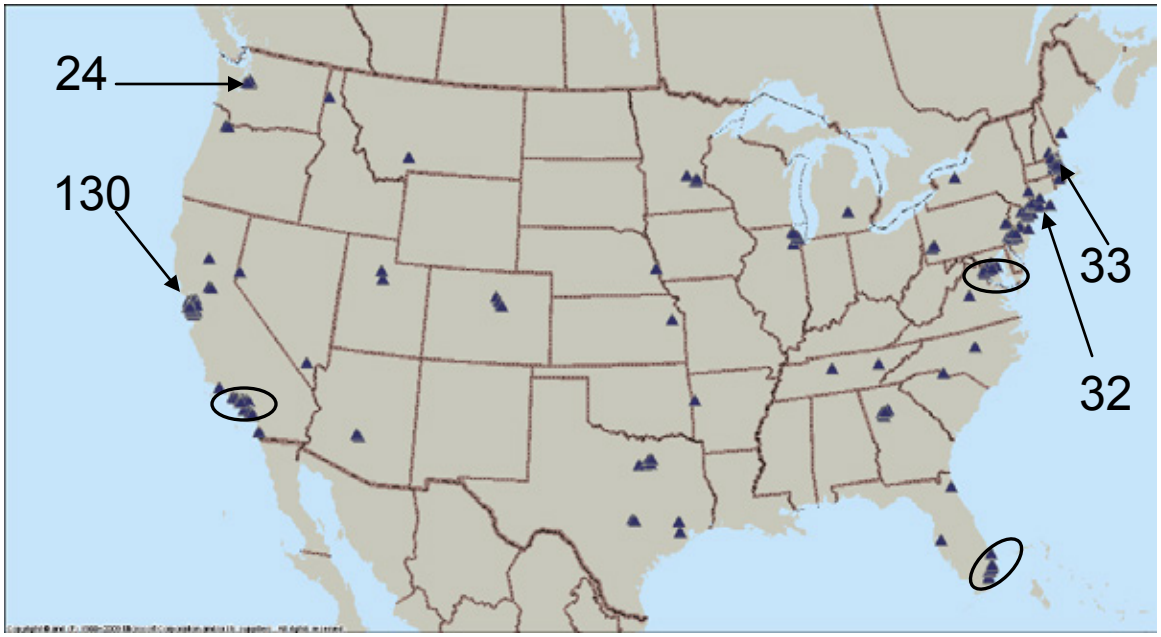
[5] For excellent discussions of this phenomenon, see Klepper (2001); Buenstorf and Klepper (2009).

the home to approximately 22% of the population, Boston has approximately 15 percent, and San Diego has approximately 9%. The four areas circled have smaller but notable concentrations of firms. As Kenney and Patton (2005) observed biotechnology IPOs exhibit significant clustering, but there is dispersion and firms are formed outside the clusters.

Figure 4.1: Location of Biotechnology IPOs, N=129

Because of the large number of Internet firms and the fact that, in contrast to biotechnology where proximity to a university is almost a condition for firm formation, access to the Internet is and was already by 1996 ubiquitous, it would be natural to expect more dispersion in firm location. In Figure 4.2, this intuition is displayed graphically. The San Francisco Bay Area had 1/3 of all of the Internet IPOs, which is an enormous concentration and, of course, includes eBay, Google, and Yahoo!, to name the most prominent. No other location has greater than 10 percent of the startups. This offers an interesting contrast with biotechnology, where though the Bay Area had the greatest concentration, it was not as great. In the case of the Internet, New York was essentially tied with Boston for the second greatest numbers of startups – likely this an outcome of the "Silicon Alley" phenomenon. While we have not explored the Boston startups individually, we would predict that many of them were affiliated with MIT, as was the case with the most visible Boston area Internet success, Akamai, which is a firm with deep technologies. With the exception of the enormous concentration in the Bay Area, there is significant evidence for a greater dispersion of the startups nationally.

Figure 4.2: Location of Internet IPOs, N = 396

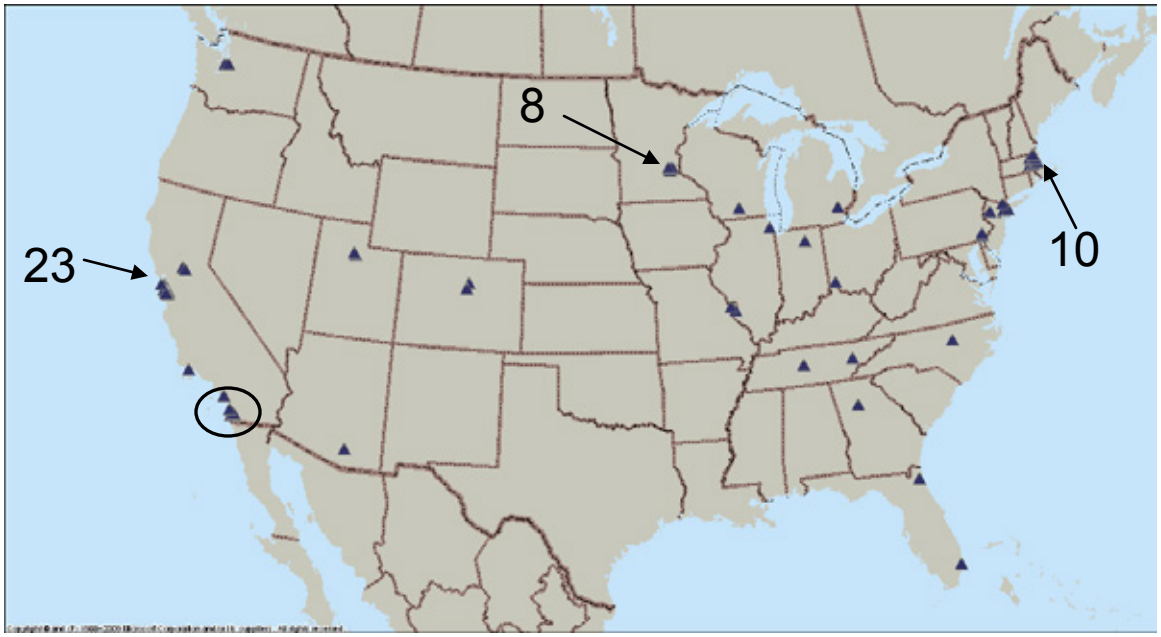


The next technology sector to be examined is semiconductors. The level of concentration in the San Francisco Bay Area is remarkable. As Figure 4.3 illustrates, 63 percent of the IPOs are located in the Bay Area. With four firms, Boston has less than 10 percent and the remainder are scattered around the nation. Effectively, this industry is now and probably permanently centered in Silicon Valley. Moreover, it is no longer the source of many IPOs. While we have not examined this issue in detail, the relatively low levels of VC funding the industry draws would suggest that, while it experiences significant technical change, it is mature in terms of new firm entry.

Figure 4.3: Location of Semiconductor IPOs, N = 60

The Medical Instruments sector is a knowledge-intensive industry that has high value-added production and is, in relative terms easier to enter than biotechnology, which tends to be high value-added molecules that must undergo extremely intensive and expensive testing prior to being approved by the FDA. Medical Instruments is not quite as intensive, but startups in this sector also often have strong university linkages. Remarkably, once again, the San Francisco Bay Area is the leader with 28 percent of the total number of IPOs (see Figure 4.4). Massachusetts is strong, but most interestingly, Minneapolis-St. Paul is significant with 10 percent of the national total. This is significant, because Minneapolis is not normally considered an entrepreneurial hot spot; however it appears to have a significant level of entrepreneurship in Medical Instruments.

Figure 4.4: Location of Medical Instruments IPOs, N = 78



The retail sector is a quite polyglot group and this is evidenced in its geography (see Figure 4.5). While the Bay Area is not known for retail entrepreneurship, firms such as Il Fornaio and Bebe are from this region, even though brand name retail firms are scattered nationally. While the employment for these firms is, quite naturally, scattered nationally, the highest value-added work is concentrated in the headquarters, which almost always is where the firm was established.

Figure 4.5: Location of Retail Trade IPOs, N = 111

5. Firm Growth

While the popular press nearly always focuses upon newly public firms such as Google and Yahoo!, which experience growth even in the most difficult periods, our aggregate data shows that newly public firms are seriously affected by overall economic conditions. Perhaps, the most important question is the fate of firms making a public offering, i.e., is it still operating at the end of the period, merged or acquired, or not surviving and bankrupt. Each of these outcomes was established for each firm through the examination of SEC filings. One caveat for Table 5.1 is that some mergers and acquisitions were roughly the equivalent of bankruptcy as the firm was sold for a very small sum. Unfortunately, making a determination on whether an acquisition was the functional equivalent of a bankruptcy is both difficult to determine and subjective and we decided not to make such a determination. In most industries the modal category was acquisition. The Internet category, which we expected would have high bankruptcy rates, was not particularly prone to bankruptcy, as many other industries experienced far greater number of bankruptcies. The fate of the Internet firms, as was the case of software and other IT sectors, was acquisition. Biotechnology and semiconductors, possibly the two most knowledge and technology intensive sectors in our study had extremely low bankruptcy and high survival rates. General Instruments, a category with extraordinarily long gestation periods, had a bimodal distribution of outcomes – they either continued to operate or were acquired.

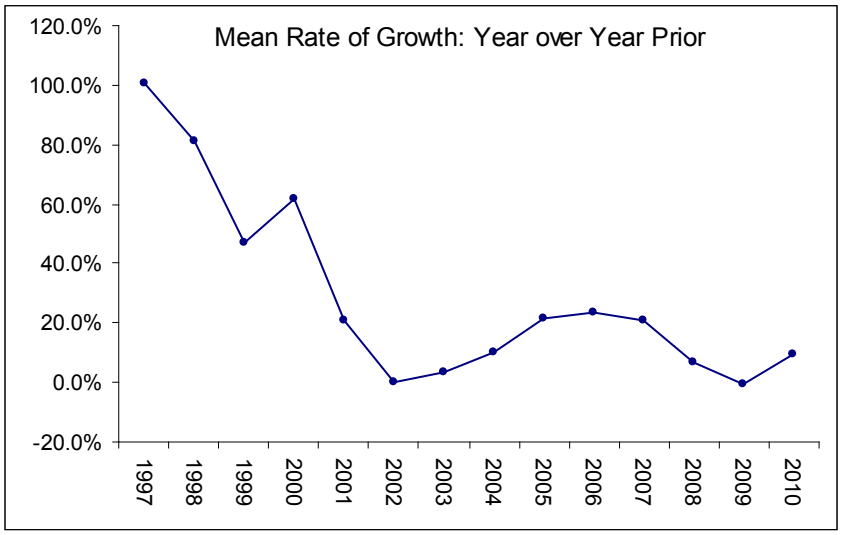
Table 5.1: IPO Firm's Fate by Industry

Percentages	Acquisitions	Bankruptcies	Operating	Total Number of Firms
Advertising, Employment & Leasing	82.9	7.3	9.8	41
Agriculture	66.7	16.7	16.7	6
Biotechnology	45.7	3.9	50.4	129
Broadcasting & Services	35.3	26.5	38.2	34
Business Services	56.5	13.9	29.6	115
Communications	55.1	12.2	32.7	49
Computer Programming	78.7	1.6	19.7	61
Computer Services	65.5	18.4	16.1	87
Computer Systems	58.9	8.9	32.1	56
Computers	47.9	8.3	43.8	48
Construction	44.4	33.3	22.2	9
Education and Research	51.5	4.5	43.9	66
Electricity Gas and Sanitation	23.5	17.6	58.8	17
Electronic Equipment	52.8	8.3	38.9	36
Finance	45.6	21.5	32.9	79
Food and Tobacco	62.5	18.8	18.8	16
General Instruments	45.8	4.2	50.0	24
Health Services	51.1	22.2	26.7	45
Holding and Investment	50.0	25.0	25.0	4
Information Retrieval	72.7	4.5	22.7	44
Machinery	60.9	26.1	13.0	23
Manufactured Goods	35.8	16.0	48.1	81
Medical Instruments	50.0	6.4	43.6	78
Oil Gas and Mining	36.6	9.8	53.7	41
Retail Trade	57.7	18.0	24.3	111
Securities Insurance and Real Estate	50.8	6.6	42.6	61
Semiconductors	36.7	3.3	60.0	60
Services	54.7	14.0	31.4	86
Software	70.9	7.4	21.7	175
Telephone and Telegraph	52.6	32.1	15.4	78
Transportation and Services	32.0	20.0	48.0	25
Wholesale Trade	59.6	14.0	26.3	57
Internet	68.2	12.1	19.7	396
All Firms	54.6	12.4	33.0	1842

The graphics presented below on growth rates should be interpreted in light of understanding that a strong survivor bias affects the results. In Figure 5.1 the mean annual growth rate of all the firms in the database in the particular year is depicted. The results should be understood in context. For example, in 1997 the only firms in experiencing growth are those that went public in 1996, while in 1998 the firms whose growth rate is being measured are those going public in 1996 and surviving until 1998 and the firms that went public in 1997, and so on.

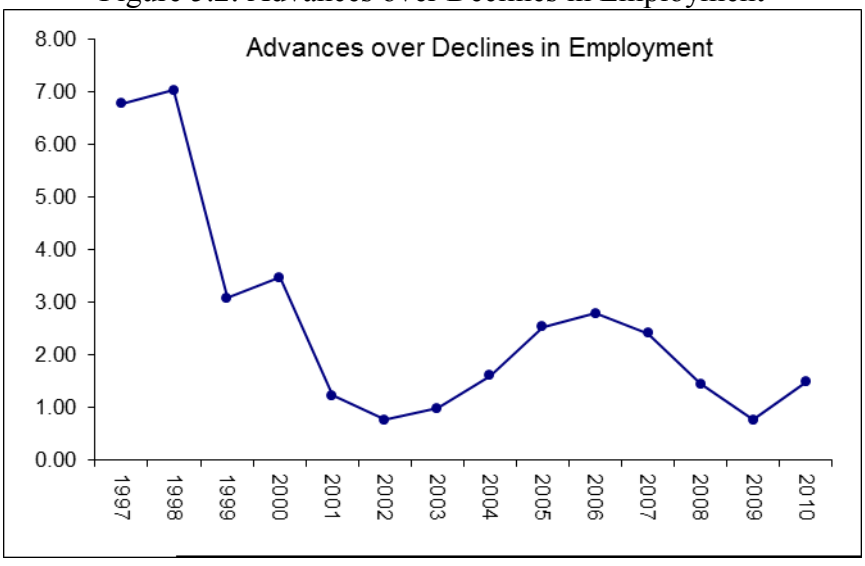
What can be seen in Figure 5.1 is that growth slows down from 1997 through 1999 spikes again and then slows dramatically through 2002 before improving and then dropping again in the last recession. As with all of this data there is a truncation that occurs as the weaker and acquired firms drop from the database. New firms entering the database can grow quickly because they have just received a capital infusion.

Figure 5.1: Mean Rate of Growth: Year over Year Prior



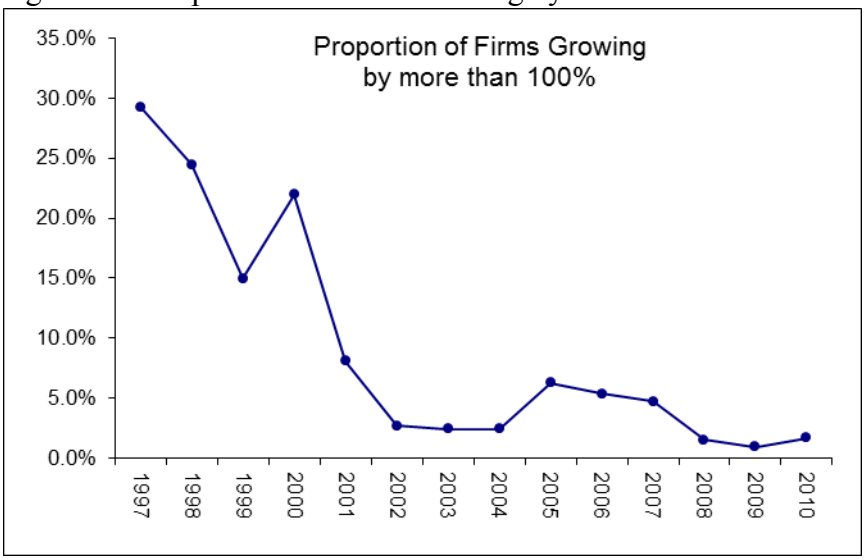
Another way to consider the overall annual growth rate of the population is to the proportion of firms experiencing an employment growth versus decline from the previous year. The data in Figure 5.2 shows the effect of the recession that began in 2000 and lingered until 2003 and then returned again in 2008 and 2009. Here again, the data is affected by the large number of firms that failed and thus left the database from mid 2000 through 2003.

Figure 5.2: Advances over Declines in Employment



The final macro-level analysis shows the number of firms that experienced greater than 100 percent year-to-year employment growth, and as with the other curves the collapse of the dot.com bubble had a similar effect as Figure 5.3 shows. Here again, this data is surely affected by the fact that immediately after a public offering a firm has new funds and is able to rapidly increase its employment.

Figure 5.3: Proportion of Firms Growing by More than 100 Percent



These data highlight the importance of macro-economic environment for the growth of start-ups and affect the performance of all firms including IPO gazelles – a topic to which we turn to in the next section.

6. Gazelles

The definition of a "gazelle" firm is always subjective. Often, it has been based on growth in sales from one year to the next. Because of the interest in employment issues, this report could have chose to use annual growth rates (the data is available), however upon consideration it was decided more significant would be three-, five-, and ten-year compound annual growth rates (CAGR). The following Tables 6.1, 6.2, and 6.3 present the CAGR for top quartile of firms, i.e., the gazelles. Caution should be taken in interpreting the growth rates because it is quite natural to have a bump in the rate of growth after raising capital (i.e., the IPO) and also there is a strong survivor bias, because firms that fail or are acquired cannot have their CAGR calculated. However, this data shows the ability of the most successful firms to grow, AND it also shows the importance of a munificent environment for encouraging growth. The closer a firm's offering is to the downturn, the less impressive are its growth rates. Finally, the table gives the original number of firms and the number of survivors to their third anniversary.

In Table 6.1 the data indicates that the top-quartile of cohorts making their IPO from 1996-2001 experienced extremely fast growth rates. The most challenged firms were those that went public during the most severe part of the downturn, i.e., 2002-2004, but remember these are CAGR so

even a 29% compound growth rate is remarkably high. The survivor rate is quite interesting. For the firms that went public during the bubble years beginning in 1997 through 2000, by the end of three years one-third of the firms had disappeared. Before the bubble years in 1996 and after the bubble far higher percentages survived until their third anniversary.

Table 6.1: Three-Year CAGR of Top Quartile of Firms by Cohort

Cohort	Original Number	Survivors	top 25%	Lowest CAGR	Highest CAGR
1996	257	200	50	59%	268%
1997	304	213	53	49%	340%
1998	206	144	36	49%	194%
1999	369	218	55	43%	238%
2000	263	183	46	32%	155%
2001	42	35	9	29%	136%
2002	40	31	8	55%	86%
2003	43	74	19	25%	66%
2004	109	85	21	38%	94%
2005	107	81	20	39%	127%
2006	102	76	19	36%	118%
			336		

The five-year CAGR is, not surprisingly, lower than that of the shorter period (see Table 6.2). This is partially an artifact caused by the fact that at the initial offering the firm is smaller and thus adding similar increments of employees can have a greater percentage effect. Again, caution must be used in interpreting the data because the survivor bias continues to operate, as failures leave the cohort. Also, as the IPO effect wanes, capital is often more difficult to raise. What is also noticeable is the post dot-com recessionary environment also has an effect on growth. Among the firms that went public during the bubble years, mortality rates reached fifty percent by their fifth-year anniversary with those going public at the height of the frenzy in 1999 having a mortality rate of nearly 55 percent.

Table 6.2 : Five-Year CAGR of Top Quartile of Firms by Cohort

Cohort	Original Number	Survivors	top 25%	Lowest CAGR	Highest CAGR
1996	257	142	36	38%	135%
1997	304	169	42	28%	169%
1998	206	110	28	29%	123%
1999	369	167	42	28%	120%
2000	263	148	37	23%	100%
2001	42	29	7	25%	64%
2002	40	24	6	23%	43%
2003	43	29	7	25%	42%
2004	109	67	17	25%	54%
2005	107	73	18	26%	71%
			240		

In many respect, the ten-year CAGR for the top quartile is most interesting, because these are the firms that survived and grew strongly (see Table 6.3). Because our employment data ends at 2010, we can only examine the firms that went public in year 2000 or earlier. Interestingly, by their 10th anniversary, the overall survival rate had dropped to 29 percent and for a number of cohorts had dipped below 25 percent for the 1996 and 1999 cohort.

Table 6.3: Ten-Year CAGR of Top Quartile of Firms by Cohort

Cohort	Original Number	Survivors	top 25%	Lowest CAGR	Highest CAGR
1996	257	80	20	22%	50%
1997	304	103	26	16%	52%
1998	206	57	14	15%	63%
1999	369	90	23	17%	49%
2000	263	72	18	18%	40%
			101		

Much has been written about the importance of VC for supporting young firms and through the financing process. In Appendix One, there are three large tables listing the ten best performing firms (we call these "super-gazelles") by cohort year for three-, five- and ten-year intervals. Table 6.4 summarizes this data, and. indicates that having a VC on a firm's board of directors does NOT increase the employment growth of a firm either for its first three and five years. For the super gazelles, in terms of three-year employment growth, California was the leader with 35% of the total and this is better than its 32% share of the total IPOs (see Table A1-1). Interestingly, Massachusetts had less than 4% of the super-gazelles, which was less than its total percentage of IPOs. For the five-year employment growth, California increases its percentage of the total to 37%, while Boston increases its percentage to 4% (Table A1-2). For ten-year employment growth, California yet again increases its percentage to 40% of the total, while Boston increases its percentage to 6% (Table A1-3). These results suggest that, though California produces a large number of firms, within that group there are some very high-performing firms. While these statistics are aggregated, due to a lack of time and space, we do not segregate these by industry and more granular spatial distinction. Massachusetts is interesting because it is so technology-centric. While for three-year old firms, Massachusetts under-performs in terms of super-gazelles, as the firms age the performance of its firms improves. The reasons for this are unclear.

For the super gazelles, the role of venture capitalists on the BoD was also interesting. Among our super gazelles, after three years there were fewer super-gazelle firms than in the total population. And yet, among the older firms, those funded by VCs became more prevalent. Again, the reasons for this are unclear, but this is a suggestive phenomenon that deserves greater attention.

Table 6.4: Percentage of VC-funded and California Super Gazelles Compared to Entire Population of Super Gazelles in Each Cohort

	3-Year CAGR	5-Year CAGR	10-Year CAGR	All IPO Firms
VC on BoD	43.6%	46.0%	56.0%	50.7%
Located in CA	34.5%	38.0%	40.0%	31.8%

7. Preliminary Examination of Entrepreneurial Support Networks

One important attribute of the database is the location of four members of the entrepreneurial support network (95+% fill rate across all members). Due to time constraints, in this draft report we are unable to provide the deeper analysis described in the next section. However, because the data has been collected such analysis is possible.

The most intimate relationship a de novo firm has is with its law firm. While our data extends to the actual address of both the firm and the law firm, for this Draft Report, we only examine the state level data. As Appendix Table A2-1 suggests, the dominant locational imperative is for firms to be serviced by law firms within their states. This means that California lawyers service more firms (626) than do lawyers from any other state. They also provide services to 80 firms domiciled in other states (the off-diagonal row). However, New York provides more legal advice to 162 out-of-state firms than any other state. In part this is because its firms provide advice to the surrounding states, but likely also because it is a service center for finance and related activities. Massachusetts provides legal advice to 54 out-of-state firms. As Florida and Kenney (1988) showed, New York City, in particular, and, to a lesser degree, are "export-oriented" entrepreneurial clusters. This can be seen even more clearly in the case of venture capital.

After the law firm, which counsels entrepreneurs on the establishment of the firm, the most important individuals to a de novo firm are those providing capital. By serving on the BoD VCs both monitor their investment, have an official position from which to provide advice, and offer a form of certification at the firm's public offering. As Appendix Table A2-2 indicates, California has the greatest number of in-state VC-firm dyads (690), but also provides 253 out-of-state linkages. Remarkably it also attracts 218 out-of-state venture capitalists to California firms. Massachusetts is a distant second, in terms of attracting and supplying VC to other locations. California is Massachusetts largest partner both in terms of supplying VC to Massachusetts firms and receiving capital from Massachusetts VCs. New York and Illinois, to a lesser degree, are the quintessential VC exporters, having far more investments outside the state than in-state. NY VCs are on more BoDs in California than they did in New York!

In Appendix Table A2-3, the location of the investment bank's lawyer (to repeat, the location of the investment banker's lawyer is an excellent predictor of the region within which the lead investment banker is located) is correlated with the location of the firm undertaking the IPO. Here, since New York is the center of the U.S. investment banking world one would predict that

it would be the leader in providing investment banking services. However, though New York provided more investment banking services to external firms than any other state, California had more investment banking relationships than did New York because California's investment bankers served its firms. As was the case with the firm lawyers and VCs, New York was the primary exporter of services. While we have not parsed the data any further, we would guess that the San Francisco Bay Area is the primary location of the investment bankers outside New York and probably it exports investment banking services to other states for information technology-based firms. Likewise, California would import investment banking services for non-technology based companies. Massachusetts was interesting, because, as was the case with the other two members of the ESN, its characteristics were more like California than New York, but also had a resemblance to New York. Finally, with the partial exception of the Texas, all of the other states were irrelevant in terms of being the location of the investment banker. Speculating somewhat beyond the confines of the data, in the case of California in particular, the sheer number of IPOs appears to have attracted investment banking services or, as was also the case, large New York investment banks purchased smaller boutique investment banks that emerged in California to serve startups. This hypothesis can be examined in more depth because the database has the name of the lead investment bank and identifying their headquarters' location is a trivial task, but, in the interest of brevity, for this Final Report this analysis is not undertaken.

This descriptive report is only preliminary, but it suggests that understanding the geography of ESNs will produce major insights into the provision of support network services. Kenney and Patton (2005) using a far smaller sample and confined to only three industries, showed that the location of members of a firm's ESN differ by industrial sector. In future research, we will examine these locational issues in greater detail. With this database it is possible to achieve greater granularity on dimensions such as technology, cohort, location, technical expertise of the management team and a variety of other dimensions.

8. Further Research Plans

Hypotheses Regarding Proximity of Entrepreneurial Support Network Actors

In considering the general propositions advanced above in General Propositions 1 through 3, we argued that clusters would support experienced ESN actors so that they would be the obvious choice to provide services for startups within the cluster. For startups outside of a cluster, though, a choice may be necessary between inexperienced but proximate service providers, and experienced but distant providers. Which choice is made will provide insight into the role of proximity in conveying knowledge.

Proximity between a firm and a member of its ESN is readily determined by distance in miles. Measuring expertise is a challenge. One actor, investment bankers, can be ranked on the basis of reputation derived from underwriters' relative placement in stock offerings as "tombstone" announcements developed by Carter and Manaster (1990) and others. However, such measures for venture capitalists and lawyers are not available. We propose to generate an experience index

for three actors; venture capital firms, law firms, and investment banks, on the basis of their relative frequency in participating in an IPO in the population of IPOs from 1996 through 2006.

All actors can be ranked along this dimension and then bifurcated into a high experience and low experience group. At the most simple level a two-by-two contingency table can be produced for each actor across all industry groups as shown in Table 8.1 below.

Table 8.1: Contingency Table Examining Possible States for ESN Members

	High Experience	Low Experience
Close (within 50 miles)	A	B
Far (over 50 miles)	C	D

In previous work in high technology industries we found that firm lawyers are the most proximate actor in our data on ESNs. Given the counseling role of a firm's lawyer we hypothesize that this holds for other industries as well. If so, we would expect that the count in cell B would be higher than in cell C in Table 1. Investment bankers, on the other hand, may very well be valued more for their expertise in which case we would expect that the count in cell C would be higher than in cell B.

Since the count in cell A depends on the geography of the particular industry, insight into the importance of proximity of actors, relative to experience, will be provided by the distribution between cells B and C. This will allow us to not only compare actors over all industries, but allow us to discover if these spatial patterns vary across industries as well.

General Proposition 4 will be tested by using data on firm employment at three separate time periods; at the firm's initial public offering, at the end of the firm's third year of operation following the IPO, and at the end of the firm's fifth year after the IPO.

Hypothesis Testing

The natural assumption from the literature is that *ceteris paribus* a startup would most benefit from having access to ESN members in close proximity. The face-to-face contact should facilitate the transfer of difficult to communicate tacit knowledge, thereby reducing information asymmetries. On the basis of the literature and our previous research, we examine four general propositions:

General Proposition 1: The proximity of ESNs to the startups they are serving will be directly related to the concentration of firms of the same industry in a given location.

The literature on industrial clusters, when applied to the constituents of a new firm's ESN implies a trade-off between proximity of a firm to its ESN, and the expertise of the members of the ESN. As a general proposition we expect that clusters would, other considerations being equal, have more experienced ESN actors serving the needs of start-ups, so that their expertise and proximity

would make them the obvious choice of start-ups within the cluster. Startups located outside a cluster, on the other hand, must choose between less experienced but physically close service providers, and more experienced but distant providers. The extent to which proximity and expertise are valued determines this choice.

General Proposition 2: The proximity of ESN actors to their focal firms will differ by industry.

General Proposition 3: The proximity of ESN actors to their focal firms will differ by actor.

General Proposition 4: Employment growth will differ by industry, location, and financing, and size of firm.

Legal assistance is often the first support an entrepreneur seeks. As Suchman (2000) shows in the case of Silicon Valley firms, lawyers not only provide assistance in the technicalities of incorporation and intellectual property law, but also introductions to venture capital firms and other business services. Because of their roles as counselors, these lawyers can be expected to have the most knowledge of the firm – a fact that would argue for close proximity. Kenney and Patton (2005) found that in three high-technology industries the firm's counsel was invariably more proximate to the firm than any other ESN constituent. In keeping with the results of our previous research, we would propose that for all industries:

P1: A focal firm's legal counsel will be the most proximate of the four ESN actors across all industries.

For firms in more remote locations from the center of entrepreneurial activity legal counsel having sufficient expertise to take a firm public may be unavailable locally. Therefore, we would propose in this case that:

P2a: The focal firm will accept a local law firm having limited experience with IPOs, or

P2b: The focal firm will seek counsel from an experienced legal firm in a distant cluster of startups in the same industry.

The expertise of an ESN actor will be measured by their frequency of having provided services to a firm going public in this population of IPOs. What this also suggests is that local governments interested in building an entrepreneurial support network should consider how to encourage the development of local legal talent capable of assisting a fledgling firm.

Access to capital is vital for most startups. Two financial intermediaries, venture capitalists and investment bankers, are included in this study. The role of spatial and network proximity for financial intermediaries has attracted scholarly attention. Agnes (2000) in a study of the interest rate swaps industry found that "different financial services have differing informational contents, with implications for the local embeddedness of financial services firms." This is confirmed by the finding that formal institutional networks are actually embedded in informal relationships through which transactions and information flows (Clark and O'Connor 1997; Pryke and Lee 1995; Thrift and Leyshon 1994). In other words, as Uzzi (1999) illustrates, formal relationships

such as the lender-borrower relationship are embedded in a social context, and this social embeddedness, what Garud and Jain (1996) in their study of technological change refer to as "just-embedded," actually reduces the cost of loans and reduces risk. Abolafia (1997) confirms this finding qualitatively by showing that the necessity of social and physical proximity differs by the nature of the financial product. So, for highly standardized products such as listed equities and government bonds, traders need not be proximate, whereas for other more idiosyncratic financial instruments proximity is of greater importance. These studies of finance are important for our study because venture capitalists and investment banker involved in IPOs are dealing with idiosyncratic uncertain transactions.

There is an ample literature suggesting that venture capital investing, being an idiosyncratic financial practice with high uncertainty, is a locally embedded practice. This is true, because of the importance of monitoring and informal assistance functions that go beyond simply providing capital (Black and Gilson 1998; Florida and Kenney 1988a; Gompers and Lerner 1999; Hellman and Puri 2000). Indeed, Greenwald and Stiglitz (1992) observed that the venture capital industry shares the same aspects of localism that characterized early financial market communities (Lamoreaux et al. 2006). Because venture capital firms operate in a tightly knit community and have detailed information on the projects they fund and the industries in which their entrepreneurs operate, there is reliance upon referral and reputation in the relationship between venture capitalists and the firms they fund. The critical venture capitalists in a startup are what are termed the "lead" venture capitalists who are the board members and those most intimately involved in monitoring and assisting the firm (Gompers and Lerner 1999). For this reason they are the most important venture capitalists in a startup and the ones that one would expect to be local, though Kenney and Patton (2005) found that this did differ by industry. Therefore, we propose for firms that are backed by venture capital:

P3: Regardless of its location, the focal firm will have at least one local venture capitalist on its BoD.

P4: The proportion of local VC directors serving focal firms will be correlated with the concentration of firms in its industry in the focal firm's location.

Investment bankers are central to the IPO process as the lead investment banker is responsible for organizing the syndicate that takes the firm public (Ritter 1998). They provide advice to the startup firm on the most auspicious time to go public among other services. New York City is the center of the investment banking industry, however the larger firms have branches, some of which specialize in the needs of certain industries, and there are many smaller local investment banks. From our previous research, we found that in the case of the more dispersed biotechnology industry, many of the lead investment bankers were located in New York City despite the fact that there were few biotechnology startups in New York City. The financial cluster in New York City appeared to have a greater attractive force than the lesser clusters and isolated biotechnology firms. For this reason, we will examine whether:

P5: Focal firms within the Silicon Valley and Boston regions will be served by investment banks/bankers in those regions. Those outside these regions will tend to be served by investment bankers from one of three regions; New York City, Silicon Valley, or Boston.

There are industries such as retail and banking that appear to not be as clustered geographically as some others in terms of startups. For this reason it is likely that their ESNs will not be as concentrated close to the startups. The thinking behind this proposition is that if there are large numbers of similar startups in one location, it will attract or cause to come into existence the financial intermediaries. Here, we can explore the attractive power of vertical clustering, i.e., close to customers, versus horizontal clustering, i.e., close to similar firms. The initial proposition is:

P6a: In more dispersed industries, the financial intermediaries, i.e., lead investment banker and venture capitalists, are more likely to be located in the New York financial cluster.

P6b: In concentrated industries, the financial intermediaries, i.e., lead investment banker and venture capitalists, are more likely to be located in close proximity to the industry (ies) they are servicing.

The final ESN members are the non-venture capital board members. This is an important, but polyglot group that can include representatives from lead customers or suppliers, academics, etc. The eclectic make-up of this group suggests that it should be the most widely dispersed. In locational terms:

P7: These board members will be the most dispersed ESN members.

P7a: Academic board members are likely to be located in close proximity to the focal firm.

P7b: Corporate board members are likely to have the greatest spatial dispersion.

There is a large literature on BoD, and while our propositions related to these board members are not fully established we believe that this group is sufficiently important so as to justify further exploration.

There has been very little research on employment growth and its relationship to ESNs. Kaplan et al. (2009) found that for the fifty VC-backed technology firms in their sample, their median employment growth from their IPO to their third annual report was 235 percent. Given the importance of venture capital financing and the value of location within industry clusters, the following proposition is suggested:

P9. Focal firms within their industry cluster and with VC backing will grow more quickly after the IPO than those outside of the industry cluster and without VC backing, after accounting for industry sector and overall national economic growth.

This proposition addresses the general proposition regarding employment growth of gazelles. It has been argued that small firms account for a disproportionate share of employment growth (Birch 1981; Birch and Medoff 1994). This study will test this assertion with regard to firms sufficiently successful to have gone public. By following specific firms and assessing them at the

same points in their life cycle, many of the problems of aggregate comparisons of firm size and employment growth can be avoided (Davis et al. 1994).

9. Relevance to Policy Makers

Studies of clusters have explicitly recognized horizontal clustering, i.e. between competing firms, and vertical clustering, i.e. separate segments of the value chain (for example, a supplier and an assembler). Unfortunately, there have been few empirical studies of the location of business services supporting entrepreneurship. Our previous work with just three high technology industries produced important results. In examining the semiconductor industry ESN it was found that the geographical proximity between these actors and the firms they support varied significantly, with a firm's legal counsel being the most proximate, followed by investment bankers, venture capitalists, and independent directors (Patton and Kenney 2005). This was followed by a comparison of the semiconductor industry with biotechnology and telecommunications equipment (Kenney and Patton 2005). The results obtained indicated that generalizations about ESNs drawn from single industries can be misleading. The economic geography of the biotechnology ESN differed significantly from the ESNs in semiconductors and telecommunications equipment, in that biotechnology had a far more dispersed ESN structure than did the two electronics related industries.

Clustering in biotechnology (and, perhaps, in other industries, such as medical devices) may be inhibited because the source of entrepreneurs is not as concentrated in existing firms, but rather more dependent upon university research. Also, it is possible to speculate that biotechnology firms may not be as dependent upon each other and on proximate suppliers, thus limiting the centripetal forces drawing them together. The normal cluster effects may not be sufficient to create the winner-take-all regional dynamics that scholars have predicted. If the centripetal forces are not as strong for the firms and the sources of knowledge are more dispersed, then it is not surprising that the ESNs are not as concentrated in close proximity to the firms.

If the sources of knowledge that are the seeds of new firms are dispersed, so too will the startups, other things being equal. Start-ups in industries whose clusters are coincident with New York, Boston, and Silicon Valley may incorrectly imply a necessary proximity to the venture capitalists and investment bankers found in these regions. Separating out these other influences on the geography of new firm formation cannot be made without the cross-industry comparisons suggested here.

With the exception of those at the federal level, most policy makers are interested in local and state income and employment growth. Gazelles are important, because initially their growth is locally concentrated. Previous to this study, there has been surprisingly little detailed study of gazelles, despite their clear importance for employment growth in their role as ‘job replacers’ as David Birch first referred to them (Birch 1981). This Draft Report provides preliminary analyses of employment growth during the life cycle of gazelles – at the time of the IPO, and their third, fifth, and tenth Annual Report. We also conduct descriptive analysis on the location of the gazelles and what we term “super gazelles” This preliminary analysis already indicates that certain states have particular strengths of which economic development professionals interested in encouraging new firm formation should be aware. For example, Minnesota has had

significant success in medical instruments and likely should place particular attention to encouraging more firm formation in this field.

As the analysis continues, more fine-grained studies should reveal deeper insights particularly regarding the ESN, which will indicate to locations

10. Conclusion

U.S. public equity markets are providing capital to small firms (under 200 employees), but their willingness to do so is strongly affected by stock market cycles. When the stock market is stagnant or dropping, far fewer firms undertake IPOs and those that do, grow far more slowly. Interestingly, while they grow more slowly, they also appear to have superior survival rates. This is likely an outcome of a weeding out of lemons as investors undertake more critical evaluations of the firm and its financials. During manias, as Kindleberger (1978) suggested, caution is thrown to the wind and many bad investments are made. The impact of the dot.com mania on our data is enormous and multi-faceted.

The most salient outcome of this research is the extraordinary concentration in California of firms capable of undertaking an IPO. Despite California's absolute dominance, it was Massachusetts that had the highest per capita number of IPOs. While these two states stood-out, Florida, New York, and Texas also were very active. Equally as eye-opening was the very few firms from important states such as Ohio, Michigan, Indiana, and even Wisconsin, which has a sizable technology cluster in Madison. Minnesota is interesting, while it does not have a large number of clusters, it has specialized in medical instruments. Put in another way, IPOs are extremely clustered in a few states, and though not analyzed in this report we believe that if the IPOs are examined by zip codes we will find even greater clustering. We also believe that our data will show that in the San Francisco Bay Area there will micro-regional clustering. For example, the biotechnology firms will be concentrated in San Francisco and South San Francisco, while semiconductors are likely to be in Santa Clara, and the Internet firms will be located in close proximity to Palo Alto.

The entrepreneurial support networks are also concentrated in California particularly in case of the VC firms, though nearly every state has at least some VC or has access to VCs from other states. New York exports VC to a variety of states, but most frequently to California and Massachusetts. Massachusetts VCs, if they invest out of state, are most likely to invest in California, but is largely inward investing. When we examine VC investing by industry, there is reason to believe that we will find a more complicated pattern than the current California-centric one.

The firm's lawyers were the most concentrated in the firm of the state, i.e., in Table A2-1 they were concentrated on the diagonals, though again New York provided significant support to many states. In effect, not only was New York a leader exporting venture capital, it was also a leader in exporting legal services. California was largely self-contained but did expert legal services to other states particularly to the surrounding states. Washington, DC provided legal services to IPO firms in Virginia and Maryland.

Our analysis of gazelles and the growth of super gazelles is only in an incipient state, but we have already found interesting results. In terms of the gazelles (top-quartile performers in each cohort by third, fifth, and tenth year CAGRs), the growth rate of the gazelles decreases over time – not a surprising observation – as growth for increasingly larger firms becomes more difficult. The cohort years that had the greatest CAGRs were 1997 and 1998, in part this may be due to survivor bias.

The super-gazelles (Top Ten performers in each cohort by third, fifth, and tenth year CAGRs) had interesting characteristics. In terms of three- growth, five-, and ten-year growth rates, California firms not only out-performed those in other states, but the performance gap grew as the firms matured. In contrast, VC-financed firms underperformed the market by the third and fifth year, but by the tenth year, those that survived dramatically out-performed their peers.

Further progress can be made in understanding the gazelles and super gazelles. For example, we did not control for industrial sector, but this should provide important insight into whether industry sector is important for generating gazelles.

This report merely overviews the unprecedented breadth and depth of the database. Further research on the growth of the firms should lead to more insights based on finer-grained analysis of specific issues. The data on the workings of the ESN should be particularly valuable.

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Appendix One

Appendix Table A1-1: Three-Year Super Gazelles Identified by CAGR

1996				
Firm	**City**	**State**	**Industry**	**3 year CAGR**
METZLER GROUP INC	DEERFIELD	IL	Services	268%
SIEBEL SYSTEMS INC	MENLO PARK	CA	Software	214%
COLLAGENEX PHARMACEUTICALS INC	NEWTOWN	PA	Biotechnology	205%
CANDLEWOOD HOTEL CO INC	WICHITA	KS	Services	203%
JAVELIN SYSTEMS INC	TUSTIN	CA	Computers	192%
MANSUR INDUSTRIES INC	MIAMI	FL	Machinery	167%
MCLEOD INC	CEDAR RAPIDS	IA	Telephone and Telegraph	155%
MIAMI COMPUTER SUPPLY CORP	Dayton	OH	Wholesale Trade	154%
MIDCOAST ENERGY RESOURCES	HOUSTON	TX	Electricity Gas and Sanitation	152%
IXC COMMUNICATIONS INC	AUSTIN	TX	Telephone and Telegraph	145%
1997				
NETBANK INC	ATLANTA	GA	Finance	341%
AMAZON COM INC	SEATTLE	WA	Manufactured Goods	228%
CD WAREHOUSE INC	OKLAHOMA CITY	OK	Retail Trade	180%
FRONTLINE COMMUNICATION	PEARL RIVER	NY	Computer Services	171%
STARTEC GLOBAL COMMUNICATIONS CORP	BETHESDA	MD	Telephone and Telegraph	140%
CIENA CORP	SAVAGE	MD	Communications	131%
AT HOME CORP	REDWOOD CITY	CA	Computer Services	130%
ONSALE INC	MOUNTAIN VIEW	CA	Business Services	130%
GROUP MAINTENANCE AMERICA	HOUSTON	TX	Construction	128%
SIGNATURE RESORTS INC	LOS ANGELES	CA	Securities Insurance and Real Estate	118%
1998				
EBAY INC	SAN JOSE	CA	Business Services	194%
INFOSPACE COM INC	REDMOND	WA	Information Retrieval	178%
EXODUS COMMUNICATIONS INC	SANTA CLARA	CA	Telephone and Telegraph	169%
VERISIGN INC	MOUNTAIN VIEW	CA	Computer Programming	161%
ALLEGIANCE TELECOM INC	DALLAS	TX	Telephone and Telegraph	155%
NORTHEAST OPTIC NETWORK INC	WALTHAM	MA	Telephone and Telegraph	142%
MGC COMMUNICATIONS INC	LAS VEGAS	NV	Telephone and Telegraph	127%
US LEC CORP	CHARLOTTE	NC	Telephone and Telegraph	125%
TECHNISOURCE INC	FT LAUDERDALE	FL	Advertising, Employment & Leasing	123%

EARTHSHELL CONTAINER CORP	SANTA BARBARA	CA	Manufactured Goods	109%
1999				
ITURF INC	NEW YORK	NY	Retail Trade	238%
ALLOY ONLINE INC	NEW YORK	NY	Retail Trade	236%
COMPUCREDIT CORP	ATLANTA	GA	Finance	159%
PHONE COM INC	REDWOOD CITY	CA	Communications	129%
DAG MEDIA INC	KEW GARDENS	NY	Manufactured Goods	126%
EXPEDIA INC	REDMOND	WA	Transportation and Services	125%
NETIQ CORP	SANTA CLARA	CA	Software	124%
BROCADE COMMUNICATIONS SYSTEMS INC	SAN JOSE	CA	Software	121%
GOTO COM INC	PASADENA	CA	Computer Services	119%
FINISAR CORP	SUNNYVALE	CA	Semiconductors	111%
2000				
PRECIS SMART CARD SYSTEMS	OKLAHOMA CITY	OK	Wholesale Trade	155%
RITA MEDICAL SYSTEMS INC	MOUNTAIN VIEW	CA	Medical Instruments	147%
XCARENET INC	ENGLEWOOD	CO	Computer Services	123%
UBIQUITEL INC	BALA CYNWYD	PA	Telephone and Telegraph	115%
SFBC INTERNATIONAL INC	NORTH MIAMI	FL	Education and Research	111%
AVENUE A INC	SEATTLE	WA	Advertising, Employment & Leasing	101%
VERSICOR INC	FREMONT	CA	Biotechnology	89%
UTSTARCOM INC	ALAMEDA	CA	Telephone and Telegraph	84%
EXULT INC	IRVINE	CA	Services	81%
AVANEX CORP	FREMONT	CA	Semiconductors	74%
2001				
Princeton Review Inc	New York	NY	Education and Research	136%
General Maritime Corp	New York	NY	Transportation and Services	77%
Galyan's Trading Co Inc	Plainfield	IN	Retail Trade	53%
Seattle Genetics Inc	Bothell	WA	Education and Research	43%
Odyssey HealthCare Inc	Dallas	TX	Health Services	38%
Magma Design Automation Inc	Cupertino	CA	Software	36%
Centene Corp	St. Louis	MO	Securities Insurance and Real Estate	32%
TheraSense Inc	Alameda	CA	Medical Instruments	29%
Verisity Ltd	Mountain View	CA	Software	29%
Encore Acquisition Co	Fort Worth	TX	Oil Gas and Mining	26%

2002				
Coml Capital Bancorp Inc CA	Irvine	CA	Finance	86%
DOV Pharmaceutical Inc	Hackensack	NJ	Biotechnology	66%
JetBlue Airways Corp	Kew Gardens	NY	Transportation and Services	65%
Crosstex Energy LP	Dallas	TX	Oil Gas and Mining	60%
Liquidmetal Technologies	Tampa	FL	Manufactured Goods	58%
Overstock.com Inc	Salt Lake City	UT	Business Services	56%
Netflix Inc	Los Gatos	CA	Services	56%
Kyphon Inc	Sunnyvale	CA	Medical Instruments	55%
SI International Inc	McLean	VA	Computer Systems	49%
MTC Technologies Inc	Dayton	OH	Computer Systems	37%
2003				
Open Solutions Inc	Glastonbury	CT	Software	66%
SigmaTel Inc	Austin	TX	Semiconductors	65%
First Marblehead Corp	Marblehead	MA	Finance	50%
Whiting Petroleum Corp	Denver	CO	Oil Gas and Mining	48%
FormFactor Inc	Livermore	CA	Semiconductors	46%
Providence Service Corp	Tucson	AZ	Services	37%
Kintera Inc	San Diego	CA	Software	36%
Franklin Bank Corp,Houston,TX	Houston	TX	Finance	34%
Integrated Alarm Svcs Grp Inc	Albany	NY	Business Services	33%
Capitalsource Inc	Chevy Chase	MD	Finance	32%
2004				
Google Inc	Mountain View	CA	Computer Services	94%
WPT Enterprises Inc	West Hollywood	CA	Services	92%
SiRF Technology Holdings Inc	San Jose	CA	Semiconductors	70%
Santarus Inc	San Diego	CA	Biotechnology	69%
Atheros Communications Inc	Sunnyvale	CA	Semiconductors	68%
Momenta Pharmaceuticals Inc	Cambridge	MA	Biotechnology	65%
NuVasive Inc	San Diego	CA	Medical Instruments	61%
Great Wolf Resorts Inc	Madison	WI	Services	59%
SalesForce.com Inc	San Francisco	CA	Software	59%
Copano Energy LLC	Houston	TX	Electricity Gas and Sanitation	58%
2005				
NxStage Medical Inc	Lawrence	MA	Medical Instruments	127%
BabyUniverse Inc	Fort Lauderdale	FL	Retail Trade	113%
SunPower Corp	Sunnyvale	CA	Semiconductors	92%
Valor Communications Group Inc	Irving	TX	Telephone and Telegraph	76%
Superior Well Service Inc	Indiana	PA	Oil Gas and Mining	73%
FairPoint Communications Inc	Charlotte	NC	Telephone and Telegraph	68%
Veri-Tek International Corp	Wixon	MI	Machinery	67%
Hercules Offshore Inc	Houston	TX	Oil Gas and Mining	64%
Tri-S Security Corp	Apharetta	GA	Business Services	60%
IntercontinentalExchange Inc	Atlanta	GA	Securities Insurance and Real Estate	60%

2006				
Capella Education Co	Minneapolis	MN	Business Services	118%
Energy Transfer Equity LP	Dallas	TX	Electricity Gas and Sanitation	115%
Western Refining Inc	El Paso	TX	Manufactured Goods	109%
Bare Escentuals Inc	San Francisco	CA	Manufactured Goods	106%
Digital Music Group Inc	Sacramento	CA	Holding and Investment	103%
First Solar Inc	Phoenix	AZ	Semiconductors	95%
Linn Energy LLC	Pittsburgh	PA	Oil Gas and Mining	76%
InnerWorkings Inc	Chicago	IL	Manufactured Goods	63%
Riverbed Technology Inc	San Francisco	CA	Computers	55%
NightHawk Radiology Holdings	Coeur d'Alene	ID	Health Services	51%

Appendix Table A1-2: Five-Year Super Gazelles Identified by CAGR

1996					
	City	**State**	**Industry**		**5 year CAGR**
SIEBEL SYSTEMS INC	MENLO PARK	CA	Software		135%
CANDLEWOOD HOTEL CO INC	WICHITA	KS	Services		105%
METZLER GROUP INC	DEERFIELD	IL	Services		98%
COLLAGENEX PHARMACEUTICALS INC	NEWTOWN	PA	Biotechnology		96%
MCLEOD INC	CEDAR RAPIDS	IA	Telephone and Telegraph		79%
U S ENERGY SYSTEMS INC	WEST PALM BEACH	FL	Electricity Gas and Sanitation		79%
MIAMI COMPUTER SUPPLY CORP	Dayton	OH	Wholesale Trade		78%
HUMASCAN INC	CRANFORD	NJ	Electronic Equipment		77%
CALPINE CORP	SAN JOSE	CA	Electricity Gas and Sanitation		74%
DIEDRICH COFFEE INC	IRVINE	CA	Retail Trade		72%
1997					
NETBANK INC	ATLANTA	GA	Finance		169%
AMAZON COM INC	SEATTLE	WA	Manufactured Goods		97%
FRONTLINE COMMUNICATION CORP	PEARL RIVER	NY	Computer Services		64%
RF MICRO DEVICES INC	GREENSBORO	NC	Semiconductors		59%
CIENA CORP	SAVAGE	MD	Communications		57%
PIVOT RULES INC	NEW YORK	NY	Wholesale Trade		55%
MICRO THERAPEUTICS INC	SAN CLEMENTE	CA	Biotechnology		50%
SIGNATURE RESORTS INC	LOS ANGELES	CA	Securities Insurance and Real Estate		50%
NEW CENTURY FINANCIAL CORP	NEWPORT BEACH	CA	Finance		50%
CD WAREHOUSE INC	OKLAHOMA CITY	OK	Retail Trade		50%
1998					
EBAY INC	SAN JOSE	CA	Business Services		123%
PENTEGRA DENTAL GROUP INC	PHOENIX	AZ	Computer Services		73%
WASTE CONNECTIONS INC	ROSEVILLE	CA	Electricity Gas and Sanitation		69%
VERISIGN INC	MOUNTAIN VIEW	CA	Computer Programming		69%
US LEC CORP	CHARLOTTE	NC	Telephone and Telegraph		67%
INFOSPACE COM INC	REDMOND	WA	Information Retrieval		66%
ALLEGIANCE TELECOM INC	DALLAS	TX	Telephone and		64%

			Telegraph		
1 800 CONTACTS INC	DRAPER	UT	General Instruments		59%
INTERCEPT GROUP INC	NORCROSS	GA	Finance		57%
BROADCOM CORP	IRVINE	CA	Semiconductors		53%
1999					
ALLOY ONLINE INC	NEW YORK	NY	Retail Trade		120%
COMPUCREDIT CORP	ATLANTA	GA	Finance		96%
EDUCATIONAL VIDEO CONFERENCING INC	YONKERS	NY	Education and Research		77%
JUNIPER NETWORKS INC	MOUNTAIN VIEW	CA	Computers		73%
DAG MEDIA INC	KEW GARDENS	NY	Manufactured Goods		64%
NETIQ CORP	SANTA CLARA	CA	Software		64%
NVIDIA CORP	SUNNYVALE	CA	Semiconductors		58%
HEALTHEON CORP	SANTA CLARA	CA	Computer Services		57%
BROCADE COMMUNICATIONS SYSTEMS INC	SAN JOSE	CA	Software		53%
PHONE COM INC	REDWOOD CITY	CA	Communications		52%
2000					
AVENUE A INC	SEATTLE	WA	Advertising, Employment & Leasing		100%
SFBC INTERNATIONAL INC	NORTH MIAMI	FL	Education and Research		90%
PRECIS SMART CARD SYSTEMS INC	OKLAHOMA CITY	OK	Wholesale Trade		86%
OMNIVISION TECHNOLOGIES INC	SUNNYVALE	CA	Semiconductors		64%
UBIQUITEL INC	BALA CYNWYD	PA	Telephone and Telegraph		55%
XCARENET INC	ENGLEWOOD	CO	Computer Services		53%
WEBEX COMMUNICATIONS INC	SAN JOSE	CA	Computer Services		48%
UTSTARCOM INC	ALAMEDA	CA	Telephone and Telegraph		48%
EVERGREEN SOLAR INC	WALTHAM	MA	Semiconductors		42%
LEXICON GENETICS INC	THE WOODLANDS	TX	Education and Research		41%
2001					
Princeton Review Inc	New York	NY	Education and Research		64%
General Maritime Corp	New York	NY	Transportation and Services		47%
Centene Corp	St. Louis	MO	Securities Insurance and Real Estate		44%
Natus Medical Inc	San Carlos	CA	Medical Instruments		27%

Seattle Genetics Inc	Bothell	WA	Education and Research		27%
Magma Design Automation Inc	Cupertino	CA	Software		26%
Odyssey HealthCare Inc	Dallas	TX	Health Services		25%
Amerigroup Corp	Virginia Beach	VA	Securities Insurance and Real Estate		24%
Encore Acquisition Co	Fort Worth	TX	Oil Gas and Mining		24%
United Surgical Partners Intl	Dallas	TX	Health Services		21%
2002					
Netflix Inc	Los Gatos	CA	Services		43%
Crosstex Energy LP	Dallas	TX	Oil Gas and Mining		42%
Overstock.com Inc	Salt Lake City	UT	Business Services		39%
JetBlue Airways Corp	Kew Gardens	NY	Transportation and Services		39%
SI International Inc	McLean	VA	Computer Systems		30%
Portfolio Recovery Associates	Norfolk	VA	Business Services		23%
Empire Financial Holding Co	Longwood	FL	Securities Insurance and Real Estate		23%
MTC Technologies Inc	Dayton	OH	Computer Systems		21%
SRA International Inc	Fairfax	VA	Computer Services		20%
Wynn Resorts Ltd	Las Vegas	NV	Services		15%
2003					
Providence Service Corp	Tucson	AZ	Services		42%
Tessera Technologies Inc	San Jose	CA	Semiconductors		35%
SYNNEX Corp	Fremont	CA	Computer Systems		35%
Whiting Petroleum Corp	Denver	CO	Oil Gas and Mining		34%
NETGEAR Inc	Santa Clara	CA	Communications		27%
FormFactor Inc	Livermore	CA	Semiconductors		26%
Pharmion Corp	Boulder	CO	Biotechnology		25%
Capitalsource Inc	Chevy Chase	MD	Finance		25%
Molina Healthcare Inc	Long Beach	CA	Securities Insurance and Real Estate		22%
Texas Capital Bancshares Inc	Dallas	TX	Finance		18%
2004					
Google Inc	Mountain View	CA	Computer Services		54%
NuVasive Inc	San Diego	CA	Medical Instruments		52%
Atheros Communications Inc	Sunnyvale	CA	Semiconductors		48%
NetLogic Microsystems	Mountain View	CA	Semiconductors		48%
SalesForce.com Inc	San Francisco	CA	Software		47%
Critical Therapeutics Inc	Lexington	MA	Biotechnology		38%
Momenta Pharmaceuticals Inc	Cambridge	MA	Biotechnology		37%
Monolithic Power Systems Inc	Los Gatos	CA	Semiconductors		37%
Santarus Inc	San Diego	CA	Biotechnology		37%
Great Wolf Resorts Inc	Madison	WI	Services		36%

2005					
NxStage Medical Inc	Lawrence	MA	Medical Instruments		71%
Rackable Systems Inc	Milpitas	CA	Computers		58%
Valor Communications Group Inc	Irving	TX	Telephone and Telegraph		49%
Under Armour Inc	Baltimore	MD	Manufactured Goods		47%
SunPower Corp	Sunnyvale	CA	Semiconductors		47%
Dexcom Inc	San Diego	CA	Medical Instruments		45%
Veri-Tek International Corp	Wixon	MI	Machinery		41%
IntercontinentalExchange Inc	Atlanta	GA	Securities Insurance and Real Estate		37%
FairPoint Communications Inc	Charlotte	NC	Telephone and Telegraph		36%
Genomic Health Inc	Redwood City	CA	Health Services		32%

Appendix Table A1-3: Ten-Year Super Gazelles Identified by CAGR

1996					
	City	**State**	**Industry**		**10 year CAGR**
METZLER GROUP INC	DEERFIELD	IL	Services		50%
COLLAGENEX PHARMACEUTICALS INC	NEWTOWN	PA	Biotechnology		39%
STERICYCLE INC	DEERFIELD	IL	Electricity Gas and Sanitation		38%
U S ENERGY SYSTEMS INC	WEST PALM BEACH	FL	Electricity Gas and Sanitation		35%
MLC HOLDINGS INC	RESTON	VA	Finance		33%
WEST TELESERVICES CORP	OMAHA	NE	Business Services		32%
CV THERAPEUTICS INC	PALO ALTO	CA	Education and Research		32%
POWERWAVE TECHNOLOGIES INC	IRVINE	CA	Communications		32%
E TRADE GROUP INC	PALO ALTO	CA	Securities Insurance and Real Estate		30%
CHICAGO PIZZA & BREWERY INC	MISSION VIEJO	CA	Retail Trade		30%
1997					
AMAZON COM INC	SEATTLE	WA	Manufactured Goods		52%
ISONICS CORP	SAN JOSE	CA	Manufactured Goods		46%
RF MICRO DEVICES INC	GREENSBORO	NC	Semiconductors		38%
AMERITRADE HOLDING CORP	OMAHA	NE	Securities Insurance and Real Estate		28%
PIVOT RULES INC	NEW YORK	NY	Wholesale Trade		28%
RACING CHAMPIONS CORP	GLEN ELLYN	IL	Wholesale Trade		27%
KENDLE INTERNATIONAL INC	CINCINNATI	OH	Education and Research		26%
CIENA CORP	SAVAGE	MD	Communications		26%
COLDWATER CREEK INC	SANDPOINT	ID	Retail Trade		25%
BEA SYSTEMS INC	SUNNYVALE	CA	Software		25%
1998					
EBAY INC	SAN JOSE	CA	Business Services		63%
BROADCOM CORP	IRVINE	CA	Semiconductors		38%
WASTE CONNECTIONS INC	ROSEVILLE	CA	Electricity Gas and Sanitation		35%
VERISIGN INC	MOUNTAIN VIEW	CA	Computer Programming		33%
DIGITAL RIVER INC	EDINA	MN	Information Retrieval		32%
PROSPERITY BANCSHARES INC	HOUSTON	TX	Finance		31%
P F CHANGS CHINA BISTRO INC	PHOENIX	AZ	Retail Trade		27%
MANHATTAN ASSOCIATES INC	ATLANTA	GA	Software		27%

REALTY INFORMATION GROUP INC	BETHESDA	MD	Information Retrieval		25%
CAREER EDUCATION CORP	HOFFMAN ESTATES	IL	Finance		21%
1999					
PERFICIENT INC	AUSTIN	TX	Computer Programming		49%
JUNIPER NETWORKS INC	MOUNTAIN VIEW	CA	Computers		44%
BROCADE COMMUNICATIONS SYSTEMS INC	SAN JOSE	CA	Software		42%
NVIDIA CORP	SUNNYVALE	CA	Semiconductors		40%
ALLOY ONLINE INC	NEW YORK	NY	Retail Trade		38%
HEALTHEXTRAS INC	ROCKVILLE	MD	Health Services		35%
RED HAT INC	DURHAM	NC	Information Retrieval		35%
UNITED THERAPEUTICS CORP	SILVER SPRING	MD	Biotechnology		34%
SONICWALL INC	SUNNYVALE	CA	Software		31%
PRIVATEBANCORP INC	CHICAGO	IL	Finance		30%
2000					
ILLUMINA INC	SAN DIEGO	CA	General Instruments		40%
EVERGREEN SOLAR INC	WALTHAM	MA	Semiconductors		35%
OMNIVISION TECHNOLOGIES INC	SUNNYVALE	CA	Semiconductors		35%
TTM TECHNOLOGIES INC	REDMOND	WA	Electronic Equipment		31%
INTUITIVE SURGICAL INC	MOUNTAIN VIEW	CA	Medical Instruments		30%
BRUKER DALTONICS INC	BILLERICA	MA	General Instruments		30%
WEBSENSE INC	SAN DIEGO	CA	Computer Systems		28%
MEDICINES CO	CAMBRIDGE	MA	Biotechnology		27%
ISTA PHARMACEUTICALS INC	IRVINE	CA	Biotechnology		25%
IXIA	CALABASAS	CA	General Instruments		24%

Appendix Two

Appendix Table A2-1: Matrix of Location of Firm and Its Law Firm

Firm State = Column, Law Firm State = Row. Note: States with less than ten IPOs were omitted to simplify presentation.

	AZ	CA	CO	CT	DC	FL	GA	IL	IN	LA	MD	MA	MI	MN	MO	NV	NJ	NY	NC	OH	OK	OR	PA	TN	TX	UT	VA	WA	
AZ	***10***	2				1										1													14
CA	3	***546***	9	1		4	2	2			2	2	3	3		7	1		1	1		3	2	1	7	2	1	10	626
CO	1	3	***29***	1		1	1											1							1	1	1		42
CT				***3***								1					1	3							1				9
DC		6	1	1	***4***	5	2				22		1	1		1	2	6	1	1			1		2		18		77
FL		1				***49***	2				1												1				1		55
GA		2			1	6	***33***			1	1			1		2	1		1					3	1		1		57
IL		4	2			1		***43***	1		1		3		1		1	1	1		1			2	3	2	1		71
IN		1							***4***																				6
LA										***3***															1				4
MD					1						***11***	1					1								1				15
MA	1	1		12	1	1	1	1			2	***112***	1		1		2	7	3	1			2		2		3	2	166
MI								1					***7***																8
MN		2									1			***30***				1	1										36
MO															***7***													1	9
NV																***1***													1
NJ								1			1						***12***	3	1				3						22
NY	1	13	5	11	3	22	3	4	1	1	3	10	1	3	1	1	25	***119***	4	3			6	4	15		10	2	281
NC																			***11***								1		12
OH												1	1							***12***					1				16
OK																					***4***				1				5
OR																						***10***							11
PA	1		1	1									1			1	8	1	1				***36***		1		2		56
TN				1																				***12***					13
TX	2	2	1			1	1	1		3								1	1		7		3		***102***	1			129
UT																										***4***			4
VA		1			1	1								1													***15***		19
WA		1		1	1																							***44***	49
	19	585	49	33	12	93	45	54	6	8	45	129	18	39	10	14	55	143	26	18	12	13	54	22	143	10	54	59	

Appendix Table A2-2: Location of Firm and Its VC BoD Members

Firm State = Column, VC Firm State = Row. Note: States with less than ten IPOs were omitted to simplify presentation.

	AZ	CA	CO	CT	DC	FL	GA	IL	MD	MA	MN	MO	NJ	NY	NC	OH	OR	PA	SC	TX	UT	VA	WA	
AZ	***1***	2																1						4
CA	4	***690***	19	5	2	13	7	5	12	36	10	5	7	15	4	3	11	9	4	21	6	10	45	943
CO		4	***7***			1	1									1				1		2		17
CT		8		***2***		2			5	8	3	3	1	4		4		7		2			1	50
DC					***2***				1									3						6
FL		2				***5***		2					1						1					11
GA							***7***			1					2							1		11
IL	2	12	8	1	1	1		***7***	1	5	1		1	2	1			1		1		1	5	51
MD	1	2	1		1	1	2	1	***10***	2	1		2	1				4				4		33
MA	1	64	1	2	2	6	5	4	2	***118***	4	3	8	10	8		1	7	2	6	2	3	7	266
MN	1	2				1		1			***14***							1		1				21
MO								1		2		***2***								1				6
NJ	1	22	3	1		1	2		6	9	3		***4***	2	3			2		2	2	2	3	68
NY		67	6	3	1	10	5	3	5	16			4	***30***	2			4	2	7	1	5	6	177
NC							1								***2***				1			1		5
OH		1		4			2	2	2	1	1	1	2			***3***								19
OR		2									1						***0***						2	5
PA		8	1	1	1	2	1	2	1	3			4					***17***		1		1		43
SC		1																	***0***					1
TX	1	2					2	3	2				1					1		**30**		1	1	44
UT		2																			**1**			3
VA			1		1				7					1								***8***		18
WA		17	3							1		2		1				2				2	***27***	55
	12	908	50	19	11	43	35	31	54	202	38	16	35	66	22	11	12	59	10	73	12	41	97	

Appendix Table A2-3 Location of Investment Banker Law Firm
(Proxy of Location of Lead Investment Banker)
Firm State = Column, VC Firm State = Row. Note: States with less than ten IPOs were omitted to simplify presentation.

	AZ	CA	CO	CT	DC	FL	GA	IL	MD	MA	MI	MN	MO	NV	NJ	NY	NC	OH	OK	OR	PA	TN	TX	UT	VA	WA	
AZ	***3***																					1					4
CA	4	***485***	17	3		6	1	5	1	3		5		7	1	3	1	1		8	2		15	5	2	33	608
CO		3	***10***			1	1		1														3				19
CT		1		***0***												1										2	4
DC		2	1		***4***	5	5	1	12	2		1			1	2	1	1			2	2	3	1	13	1	60
FL		3		1		***13***				1					1	2			1								22
GA		3	1			10	***17***	2								1		1				4	2		1		42
IL	1	5	3	1		4	1	***21***	2	2	6	5	2		1	3	1	1	1		2		3	1	4	1	71
MD		1				2	1		***3***	2					2	1	2				1	1	2		1		19
MA		3	1	8		6	4	3	3	***88***	3	1	3		6	17	1	1			4	2	3		5	1	163
MI											***0***																0
MN		2										***18***				1										1	22
MO	1												***0***					1									2
NV														***0***													0
NJ				1											***0***										1		2
NY	5	65	12	18	7	46	13	21	20	30	4	8	5	7	42	***107***	18	9		1	31	10	42	2	24	5	552
NC																	***1***										1
OH											1					1		***3***			1			1			7
OK																			***1***								1
OR		2														1				***4***							7
PA		2			1				1						1	1					***7***				1		14
TN	1						1															***1***					3
TX	4	2	3					1		1	2	1				1			9		4		***69***				97
UT		1	1																					***0***			2
VA									2		1					1									***1***		5
WA		2																					1			***14***	17
	19	582	49	32	12	93	44	54	45	129	17	39	10	14	55	143	25	18	12	13	54	21	143	10	53	58	