THE DETERMINANTS OF KNOWLEDGE EXPLORATION AND EXPLOITATION IN CORPORATE VENTURE CAPITAL INVESTMENT

GRACE SHEN SIEN

A THESIS SUBMITTED
FOR THE DEGREE OF MASTER OF SCIENCE
(MANAGEMENT)
DEPARTMENT OF DECISION SCIENCES
NATIONAL UNIVERSITY OF SINGAPORE
2005

ACKNOWLEDGEMENTS

First of all, I would like to express my gratitude and appreciation to my supervisors, Prof. Soh Pek Hooi and Prof. Lim Kwang Hui, who have always been willing to help and support me during the whole process of writing this thesis. Their encouragement and insightful guidance made this study possible. I also wish to thank my thesis committee members Prof. Ishtiaq Mahmood and Prof. Foo Maw Der for their helpful comments on this thesis.

Special thanks go to Aaron, for his generous help on data collection and continuous encouragement. Help from Philip, Zhaohua and many others is also very much appreciated.

I am also grateful to NUS for providing a research scholarship during my Master's study. NUS is a great place to study, and these two years will always be a treasured part of my memory.

Finally and most importantly, I want to thank my parents for their unfailing love and support. This research would not have been possible without their continuous encouragement and prayers. I am also grateful to God's love. It is He who led me during my study and has been giving me wisdom, strength and perseverance. Without His grace, I could achieve nothing.

TABLE OF CONTENT

SUMMARY

This study examines how firms learn from corporate venture capital (CVC) investments. A firm's CVC investments can shape its ability to explore and exploit new knowledge. Applying the exploration–exploitation framework of organizational learning in the context of CVC investments, I hypothesize that the key determinants of this learning process are (1) market diversification of investments (2) technological relatedness and (3) market relatedness between the CVC investors and investees. Moreover, stronger ties between corporate investors and investees are likely to enhance the explorative and exploitative learning benefits. Based on a sample of 516 investor-investee pairs in the biotechnology and semiconductor industries from 1978 to 2002, I find that investment diversification has a positive impact on explorative learning. The effect on this learning benefit is stronger when the duration of tie between the investors and investees increases. The findings suggest that both technological relatedness and market relatedness have a positive impact on a firm's exploitative learning, and that a moderate level of technological relatedness enhances a corporate investor's knowledge exploration as well. Moreover, investors and investees with longer duration ties benefit more from exploitative learning when investing in related ventures. The finding of this study provides evidence for the role of corporate venture capital investment in enhancing a firm's knowledge exploration and exploitation.

LIST OF TABLES & FIGURES

CHAPTER 1. INTRODUCTION

1.1. OVERVIEW & MOTIVATION

In most industries, a constant stream of new technologies, together with changing environments, globalized markets, and fierce competition produce a competitive environment that is best characterized by its increasing pace of change. Firms are faced with a transformation of existing markets and the emergence of completely new business opportunities. In this challenging environment, firms need to renew themselves by constantly absorbing new knowledge and developing capabilities.

Researchers have examined a number of ways in which firms may seek external knowledge to acquire and develop valuable resources and capabilities for continuous growth. For instance, strategic alliances, mergers and acquisitions (M&A), university-industry partnerships and joint ventures are all different mechanisms for accessing external knowledge. However, investing in corporate venture capital (CVC), an important source of external knowledge, has only received scant attention in the literature.

CVC investment refers to established firms' participation in the private equity market by providing start-ups with funding in return for equity positions (Gompers and Lerner, 1998). During the past two decades, many large corporations have turned to CVC activities as a way to learn about new technologies and markets, to promote innovation, and to spur continuous growth (Silver, 1993; McNally, 1997; Chesbrough, 2002; McKinsey & Co, 2003). According to the National Venture Capital Association (NVCA), at its peak in the year 2000, there were over 200 corporations with CVC investments, reaching $17 billion and representing 16% of all VC investment.

CVC activity can be understood as a process for developing new business

opportunities and a process of renewal which includes recognition, understanding, and exploitation of new opportunities. In other words, the firm needs to explore new knowledge and capabilities and exploit the exiting ones. For example, the declared goal of Nokia Ventures, the CVC program of Nokia is to “fuel future growth and to boost new product and long-term business development” (Business Wire, 1998). Lucent Technologies CEO Rich McGinn stated that Lucent Venture Partners “will give us early insight into the technologies, products and companies developing outside Lucent's walls that can help support our current competence and future growth" (Lucent Technologies, 1998).

While many companies have participated in CVC investment with the objectives to explore and/or exploit knowledge, some fundamental questions about how firms learn from CVC investment remain unanswered. Thus, this study tries to answer the question and is motivated by the increasing trend of CVC investment activity and its role in organizational learning and corporate strategy. Specifically, this study intends to answer the following two questions:

1. How do different relationship characteristics relate to explorative and exploitative learning in the context of CVC investment?
2. How is learning from CVC investment enhanced through its social network?

The concept of explorative and exploitative learning (March, 1991) contrasts two types of learning activities: explorative learning emphasizes the entrepreneurial search for new opportunities and knowledge, while exploitative learning is more adaptive and risk-averse and it usually leverages existing knowledge and resources. Exploration activities include search, variation, risk taking, experimentation, play, flexibility, discovery, or innovation (March, 1991). Knowledge generated by such

activities is often distant from the existing knowledge base of the firm (Katila, 2002). Exploitative learning is a directed search emphasizing limiting variety (McGrath, 2001), and its activities include refinement, choice, production, efficiency, selection, implementation, and execution (March, 1991). Organizations search by using knowledge that is closely related to their pre-existing knowledge bases (Helfat, 1994; Stuart and Podolny, 1996).

CVC investments can promote both explorative and exploitative learning. By investing in new ventures, firms can explore new business opportunities and acquire new knowledge about emerging technologies and markets that is different from their existing knowledge bases. At the same time, by accessing the knowledge that their portfolio companies possess, firms can put the related knowledge into immediate use to promote the utilization and exploitation of existing capabilities. In this study, I develop and test hypotheses concerning the determinants of knowledge exploration and exploitation in CVC investments.

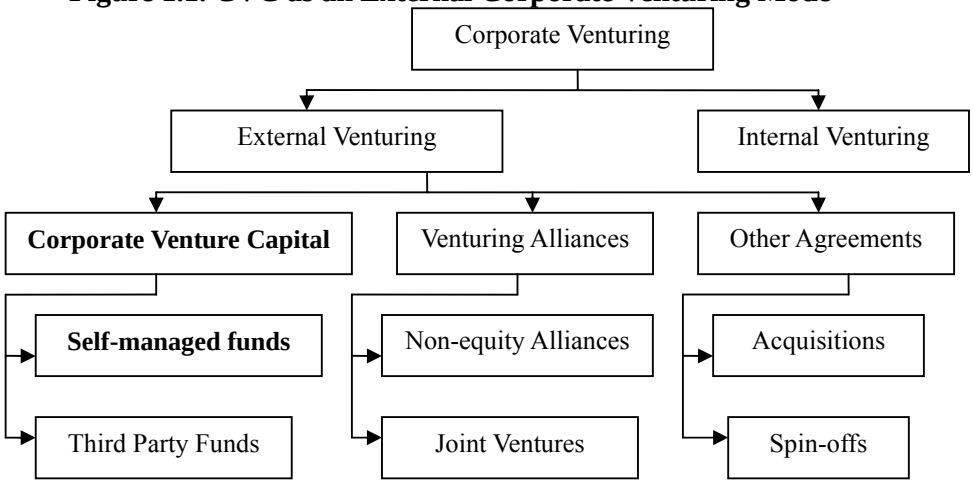
1.2. BACKGROUND OF CVC

1.2.1. What is CVC?

The domain of corporate venturing can be categorized as internal venturing and external venturing (Sharma and Chrisman, 1999). Sharma and Chrisman defined internal venturing as "corporate venturing activities that result in the creation of organizational entities that reside within an organizational domain". CVC investment, as a boundary spanning operation, belongs to another category that is labeled as external venturing. Sharma and Chrisman defined external venturing as "corporate venturing activities that result in the creation of semi-autonomous or autonomous organizational entities that reside outside the existing organizational domain."

According to the framework of corporate venturing proposed by Keil (2001), external venturing activities can be further categorized into three groups: corporate venture capital, venturing alliances, and other agreements such as acquisitions and spin-offs (see Figure 1.1). CVC investments resemble the operations of traditional venture capital firms in regards to programs that reside at the various levels of corporations where investments are made in independent external companies (Chesbrough, 2000). CVC investment can be made directly into ventures or indirectly through dedicated funds or pooled funds that are managed by external venture capital firms (Sykes, 1990; McNally, 1997; Aernoudt and San Jose, 2003). A recent survey (Ernst & Young, 2002) has found that the direct investment through self-managed funds seems to be the most common approach and is used by 86% of companies surveyed. This type of CVC investment is common amongst firms seeking to enhance their competitive position by facilitating the acquisition and the transfer of technology, resources and capabilities from external sources. The process can be relatively informal, comprising of just a team of individuals searching for entrepreneurial and innovative opportunities in the market or more formal, involving the setting up of a dedicated unit (Ernst & Young, 2002).

Figure 1.1. CVC as an External Corporate Venturing Mode



Source: Keil (2001)

In this study, I define CVC investments as an equity-link (typically minority) investment of corporate funds *directly* into start-up companies that are executed and controlled by a non-financial corporation[1]. This definition excludes investments made through an external fund managed by a third party, even if the investment vehicle is funded by and specifically designed to meet the objectives of a single investing firm. The definition does however include investments made in start-ups that a company has already spun off as independent businesses. In CVC the only limited partner is a corporation. Alternatively, a CVC fund can be a subsidiary of a corporation. The focus of this study is highlighted in the Figure 1.1.

1.2.2. The History of CVC Investment

Three different waves of CVC activity have been identified (Gompers and Lerner, 1998). First, in the late 1960s, corporations participated in CVC in order to gain a "window of technology". More than 25% of the Fortune 500 corporations were engaged in CVC in the late 1960s and early 1970s. Following the collapse in the market for IPO in 1973, the return on venture capital rapidly declined and most of the CVC programs were quickly dissolved. The second wave of CVC activity took place in the 1980s when it was used as a diversification tool. This wave peaked in 1986, when 12% of the total VC investment was managed by CVC programs. However, only a small number of CVC programs were successful and most of them were again dissolved after the crash of the stock market at the end of the 1980s. During the latter half of the 1990s CVC emerged again, this time in a much larger scale than ever before. However, following a peak in 2000, the volume of CVC investments rapidly declined due to the economic slowdown since 2001. The development of CVC from

[1] Detailed definition of "non-financial corporation" would be described in the research design part.

1995 until the first two quarters of 2004 is reported in Table 1.1. Table 1.2 lists the top US corporate investors in the venture capital market in the year of 2001 and 2002.

Table 1.1. Corporate Venture Capital Investment (1995-2004/6)

	Corporate Venture Capital	All Venture Capital	% of Whole	Corporate Venture Capital	All Venture Capital	% of Whole	Corporate Venture Capital	All Venture Capital	% of Whole
Year	**$M Invested**	**$M Invested**	**$M Invested**	**No. of Deals**	**No. of Deals**	**No. of Deals**	**No. of Companies Funded**	**No. of Companies Funded**	**No. of Companies Funded**
1995	427	8,373	5%	133	1,949	7%	124	1,613	8%
1996	711	11,886	6%	221	2,731	8%	204	2,183	9%
1997	1,011	15,484	7%	365	3,296	11%	332	2,645	13%
1998	1,839	21,847	8%	538	3,781	14%	498	3,083	16%
1999	8,555	56,144	15%	1,339	5,731	23%	1,174	4,575	26%
2000	17,042	107,714	16%	2,170	8,294	26%	1,981	6,582	30%
2001	5,019	42,887	12%	1,017	4,854	21%	958	4,005	24%
2002	1,876	21,776	9%	567	3,109	18%	528	2,616	20%
2003	1,216	18,924	6%	450	2,884	16%	424	2,383	18%
1H04	660	10,709	6%	245	1,449	17%	235	1,364	17%
TOTAL	**38,491**	**320,034**	**12%**	**7,119**	**39,347**	**18%**	**6,527**	**32,068**	**20%**

Source: NVCA (PricewaterhouseCoopers/Thomson Venture Economics/National Venture Capital Association MoneyTree™ Survey)

Table 1.2. Top US Corporate Investors (2001 & 2002)

2001	
Corporate Investor Name	**Number of Deals**
Intel Corporation	75
GE Capital, Equity Capital Group	41
Johnson & Johnson Development	20
Mitsui & Co. Venture Partners	19
Mitsubishi	19
Cisco Systems	18
AOL Time Warner Ventures	17
Texas Instruments	13
2002	
Corporate Investor Name	**Number of Deals**
Intel Corporation	24
GE Capital, Equity Capital Group	13
Cisco Systems	8
Johnson & Johnson Development	6
Dell Ventures	6
Texas Instruments	6
Sun Microsystems	5
Accenture Technology Ventures	5
Lucent Venture Partners	4

Source: Ernst & Young Corporate Venture Capital Report (2002)

1.3. CONTRIBUTION

This thesis makes three main contributions. First, this study extends our understanding of CVC activity by examining corporate investor's learning benefits from an inter-organizational learning perspective. Previous studies on CVC have mainly either focus on financial returns to investing firms (e.g. Gompers and Lerner, 1998) or examine the benefits such as IPO value from the venture's perspective (e.g. Maula and Murray, 2001). Few studies have examined the learning benefits from the corporate investor's perspective. Second, it contributes to inter-organizational learning literature by empirically examining the determinants of explorative versus exploitative learning outcomes in the context of CVC. Previous studies have examined various forms of inter-organizational learning activities such as strategic alliances, joint ventures and M&As, yet few studies have made a distinction between explorative and exploitative learning, nor rigorously investigated what factors have an impact on explorative versus exploitative learning outcomes. Third, this study enriches the literature on learning through CVC investment by integrating multiple perspectives from both strategic management and social network literature.

1.4. STRUCTURE

This study has seven chapters. Following this chapter, Chapter two provides a review of core literature areas that underlie the theoretical arguments of this study. In the third chapter I propose the research model and develop the corresponding hypotheses. Chapter four describes the research design including research setting, sources of data, measures and statistical models. Chapter five presents statistical analysis results and main research findings. In chapter six I discuss the findings and their implications. I close in chapter seven with some concluding remarks.

CHAPTER 2. LITERATURE REVIEW

This chapter reviews several streams of research that underlie the key concepts and theoretical arguments for developing a framework of learning from CVC investment activities. First, I will present a literature review on CVC investment and its learning objective. Then, I discuss how we can extend organizational learning theories to establishing the learning mechanisms in corporate investment activities. Finally, I identify several factors that might influence the learning outcome of CVC investments by integrating the relevant literature on business diversification, strategic alliances and social network theory. The overall discussion in this chapter will provide the basis of hypotheses development in Chapter 3.

2.1. CVC INVESTMENT AND ITS LEARNING OBJECTIVE

2.1.1 Strategic Objectives of CVC Investment

Extensive studies have examined the motivations for firms to form inter-organizational relationships. Inter-firm cooperation is motivated not only by cost minimization (e.g. Glaister and Buckley, 1996), access to resources (e.g. Dyer and Singh, 1998), and strategic positioning (Mitchell and Singh, 1992), but also driven by knowledge acquisition and learning (e.g. Hamel, 1991; Powell et al, 1996; Stuart, 2000). Like other forms of inter-firm relationships, these motives are also applicable for firms engaging in corporate investment relationship.

Most firms involving in CVC investment are driven by the strategic objectives rather than financial objectives. As the mission statement of Intel Capital declared:

"We invest with strategic intent, aiming to create and expand new markets for Intel's products. We want to stimulate growth in the internet, computing and

communications to grow the total internet infrastructure now and in the future. While financial returns are not our primary goal, we are seeking companies that can succeed and have an impact on their market segment." (Intel capital, 1990)

The literature on CVC investment is relatively scant. Previous studies have shown that the main reason for firms to engage in CVC activity is to achieve their strategic objectives rather than financial gains. For instance, Seigel et al. (1998) found that exposure to new technologies and markets is one of the important objectives of CVC investment. Sykes (1990) found that identifying new opportunities and developing business relationships were the most important goals for corporations investing directly. Similarly, Silver (1993) found in his survey that getting exposure to new markets, acquisition targets, adding new products to existing distribution channels, externalizing R&D, and utilizing excess plant space, time, and people were the most important objectives. McNally (1997) surveyed U.K. corporations and found that identifying new markets, exposure to new technologies, financial return, identifying new products, and developing business relationships were the five most important corporate objectives for direct CVC. Bannock Consulting (2000) found in their survey of 150 European corporations that on average 62% had strategic goals, and 27% had financial goals, as their primary motivations for CVC investments, while many had several goals. Based on seven in-depth case studies of external corporate venturing activities of information and communications technology corporations, Keil (2001) identified four primary strategic objectives: monitoring of markets, learning of markets and new technologies, option building, and market enactment.

2.1.2. Learning in CVC Investment

Motivated by the above strategic objectives, CVC plays a critical role in

acquiring external knowledge. CVC investment can be understood as a process of identifying new business opportunities as well as a process of understanding and exploiting the opportunities. In other words, the investing firm needs to explore new knowledge and capability while exploiting the existing knowledge and capability. The nature of exploration and exploitation in learning through CVC activity can also be summarized from the existing literature.

One prevailing aspect of learning in CVC is that it allows the firm to search a broader space for new business opportunities. Established firms can learn from constantly monitoring the new ventures and, therefore, being exposed to developments of new technologies, markets and business models (Sykes, 1990; Silver, 1993; McNally, 1997; Keil, 2001; Ferrary, 2003).

As mentioned by Vadasz, Senior Vice President of Intel Capital about Intel's motive to engage in CVC investment (Lane, 2000):

"A step (we have taken) is the realization that corporate venture capital investment can be a good way to understand new technologies that are not today's concern in the business units, but might become important in the future."

Corporate investors also realize their learning benefit by an indirect learning process from CVC activity. CVC investment has been used to change corporate culture and to learn about venture capital (Sykes, 1990; McNally, 1997), to support development of internal venturing processes (Winters and Murfin, 1988; Keil, 2001), and to provide contacts with related actors like investment banks, scientists and venture capitalists (Winters and Murfin, 1988). All these indirect learning processes provide the investing firm with new business opportunities.

Besides exploration of new business opportunities, learning benefits in CVC investment is also realized via the exploitation of existing knowledge and capabilities

through three mechanisms. First, CVC allows firms to *leverage* their internal resources. For instance, corporate investors are able to utilize their existing recourses to develop new technologies with their invested ventures without acquiring new recourses (Keil, 2001). Firms can also use CVC to stimulate demands for their technologies and products by sponsoring companies using and applying them (McKinsey & Co, 1998). In addition, firms can use CVC to proactively shape markets, and steer and promote the development of de-facto standards around their technologies by supporting favorable companies (Keil, 2001).

The objective of leveraging and exploitation in CVC investment is well described in the General Electric (GE) Equity's mission statement:

"To be a global equity provider that creates value for its customers by leveraging the GE system. The objective is to combine investee performance with their request/need and our skills and knowledge."

Secondly, CVC provides *access to complementary capabilities* that may be necessary to facilitate a firm's entry into new markets or new technological fields (McNally, 1997) with existing resources. Also, some corporations use CVC as a form of external R&D to develop their knowledge bases, competencies, technologies, products and processes (Silver, 1993; Rice et al, 2000; Ferrary, 2003). This type of exploitation often requires closer collaborations and frequent communications with portfolio companies (Sykes, 1990; Keil, 2001; Ferrary, 2003).

Lastly, CVC can create *options* to acquire the investee company for rapid entry into new markets or technologies. Often, the viability of competing technologies or the potential of markets are difficult to assess in advance. CVC provides options to acquire investees that enable the use of existing resources more efficiently while enabling the building of new capabilities more rapidly (McNally, 1997; Bannock

Consulting, 2000; Chesbrough, 2002). One CVC manager explains the logic of this acquisition activity like this (Keil, 2001):

Over time you might want to do acquisitions to add some of the capabilities to your portfolio. We have done exactly this through the acquisitions of (venture 1 and venture 2). These were third parties that were doing something we thought was becoming fundamentally important to what we are doing. So we transformed that from being part of our value web to being part of our organization."

From the above review, we can conclude that learning in CVC investment can serve two broad functions (see Table 2.1). It allows firms to broaden their search for business opportunities by monitoring new technological and market development. At the same time, CVC investment facilitates the rapid exploitation of emerging opportunities. Although previous studies on CVC have provided insights on potential learning benefits from CVC activities, the existing literature has not provided much understanding about how firms learn from CVC or what factors have impact on a corporate investor's learning outcome. Thus, this study intends to fill this gap in this aspect.

Table 2.1. Learning in CVC Investment

Learning Benefits		Study Example
Exploration (Broadening Search)	Exposure to /forging a link with new technologies, markets & business models to spur innovation	Winters & Murfin 1988, Silver 1993, McNally 1997, Bannock Consulting 2000
	Indirect learning from CVC process	Winters & Murfin 1988, Sykes 1990, McNally 1997, Keil 2001.
Exploitation (Rapid Entry)	Leveraging internal resources	McKinsey & Co 1998, Keil 2001
	Access to complementary capabilities	McNally 1997, Sykes 1990, Silver 1993, Rice et al 2000, Ferrary, 2003
	Options to acquire companies/to enter new markets	Winters & Murfin 1988, Siegel et al. 1988, McNally 1997, Chesbrough 2002

2.2. ORGANIZATIONAL LEARNING

2.2.1. Explorative and Exploitative Learning

Organizational learning has been defined primarily through its results, such as a quantifiable improvement in activities, increased available knowledge for decision making or sustainable competitive advantage. Organizational learning can also be characterized based on the various processes involved, such as the ways companies build routines or socialize employees into a corporate culture (Miller, 1996). Not all organizational learning however is the same. Two different types of organizational learning are commonly discussed in the literature: explorative learning and exploitative learning (March, 1991).

The first type of learning is explorative learning. March (1991) described exploration as "experimentation with new alternatives" which involves questioning existing boundaries, searching and experimenting with new technologies or entrepreneurial opportunities for wealth creation and above average returns. Exploration involves innovation, basic research, invention, risk taking, building new capabilities, and entering new lines of business (Koza and Lewin, 1998). This type of learning is referred to under labels such as "double loop" (Argyris and Schön, 1996), "generative" (Senge, 1990), "strategic" (Coopey, 1996), "second-order" (Fox-Wolfgramm et al. 1998), "revolutionary", "frame-breaking", "proactive" (Weick and Westley, 1996), and "radical" (Miner and Mezias, 1996).

The second type of learning is exploitative learning, which is defined as "the refinement and extension of existing competencies, technologies, and paradigms" (March, 1991). It is characterized as routine learning which adds to the existing knowledge and competencies of a firm without changing the nature of its activities (Hagedoorn and Duysters, 2002). Exploitation is associated with increasing the

productivity of employed capital and assets, standardization, and systematic cost reduction. It is described in the literature as "'single-loop" (Argyris and Schön, 1996), "adaptive" (Senge, 1990), "operational" (Coopey, 1996), "first-order" (Fox-Wolfgramm et al., 1998), "evolutionary", "frame-taking", "reactive" (Weick and Westley, 1996), and "incremental" (Miner and Mezias, 1996).

The explorative–exploitative learning framework developed by March (1991) highlights the different nature of learning. In comparison with exploitation, exploration is more experimental in nature, long-term oriented, and highly uncertain. However, both types of learning are believed to enhance the competitive ability of an organization. Levinthal and March (1993) argued that the survival of the firm is dependent upon the firm's ability to "engage in enough exploitation to insure the organization current viability and engage in enough exploration to insure its future viability".

By applying March's framework, the learning outcome in CVC investment (as described in Section 2.1) could be categorized into explorative learning and exploitative learning as well. Since this thesis aims to examine what are the determinants of the explorative and exploitative learning in CVC investment, the following sections review the related literature on factors influencing learning outcome.

2.2.2. Absorptive Capacity

Learning involves both transfer and assimilation of new knowledge. One of the most frequently discussed factors affecting knowledge transfer and assimilation in organizational learning is the absorptive capacity of the firm that tries to learn. Cohen and Levinthal (1989, 1990, and 1994) found that the ability to absorb external

knowledge and technologies is related to a firm's internal research and development (R&D) activities in *related* areas. Creating related knowledge through internal R&D helps to identify appropriate knowledge to assimilate it and to apply it. Internal R&D efforts perform two functions within this process. On the one hand, the understanding of the knowledge is supported by related internal efforts during the search, assimilation, and application of knowledge. On the other hand, the R&D can create complementing knowledge that is necessary in order to exploit external knowledge (Granstrand et al, 1992).

In particular, Cohen and Levinthal (1990) identified that the relatedness of the knowledge produced by the internal R&D activities affects the ease of internalizing external knowledge. The more related knowledge of the firm is to the knowledge to be assimilated, the higher the capability of the firm to understand and integrate the external knowledge. Researchers have reported that firms with an expertise in a given research domain exhibit higher levels of knowledge absorption from external sources (Pisano, 1991; Veugelers, 1997). The position is that in seeking and applying relevant knowledge, a firm needs to possess a knowledge base in the same or similar areas. It is only through such similarities that a firm can achieve an understanding of the new knowledge and its applicability to the firm's unique circumstances.

While Cohen and Levinthal (1990) stressed the firm-specific component of absorptive capacity, Lane and Lubatkin (1998), as well as Dyer and Singh (1998), focused on the relationship-specific component. They pointed out that firms are not uniformly able to develop effective knowledge assimilation with all partners. Partner-specific absorptive capacity may be partially a function of effective knowledge sharing routines between the partners. It may also be a function of similar or dissimilar knowledge structures within the organization (Lam, 1997). Lane and

Lubatkin (1998) argued that in a dyad relationship, a firm's ability to learn from another firm depends on the *similarity* of both firms along three dimensions. These dimensions are firms' knowledge bases, the organizational structures and policies, and the dominant logic. The authors found the similarity of the partner's basic knowledge, lower management formalization, research centralization, compensation practices, and research communities related to inter-organizational learning.

2.3. BUSINESS DIVERSIFICATION

Literature on business diversification has examined a number of mechanisms through which the diversification could influence a firm's performance, and learning is one of the mechanisms. Since learning involves search of new knowledge, business diversification could serve as a form to broaden a firm's knowledge search scope and to expand its knowledge domains, and therefore enhance the firm's learning outcome and performance.

The prevailing theory of diversification draws heavily on the resource based view (RBV) of firms. According to the RBV, firms attempt to accumulate valuable, rare, inimitable and non-substitutable resources and use them in value-creating strategies to attain a sustainable competitive advantage (Eisenhardt and Martin 2000). Empirical tests have provided support for the positive relationship between diversification and a firm's performance. For example, researchers found that there is a positive relationship between international market diversification and firm innovation (e.g. Hitt et al, 1997). Many other studies also have shown evidence that product/market diversification provide benefit to a firm's performance (e.g. Pandya and Rao, 1998).

2.4. STRATEGIC ALLIANCES

One significant stream of research on strategic alliances has examined the impact of the partnership on firms' learning benefits and innovative performance. The fundamental argument is that learning involves exploration and acquisition of new knowledge by the organization (Kumar and Nti, 1998). By forming inter-firm collaboration, firms can access external knowledge and resource that are necessary for its development and growth.

Many empirical studies have provided evidence of the role of alliances in firms' learning benefits and performance. For instance, Kogut (1988) argued that alliances are formed because they help the transfer of tacit knowledge that is not easily transferred in arms-length relationships. Shan et al (1994) analyzed alliances of 85 biotechnology firms finding a positive relationship between the number of strategic alliances and a firm's research productivity. Later, Deeds and Hill (1996) analyzed alliances of 132 entrepreneurial biotechnology firms and found a curvilinear (inverted U shape) relationship between a start-up's strategic alliances and its new product development. Hagedoorn and Schakenraad (1994) and Ahuja (2000) indicated that knowledge from innovative alliance partners may spillover and positively affect the innovativeness of a firm. Stuart (2000) showed that a firm's patenting rates increase the more technologically advanced are its alliance partners. The number of strategic alliance not only has impact on a start-up's learning and performance, but also has an impact on incumbent firms. The curvilinear relationship between an incumbent's strategic alliances with providers of the new technology and the incumbent's new product development is further confirmed by Rothaermel (2001).

Baum et al. (2000), by studying the start-ups' innovative performance in Canadian biotechnology, also demonstrated that alliance network composition has a

positive effect on biotechnology start-ups performance. Their analysis, from the perspective of the startup firm rather than the established firm, empirically validates the impact of inter-organizational arrangements on the learning benefits. Nevertheless, they also acknowledged that there are limitations to the usefulness of collaborative agreements. Specifically, the larger the number of a firm's collaborative partners, the higher the risk of redundancy (i.e. the risk that different partners provide access to the same information or complementary knowledge; Burt, 1992; Gomes-Casseres, 1994). Therefore, Baum et al. (2000) came to the conclusion that it is not the amount of collaborative partners per se, but rather the diversity of the firm's alliance network that is influencing the knowledge acquisition and innovative performance of the firm.

Recently, researchers have started to make a distinction between the different kinds of inter-firm relationships by looking at the learning objectives of the collaborations. Applying March's (1991) dichotomy of exploration and exploitation, researchers have made a distinction between explorative and exploitative alliances (Koza and Lewin, 1998; Rothaermel, 2001, Rothaermel and Deeds, 2004). In this way, it is emphasized that the firm's choice to enter into a collaboration can be distinguished in terms of its motivation to exploit an existing capability with focus on leveraging existing skills and knowledge or to explore new opportunities (Koza and Lewin, 1998).

Exploitative alliances are those partnerships where firms pool their existing complementary resources to generate benefits for both firms involved. The most common form of an exploitation alliance involves the joint maximization of complementary assets by sharing in the residual returns from a business activity (Koza and Lewin, 1998). Examples will be upstream and downstream outsourcing agreements, joint manufacturing, and shared distribution or service (Yoshino and

Rangan, 1995). Quite often efficiency and value adding is the major goal of carrying out the activity via an exploitative alliance (Yoshino and Rangan, 1995). Explorative alliances are set up to create new knowledge that can later be applied or manufactured by the partners either jointly or separately, or even by a third-party. Examples will be firms forging alliances with aims to develop new technologies or products, adopt new business models, and enter new market segments. Innovation and knowledge creation is the major goal in explorative partnerships.

The above literature review indicates that strategic alliance plays an important role in a firm's learning outcome. Therefore, when examining the determinants of learning in CVC investment, alliance is a necessary factor that needs to be incorporated to rule out the alternative explanations.

2.5. SOCIAL NETWORKS

Apart from the above strategic management perspectives, another perspective of examining the determinants of inter-firm learning is from the social network theory. In the most general terms, the concept of social networks is about the value of connections. The existing literature on social networks implies two basic opposing mechanisms of how network structure might affect an organization's ability to mobilize and acquire information through one's networks.

The first of these is the strength of weak ties perspective associated with Granovetter (1973) and Burt (1992), emphasizing the opportunities to access information stemming from having a central brokering position within the flow of information. According to this view, large networks composed of heterogeneous and transient ties are especially valuable, because they provide organizations with a wide range of information and are more likely to introduce the decision makers to

fundamentally new and foreign ideas and insights (Granovetter, 1973; Rogers, 1995).

A second alternative view emphasizes the strength of strong ties associated with Coleman (1990) and Uzzi (1996). The strong tie view argues that having a densely knit network makes it easier to gain support and get those who have the information to actually share it. Strong network ties have three defining characteristics. These are: (1) frequent interaction, (2) an extended history, and (3) intensity or "mutual confiding" (Granovetter, 1982) between the parties in the relationship (Krackhardt, 1992). As noted, networks composed predominantly of strong ties provide less diverse or novel information. However, they are more likely to promote in-depth, two-way communications and to facilitate the exchange of detailed information between organizations (Uzzi, 1996). In addition, the trust and mutual identification, that are likely to exist when ties are strong, make it more likely that both organizations will share valuable information with one another and that the information provided will be taken into account and acted upon (Uzzi, 1996).

Empirical research has indicated that strong tie and frequent social interaction are factors facilitating the knowledge transfer and learning process. For instance, Mowery et al. (1996) found in their analysis of 792 alliances that strong ties (i.e. equity joint ventures) are more likely to be used to transfer complex capabilities than weak ties (i.e. contract-based alliances). They also found that strong ties (i.e. bilateral contracts) are more effective than weaker ties (i.e. unilateral contracts) for knowledge transfer. Dyer and Singh (1998) indicated that social interaction facilitates the exchange of information and the identification of opportunities for cooperation. Similarly, Kale et al. (2000) found in their research on alliances of 278 U.S. companies that relational social capital is positively related to learning from the alliance partner. Examining knowledge acquisition in key customer relationships of

180 technology-based new firms, Yli-Renko et al (2001) found that social capital embedded in the key customer relationship greatly facilitates the knowledge acquisition from key customers. By studying the networks around managers in a large American electronics company, Burt (2004) also found that people connected across groups (i.e. having a brokerage position in the networks) tend to get new and good ideas.

The existing literature on social networks implies that social networks could affect an organization's ability to mobilize and acquire information and thus enhance its learning outcome. Therefore, we could expect this social network effect in the CVC investment relationship as well. Stronger ties between corporate investors and investees allow firms to gain more learning benefits through communication and knowledge exchange.

2.6. SUMMARY

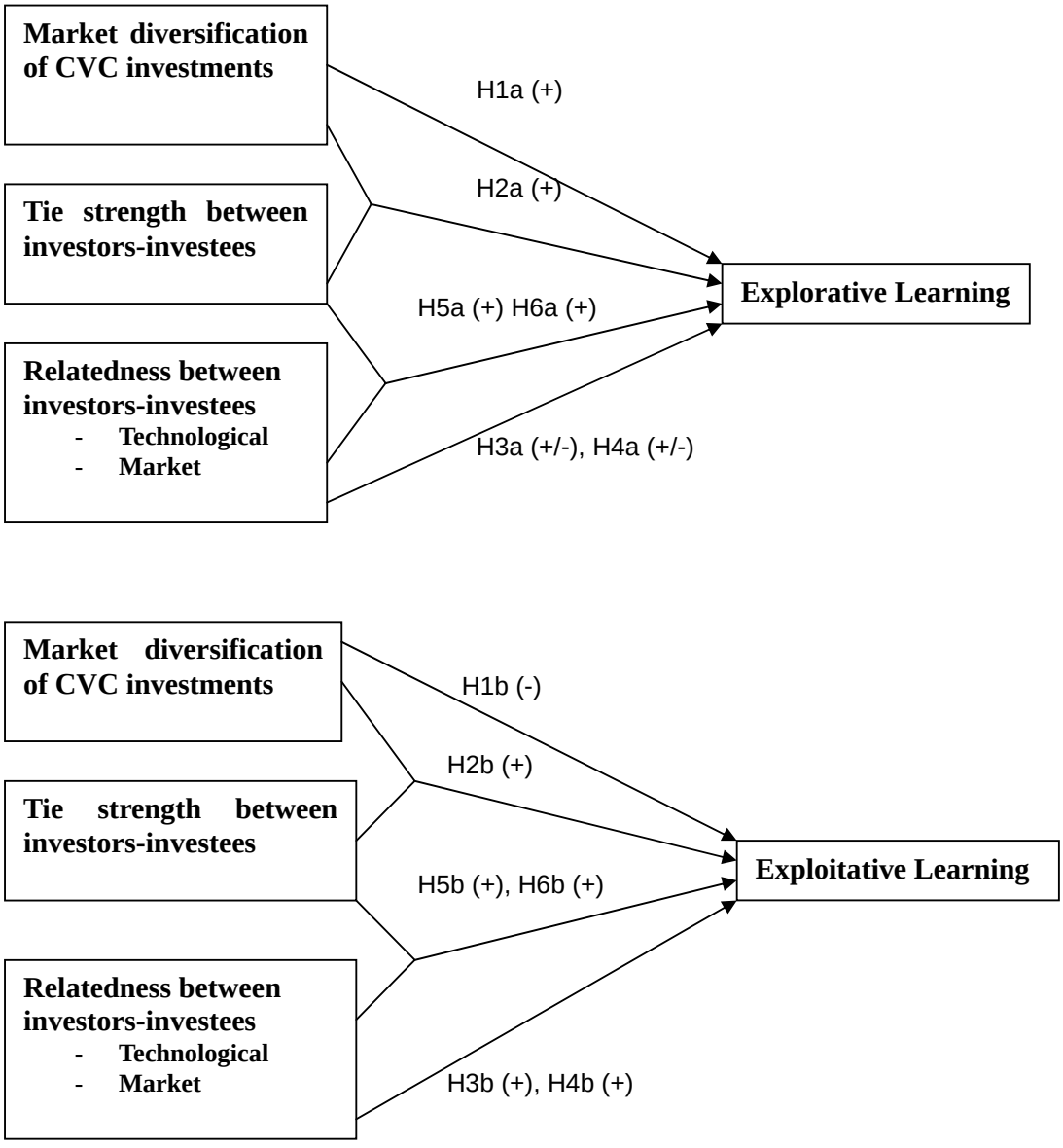
Existing literature on CVC investment has identified learning from new ventures and other investee companies as one of the most important strategic objectives for corporate investors. Several other streams of research such as business diversification, strategic alliances and social network theory have also discussed how different organizational factors may drive the learning outcomes stemming from an inter-firm relationship. However, few empirical studies on CVC investment have examined rigorously how corporate investors can benefit from the learning activities established with their investee companies. Existing studies which investigated the learning activities of CVC investment also did not make a distinction between knowledge exploration and exploitation, both of which are important learning mechanisms that form the knowledge base of the firm. Therefore, in the next chapter, to enhance our

understanding of how corporate investors learn from their investee companies, I will integrate multiple perspectives of factors that drive such learning process and develop hypotheses that establish their impact on explorative and exploitative learning outcome.

CHAPTER 3. HYPOTHESES

This chapter presents the main hypotheses of this study as summarized in Figure 3.1 below. Based on the literature review in Chapter 2, these hypotheses establish the causal relationships between different relational characteristics of investor-invested firms and explorative/exploitative learning from CVC investments.

Figure 3.1. Hypotheses



The following are the primary components of the hypotheses that explain explorative and exploitative learning from CVC investment: market diversification of

CVC investments, technological relatedness and market relatedness between investors and investee ventures, and tie strength between the investors and investees. These factors and their corresponding hypotheses are identified based on strategic management literature and social network theory reviewed in the previous chapter.

3.1. DIVERSIFICATION OF CVC INVESTMENTS

3.1.1. Investment Diversification and Explorative-exploitative Learning.

Most CVC programs start with a specific budget that limits the scope of investments. Firms can choose to invest in many different industries with multiple investee companies in their portfolio, or to invest in one or few industries with limited investees. The market diversification in a firm's investment portfolio is not only associated with its financial ability but also has an impact on corporate investor's learning benefits from CVC investments.

One of the main reasons for established firms to undertake CVC activities is to have a window to new technologies, markets and business models (e.g. McNally, 1997; McKinsey & Co, 1998; Chesbrough, 2002). In order to realize this strategic objective, corporate investors could choose to diversify their investments by investing in different markets to gain broader exposure of opportunities that leads to more explorative learning. Market diversification of investments could provide corporate investors a larger body of new knowledge to search and acquire. Since start-ups operating in different markets do not have the same knowledge base, investing in multiple markets allows firms to have a wider knowledge space and explore a more diverse set of emerging technologies and markets. In addition, by diversifying the investments incumbents can reduce the risks associated with the experimental nature

of exploration, while at the same time maintain an option for learning especially about emerging and radically new technologies. Hence, I hypothesize:

> ***Hypothesis 1a**: The more diverse the CVC investments (diversification as measured by the different industries invested in the portfolio), the more explorative learning takes place in investing firms.*

While market diversification of investments could enhance explorative learning in CVC, it could hamper investing firm's exploitative learning. Investing into different industries might challenge the number of knowledge domains a firm can cover or master. Firms might have difficulties in absorbing different sources of knowledge they obtain from multiple industries because of a lack of absorptive capacity (Cohen & Levinthal, 1990) in multiple areas. Therefore, investing into different industries might decrease the ability of a firm to apply and exploit the knowledge in a given area. Further, when managing a large number of CVC investments in multiple industries, the firm cannot dedicate its resources to any single invested company or to any particular industry. This could limit the firm's interactions with startups, delaying the flow of incoming knowledge that fosters exploitative learning.

> ***Hypothesis 1b**: The more diverse the CVC investments (diversification as measured by the different industries invested in the portfolio), the less exploitative learning takes place in investing firms.*

3.1.2. Moderating Effect of Tie Strength

Previously, it is argued that diversification of investments has different impact on a firm's explorative and exploitative learning from CVC investment. However, the existence of diverse investees in a portfolio alone is not enough for the realization of the potential learning benefits. The extent to which a firm can acquire external knowledge from others will also depend on the ability to recognize and assess the value of knowledge, on the willingness to share information, and on the patterns of interaction with partners (Dyer and Singh, 1998; Lane and Lubatkin, 1998).

One of the biggest challenges for knowledge acquisition and learning processes concerns the transfer barriers between the source and the recipient. Researchers have summarized such barriers as the ignorance of where to identify knowledge, a lack of motivation, obstacles to the effective search for knowledge, lack of trust, and unfavorable access to knowledge (Rivkin, 2001). Additionally, scholars consider knowledge as experts' cognitions distributed in certain social networks (Hansen, 2002), and emphasize the nature of embeddedness in knowledge transfer. The fact that knowledge is embedded, not only in practice but also in dynamic interactions between people and their social context, raises another barrier to knowledge acquisition and learning.

These barriers of knowledge transfer and acquisition could be eased by the high level of social interaction between parties involved in this transfer process. Thus I contend that the amount of knowledge acquisition and learning benefits a corporate investor realized from CVC investment depends on the level of social interaction between investors and investees in the investment portfolio. Social interaction refers to the extent of social relationships between the firms, or in other words, the *tie strength* as defined by Granovetter (1973). Specifically, I argue that the duration of

the ties, the frequency of the interactions, and the intensity level between investors and investees could lower the knowledge acquisition barrier and enable firms to gain more learning benefits.

The first dimension of tie strength that can lower the barriers is the *duration of ties*. Firstly, longer duration of a relationship can reduce the difficulty of recognizing and valuing external knowledge. Longer engagement of relationships should assist in the identification of opportunities for cooperation (Dyer and Singh, 1998) and enhance the ability of investing firms to evaluate the pertinent knowledge of the investees. Secondly, social interactions develop over time in dyadic relationships as exchange partners become more comfortable with each other's competence and reliability in economic exchange (Larson, 1992; Ring and Van de Ven, 1994). Therefore, stronger ties with longer duration of relationships can not only promote trust but also reduce unethical behavior (Gulati, 1995; Uzzi, 1996). By this means, the barriers of lack of motivation to transfer knowledge could also be lowered.

The second social factor of lowering knowledge acquisition barriers is the *frequency of interaction*. Previous studies have shown that social interaction facilitates the exchange of information (Tsai and Ghoshal, 1998; Hansen, 2002) and as more social interactions build, a greater intensity and breadth of information can be exchanged (Yli-Renko et al, 2001). Prior studies on CVC have also reported that frequency of communication between investors and investees is one of the determinants of successful CVC investment program (Sykes 1990). In addition, direct frequent interactions also induce more trust and improve the willingness of individuals to share knowledge (Tsai and Ghoshal, 1998, Zahra et al 2000). When the communication efficiency is enhanced through repeated social interactions, both parties have a relatively greater incentive to invest more in knowledge-sharing

routines. By intensifying knowledge-sharing activities, social interaction serves to increase the relative capacity and effectiveness of an investing firm in recognizing and adapting external knowledge from the investees. Therefore, through frequent interactions with each other, the barriers of both explorative and exploitative learning process are reduced.

In addition to duration and frequency of interaction, the *intensity level* of social ties is another dimension of tie strength to facilitate learning processes. One of the methods to establish intense and intimate relationships among organizations is to create ties through a member of one organization sitting on the board of another (often called board interlocks). From an information perspective, scholars have seen board interlocks as a means by which organizations reduce uncertainties and share information about acceptable and effective corporate practices (e.g. Haunschild, 1993; Gulati and Westphal, 1999; Westphal et al, 2001). The intensity of ties established through board interlock would allow a CVC investor to have a more direct monitor of the investee, a more direct communications channel, as well as a greater exposure to the technologies and practices of the venture. Moreover, this intensity of ties could provide a mechanism to reduce the problem of information asymmetry that investors sometimes incur. High levels of intensity in interaction also enables a firm to get close enough to acquire not just the observable components of knowledge, but the deeper tacit components of knowledge as well (Kogut and Zander 1996). As a result, CVC investors can have greater access to their ventures and enhance both their explorative and exploitative learning from the start-ups in relation to firms without a board interlock.

In summary, I argue that stronger ties (longer duration of investment relationships, more frequency of interactions, and higher level of intensity) between

investors and investees tend to lower the barriers of the knowledge acquisition and transfer in both explorative and exploitative learning processes in an CVC investment relationship. In particular, when the diversification of investment might have a negative impact on the investing firm's exploitative learning (as hypothesized in 1b), a stronger ties between the two firms could help to weaken this negative relationship by enhancing their knowledge exchange and acquisition through longer duration of investment relationship, more frequency of interactions and high level of intensity. Thus, I hypothesize:

> ***Hypothesis 2a:*** *The positive relationship between investment diversification and explorative learning from CVC activities will be strengthened by a stronger tie between the investor and the investees in the investor's portfolio.*
>
> ***Hypothesis 2b:*** *The negative relationship between investment diversification and exploitative learning from CVC activities will be weakened by a stronger tie between the investor and the investees in the investor's portfolio.*

3.2. RELATEDNESS

3.2.1. Relatedness and Explorative-exploitative Learning

Previous research on corporate venturing have studied relatedness mainly for internal ventures, focusing mostly on the impact of business relatedness on a venture's financial performance. The results of these studies have been mixed (Thornhill and Amit, 2001). Some authors found a positive relationship between relatedness and

performance (e.g. Dougherty, 1995), while others found a negative relationship (e.g. Ginsberg & Hay, 1994) or no relationship at all (Sorrentino and Willianms, 1995).

The impact of business relatedness on learning in the context of CVC activity has not been given the same level of attention. However, arguments can be derived from the relevant strategic management literature. For example, study shows that a corporation might be able to generate new technologies through combining research and development resources in a related acquisition (Hagedoorn and Duysters, 2002). In the joint ventures, the higher the relatedness between the parents and their joint ventures, the higher the perceived performance of the joint ventures (Lane et al, 2001). Besides literature on acquisitions and joint ventures, some arguments of relatedness have focused on underlying characteristics of knowledge and learning. For instance, Kogut and Zander (1992) argued that elements of similar knowledge facilitate the integration of the partners' knowledge bases. Common skills and similar cognitive structures enable the partners to communicate and learn from each other (Lane and Lubatkin, 1998; Nahapiet and Ghoshal, 1998).

In the context of CVC investment, by business relatedness, I refer to those investments in which investing firms and invested ventures conduct similar research and development activities, employ similar production technologies, serve similar markets and use similar distribution systems (Rumelt, 1974). Thus, I categorize business relatedness into two sub-groups: technological relatedness and market relatedness.

Technological relatedness. Previous studies have examined technological relatedness as an influencing factor of the amount of learning in inter-organizational relationships such as alliances (Lane and Lubatkin, 1998), joint ventures (Shenkar and Li, 1999), and acquisitions (Ahuja and Katila, 2001). It is argued that a firm's

previous related knowledge can facilitate the identification, interpretation, and digestion of external knowledge (Cohen and Levinthal, 1990). Therefore, if the knowledge bases of the two partners are similar, learning benefits should increase among the partners (Lane and Lubatkin, 1998).

The above arguments would suggest a linear positive relationship between technological relatedness and explorative learning. However, if the knowledge bases of two firms are too closely related, little learning might take place (Ahuja & Katila, 2001). In other words, relatedness can negatively affect learning outcome since once an optimal point is achieved, similar knowledge bases might reduce the learning benefit. The diminishing returns of learning from closely related technological knowledge base could bring negative impact at some point due to the rigidity and limitation of knowledge search space. In the context of CVC investment, one of the main learning objectives for corporate investors is to be exposed to and to forge a link with new technological knowledge (Winters and Murfin, 1988, Silver 1993, McNally 1997, Bannock Consulting, 2000). Such explorative learning benefits would be dampened if the investor and investee share a knowledge base that is too similar, which leads to no new knowledge exploration. Therefore, although the similarity of knowledge would be necessary to increase explorative learning benefit at first, too much similarity would reduce the exposure of experimenting and new knowledge, and results in negative effect on the explorative learning outcome.

Exploitative learning, however, is more likely to take place within very closely related knowledge bases. Firstly, since both parties share most of each other's knowledge, knowledge transfer is likely to be refining or incrementally extending the exiting knowledge base of the firm. Secondly, if the investor and the investee have similar technology know-how, the investing firm would be more likely to leverage its

own capabilities via acquiring knowledge from the investee, because the elements of similar knowledge facilitate the integration of the partners' knowledge bases (Kogut and Zander, 1992), In addition, the prior knowledge would be relevant enough to facilitate learning processes and knowledge exploitation. Therefore, I hypothesize:

> ***Hypothesis 3a****: Technological relatedness between investors and investees in CVC activities is curvilinearly related (inverted U) with explorative learning that takes place in investing firms.*
>
> ***Hypothesis 3b****: The more technological related between investors and investees in CVC activities, the more exploitative learning takes place in investing firms.*

Market relatedness. Apart from technological relatedness, there is also market relatedness affecting the learning benefit from CVC investments. Corporate investors can invest in ventures that operate in the same or similar markets or in markets they are not familiar with. Related markets share important characteristics that support incremental learning and make explorative learning less likely. In other words, the more related the markets are, the more we expect learning to be incremental, building and refining of existing knowledge; the less related the markets are, the more likely the explorative learning would take place.

If a corporate investor and its investee operate in similar markets, this similarity should allow two firms to exchange knowledge more easily and consequently to enhance operation in exiting markets. Similarities in business logic and cognitive framework makes two firms more likely to share the same views on the future evolution of markets and technologies and will search for knowledge in similar places

(Silverman, 1999). In this way firms are more likely to explore opportunities in new markets as well as to exploit their capital, assets and capability in the exiting markets.

While market relatedness can help firms obtain new knowledge, too much market relatedness might make a firm less likely to have an opportunity to acquire knowledge of new markets and to explore new business opportunities. When the investor and investee operate in very similar or completely the same markets, they are more likely to focus on how to compete with each other and exploit from the partner instead of to explore new knowledge and business opportunities.

> ***Hypothesis 4a**: Market relatedness between investors and investees in CVC activities is curvilinearly related (inverted U) with explorative learning that takes place in investing firms.*
>
> ***Hypothesis 4b**: The more market related between investors and investees in CVC activities, the more exploitative learning takes place in investing firms.*

3.2.2. Moderating Effect of Tie Strength

Previously, it is argued that technological relatedness and market relatedness between an investor and an investee have impact on the investor's learning benefits from CVC investments. Here it is further hypothesized that the relationship between the relatedness and learning outcome is influenced by the tie strength between the two firms.

As discussed in the section 3.1.2, close social interaction could facilitate knowledge transfer and acquisition (e.g. Mowery et al.,1996; Yli-Renko et al, 2001).

Through interacting with the investee on a long, frequent and intense level, an investing firm should be better able to absorb the technological and market knowledge provided by the invested company. This strengthening effect of a strong tie is especially true when the corporate investor invests in unfamiliar technologies and markets. Moreover, a lasting, repeated and close relationship also helps to foster more trust between the two parties and willingness to share knowledge between the individuals (Tsai and Ghoshal, 1998, Zahra et al 2000). Therefore, the stronger ties between the investors and investees play the enhancing role in the relationship between the relatedness and knowledge exploration/exploitation. Thus, I hypothesize that:

***Hypothesis 5a**: The positive relationship between technological relatedness and explorative learning from CVC activities will be strengthened the stronger the tie is between the investor and the investee.*

***Hypothesis 5b**: The positive relationship between market relatedness and explorative learning from CVC activities will be strengthened the stronger the tie is between the investor and the investee.*

***Hypothesis 6a**: The positive relationship between technological relatedness and exploitative learning from CVC activities will be strengthened the stronger the tie is between the investor and the investee.*

***Hypothesis 6b**: The positive relationship between market relatedness and exploitative learning from CVC activities*

will be strengthened the stronger the tie is between the investor and the investee.

3.3. SUMMARY

The primary components of the hypotheses that explain explorative and exploitative learning from CVC investment are: market diversification of CVC investments, technological relatedness and market relatedness between investors and investees, and tie strength between investors and investees. These factors and their corresponding hypotheses are summarized in the table below.

Table 3.1. Hypotheses Summary

Variables	Proposed signs	Hypotheses
Explorative learning (DV)		
Market diversification of CVC investments	+	H1a
Market diversification * Tie strength between investor-investee	+	H2a
Technological relatedness between investor-investee	+/- (inverted U)	H3a
Market relatedness between investor-investee	+/- (inverted U)	H4a
Technological relatedness * Tie strength between investor-investee	+	H5a
Market relatedness * Tie strength between investor-investee	+	H6a
Exploitative learning (DV)		
Market diversification of CVC investments	-	H1b
Market diversification * Tie strength between investor-investee	+	H2b
Technological relatedness between investor-investee	+	H3b
Market relatedness between investor-investee	+	H4b
Technological relatedness * Tie strength between investor-investee	+	H5b
Market relatedness * Tie strength between investor-investee	+	H6b

CHAPTER 4. METHODOLOGY

In this chapter, I discuss about the research methods used to test the proposed hypotheses made in the prior chapter. I will first describe the data sources and sample selection process. Then I will present measures of all the variables used in the study. The third section specifies the models to be used in testing the hypotheses and describes the statistical methods.

4.1. DATA

The research setting of this study is CVC investment activities in high-tech industries. The reason for choosing high-tech industries as the setting is based on the following two considerations. First, according to the NVCA (2004), over 90% of CVC investment deals since the 1970's are in the high-tech industries. Secondly, the fast growing, technologically intensive nature of high-tech industries stimulates creation of new knowledge to a degree where "learning" within established firms varies measurably: an essential consideration for this study.

To be specific, I choose two high-tech industries, the biotechnology and semiconductor industry as the research setting. The emergence of biotechnology can be interpreted as a radical process innovation that reduces the barriers of entry into the pharmaceutical industry, among other industries (Pisano, 1990). The commercialization of biotechnology is characterized by extensive inter-firm co-operations including the mode of CVC. Since the early 1970's about 1600 new biotechnology firms have emerged to commercialize this technological breakthrough (Rothaermal and Deeds, 2004). Another industry in the sample is the semiconductor industry. Like the biotechnology industry, entrepreneurial start-ups and inter-firm relationships also play important roles in the evolution of the semiconductor industry

(Almaida and Kogut, 1999). Considering the extensive new knowledge generation and widely used inter-firm cooperation, the biotechnology and semiconductor industry provide a good setting for this study.

Data of corporate investors and portfolio companies in CVC activities comes from the Thompson Financial SDC Platinum database. The "VentureXpert" database in SDC Platinum contains a comprehensive coverage of investment, exit, and performance in the private equity industry from the 1970's to present. It provides information about firm/fund profiles for both investors and portfolio ventures and information of deal details relevant to this study.

The samples are selected from the SDC Platinum database according to the following three criteria: First, the type of investing firms is "non-financial corporate/affiliate/subsidiary"[2]. They will be referred to as "**firms**" subsequently. The second criterion is that the fund type is "direct investment". The third criterion is the invested companies (which will be referred to as "**companies**" subsequently) belong to either biotechnology or semiconductor industry. Based on these three criteria, the database identifies 337 CVC deals (or called "investment rounds") in the biotechnology industry with 99 firms and 201 companies from 1978 to 2002. In the semiconductor industry, there are 409 CVC deals from 1978 to 2002, with 142 firms and 217 companies.

I choose to use panel data to analyze longitudinal changes of learning outcome

[2] Other types of firm/fund in VentureXpert database include: Private Firm Investing Own Capital; Private Equity Advisor or Fund of Fund Manager; Investment/Merchant Bank Subsidiary or Affiliate; Commercial Bank Affiliate or Subsidiary; Bank Group; Investment Management/ Finance Consulting; Affiliate/Subsidiary of Other Financial Institution; Insurance Firm Affiliate or Subsidiary; Pension Fund, Public; Pension Fund, Corporate; Profit Sharing Fund; Endowment; Foundation; Incubator; University Affiliated Program; Business Development Fund; State Govt Affiliated Not Elsewhere Classified; Federal Govt Affiliated Not Elsewhere Classified; Government Program Not Elsewhere Classified; MESBIC Not Elsewhere Classified; SBIC Not Elsewhere Classified; Individuals; Investment or Angel Network; Management Consulting Firm; Venture Consulting Firm; Accounting Firm; Placement Agent; Law Firm; Other Service Provider; Other Not Elsewhere Classified

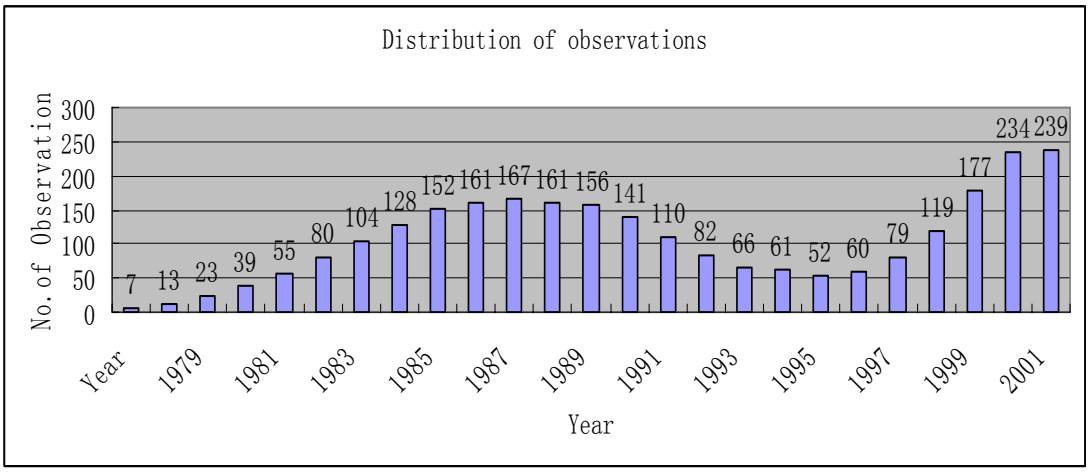
taking place in established firms resulting from CVC investment activities. Based on the information of investment exit or start-up IPO provided in the SDC database, the final panel dataset includes a total of 2666 observations with 516 firm-company pairs. Table 4-1 summarizes the total number of observations with firm-company pairs in each industry type in the sample. Figure 4-1 describes the distribution of these observations in each year from 1978 to 2002. The name of the investing firms and investee companies are listed in Appendix 1.

Table 4.1. Sample Summary (1978-2002)

Industry	**No. of observations**	**No. of investor-investee pairs**	**No. of investors**	**No. of investees**
Biotechnology	1265	237	99	201
Semiconductor	1401	279	142	217
Total	***2666***	***516***	***214 (unique)***	***418***

Source: "VentureXpert" database, SDC Platinum

Figure 4.1. Distribution of Observations (1978-2002)



Source: "VentureXpert" database, SDC Platinum

4.2. MEASURES

In this section, measures of variables are discussed. I will first discuss the two dependent variables of the study: explorative learning and exploitative learning. Independent and control variables are introduced next. Unless otherwise noted, all variables of the study are annual values collected yearly ranging from 1978 to 2002. To aid the reader, all variables, the proposed measures and corresponding data sources are listed in Table 4.2 as follows.

Table 4.2. Key constructs, Measures & Data Source

Key Constructs	Measures	Data Sources
Explorative/exploitative learning	*EXPLORE*: patent counts in "explorative classes" *EXPLOIT*: patent counts in "exploitative classes"	NUS Patent Database
Market diversification of investment (H1)	*DIVERSE:* number of different industries (SIC of investees) invested in the portfolio	SDC; CorpTech; Osiris
Technological relatedness (H3)	*TECHREL_1*: 0, 0.25, 0.5 or 1 depending on the number of publication/conference proceedings sharing same keyword (s) *TECHREL_2**: 0, 0.25, 0.5 or 1 depending on the overlap between international patent classifications.	Web of Science; BIOSIS Review; ISI Proceedings NUS Patent Database
Market relatedness (H4)	*MKTREL:* 0, 0.25, 0.5,0.75, or 1 depending on the number of same SIC digit	SDC; CorpTech; Osiris; Dun&Bradstreet; SEC
Moderating effect of tie strength (duration/ frequency /intensity) (H2, H5 & H6)	Pair level: *DUR*: investment duration (in years) *FQY*: number of cumulative investment round *ITY:* dummy coded as 1 with board interlock, otherwise 0. Portfolio level: *DUR_AVG: average duration of investment in the portfolio* *FQY_AVG: average investment round in the portfolio* *ITY_AVG: average number of board interlock in the portfolio*	SDC
Controls: Firm size Firm experience R&D expenditure Sales Strategic alliance Co-investor networks Industry Company age	*SIZE:* firm annual total assets *FIRM_AGE:* based on year of foundation *R&D:* firm annual R&D disbursement *SALES:* firm annual sales amount *ALLIANCE_2* & ALLIANCE_3:* number of cumulative alliances a firm has formed in the prior 2 or 3 years *NETWORK*: number of cumulative co-investors *INDUSTRY:* dummy (biotech=1, semiconductor =0) *COM_AGE1*: based on company first publication year *COM_AGE2*: based on company first patent application year	WRDS; SDC; Recap; Web of Science; BIOSIS Review; ISI Proceedings; The dataset used in Soh & Roberts, 2003

4.2.1 Dependent Variables

Explorative learning & Exploitative learning (EXPLORE & EXPLOIT). Yearly patent counts from NUS patent database[3] are used to derive the two dependent variables—explorative learning and exploitative learning. Although researchers have pointed out that patents as innovative output have limitation (e.g. Griliches, 1990; Trajtenberg, 1990), patent data has been widely used to as a proxy for technological capabilities, learning and innovativeness (Cockburn and Henderson, 1998; Stuart and Podlony, 1996; Stuart, 2000; Ahuja and Katila, 2001).

Technological profiles of all firms are computed to find out whether a patent in a particular year has to be categorized as "exploitative" or "explorative". This categorization is based on the international patent class of each patent provided by the NUS patent database. Each international patent class is a hierarchical seven-digit code comprising combined symbols representing the section, class, subclass and group[4]. Based on the classification, a firm's technological profiles can be created by adding up the patents that a firm received in each patent class during the five years prior to a given year. A moving window of 5 years is the appropriate time frame for assessing the technological impact (Podolny and Stuart, 1995; Stuart and Podolny, 1996; Henderson and Cockburn, 1996; Ahuja, 2000). Studies about R&D depreciation (Griliches, 1984) have suggested that knowledge capital depreciates sharply, losing most of its economic value within 5 years. As a result, a 5-year period is appropriate to assess the technological profile of a firm.

These technology profiles allow us to make a distinction between exploitative and explorative technology classes. Classes where a firm had not received a patent in

[3] NUS patent database (http://patents.nus.edu/) contains all US patents issued between 1976 and 2004 by US Patent Office. Technological classes, citation counts, and inventor and assignee details are included.

[4] For example, A 01 B 2/34 is an international patent class. A--section, 01--class, B--subclass, 2/34--group/subgroup.

the prior five years but did receive a patent in the year of observation is considered as "explorative" patent classes. I choose the year when the firm filed for the patent rather than the year when it was granted because the learning benefits for the firm would have been realized as of the filing. All the classes where a firm had successfully applied for a patent in the previous five years and successfully applied for a patent in the year of observation is considered "exploitative" patent classes.

The dependent variable EXPLORE is then calculated by adding up all the patents applied for in the year of observation in the "explorative" patent classes. In other words, explorative learning is considered to take place when a firm first applies a patent in a new class in which it had not patented in the previous five years. The same is done for the dependent variable EXPLOIT. By adding up the patents in the "exploitative" classes, we can obtain a measure for exploitative learning.

Considering that learning from another organization and then integrating that knowledge into a firm's own routines or technologies are time consuming processes (Stuart, 2000), I assume a two year lag between the regressors and dependent variables to address the time lag effect of the CVC investment on learning outcome. In other words, I examine the association between last two-year's value of independent variable and this year's EXPLORE and EXPLOIT value.

I do not exclude firms without patents in the sample. Instead, I keep all the 2666 observations and if the firm does not have any explorative or exploitative patent count, I give the value of zero (0) for the observation.

4.2.2. Independent Variables

Diversification of investment (DIVERSE). Empirical studies on diversification have commonly used Herfindahl-based measure to measure market diversification

(e.g. Hitt et al, 1997). Such measure is based on data of segment market shares. In the context of CVC investment activities however, so far there is no available data source which is able to provide the break-downed information on each firm's investment shares in different industries/markets.

Given the above, diversification of investment in this study is measured by the number of different industries the firm invests in its portfolio. The classification of industry is based on the first three digits of the 4-number US Standard Industry Code (SIC) of each investee in the portfolio. In other words, the market diversification of investment is measured as the number of different 3-digit SIC of the investees in the portfolio each year. The source of SIC code is from the VentureXpert database in SDC Platinum, CorpTech database[5] and Osiris database[6].

Tie strength. Prior social network studies have employed several different measures of "strength of ties" (Marsden and Campbell, 1984). In this study, I introduce three widely used constructs to measure tie strength: duration of ties, frequency of ties, and intensity level of ties. There are two sets of measures for tie strength in this study: the tie strength between each pair of investor and investee, and the overall tie strength between the investor and investees on the portfolio level.

For tie strength on the pair level, the duration of ties (DUR) is measured by the investment duration in terms of years between each firm-company pair, i.e. the duration between the year of the firm making its first investment and the year of observation. For the second construct frequency of ties (FQY) I use the number of cumulative investment rounds that a venture receives from the investor in the year of observation as a proxy[7]. Intensity level of ties (ITY) is measured as a dummy variable.

[5] CorpTech (www.corptech.com) provides business information of over 95,000 public and private hi-tech companies.
[6] Osiris database covers over 90 countries and includes over 22,000 publicly listed companies.
[7] Investment rounds could also be a proxy of commitment level to an area where the investing firms want

It is coded as one (1) if the firm and its investee have board interlock, i.e. a member of one organization sitting on the board of another. Otherwise, it is coded as zero (0). All the data for these three constructs are collected from the VentureXpert database in SDC Platinum. Accordingly, the corresponding measures of tie strength on the portfolio level are the average value of DUR, FRY and ITY in the investor's portfolio.

Technological relatedness (TECHREL). I use two measures for the technological relatedness between firms and companies. The first measure "Techrel_1" is based on science publication and conference information of the investor and investee. Based on the number of publications or conference proceedings sharing the same keyword(s), I give values of 0, 0.25, 0.5, or 1 to each investor-investee pair. Techrel_1 is coded as 0 if the investor firm and investee company do not have any publication or conference proceedings that share keywords within their abstracts during the year of observation. The two firms are treated as technologically unrelated. The technological relatedness receives a value of 0.25 if the pair has one or two publications or conference proceedings that share keyword(s) in their abstracts. Techrel_1 is coded as 0.5 if the pair has more than two but less than five publications or conference proceedings that share keyword(s). If they have five or more publications or conference proceedings that share keyword(s), it is coded as 1, meaning these two firms are highly technologically related to each other. I use databases like Web of Science, BIOSIS Review and ISI Proceedings to get publication/proceeding data for each firm and company.

Considering the fact that publication is only one aspect that reflects a firm's technological status (which might cause a bias if the construct is solely based on it), I use the second alternative measure "Techrel_2" based on patent information provided

to exploit with the investee companies. A more accurate measure would be first-hand data on communication frequency in the CVC investment relationship. However, such data is not available due to data source and collection constrain. Therefore investment rounds is used as an alternative proxy here.

by NUS patent database. The database provides information of international patent classification for each issued patent. As mentioned before, an international patent class is a hierarchical code comprising combined symbols representing section, class, subclass and group. In order to test the effects of the relatedness, a method similar to the first measure is used: the firm-company pairs are divided into four groups: Unrelated (coded as 0), moderately related (0.25), closely related (0.5) and highly related (1). The Techrel_2 variable is coded as 0 if the investee has no patent that falls in the same class of its investing firm's patent stock. The variable is coded as 0.25 if the venture has patents that share the same classes as the firm's patents. Similarly, it is coded as 0.5 when they have the same subclasses. When there are patents of the venture having the same main group or subgroup coding as the investing firm's patents, this variable is coded as 1. Following Jaffe (1986), a continue construct of technological relatedness based on patent information is also derived from the above mention patent profiles of both investing firms and invested companies. This continuous measure is used in the sensitivity tests.

Market relatedness (MKTREL). The most common technique to assess market similarity relies on SIC codes (Chatterjee and Blocher 1992). SIC-based measures of relatedness mainly measure product-market similarities between different business lines. In my samples, firm-company pairs operating in the same or similar industries are considered to serve similar markets. Therefore, I construct the variable market relatedness based on the overlaps of 4-digit Standard Industry Codes (SIC) of the investors and investees. By comparing the SIC codes of each investor-investee pair, this construct has face validity.

The variable receives values 1, 0.75, 0.5 or 0.25 if the firm and company have the same SIC code on four, three, two or one digit level, respectively. If the firm and company have totally different SIC code, then it receives a value of zero (0). Similar measures based on number of matching digit of primary SIC codes have been used to measure market relatedness in prior research (e.g. Finkelstein and Haleblian, 2002; Villalonga and McGahan, 2003). Appendix B lists the SIC codes and business description for all the investor-investee pairs. The data sources are from the SDC, CorpTech, Osiris, Dun & Bradstreet[8], and SEC[9] databases.

4.2.3. Control Variables

Firm size (SIZE). I include eight control variables in my regression models. Firstly, larger firms may have greater scope of technological opportunities, enabling firms to leverage their resources for successful explorative and exploitative learning. I measure a firm's size using a natural logarithm of the total firm assets (in millions of dollars). Each firm's total assets data are obtained from the CRSP/COMPUSTAT merged database provided by WRDS[10].

Firm age (FIRM_AGE). Secondly, firms with more experience are more likely to identify successful investment opportunities and possess a greater ability to acquire external knowledge that allows the firm to gain more learning benefits than those with less experience. Firm experience is measured as a firm's age based on its year of foundation. SDC database provides information of firms' foundation year.

Research & Development expenditure (R&D). The third control variable is the

[8] www.selectory.com
[9] www.sec.gov
[10] WRDS: Wharton Research Data Services.

natural logarithm of annual R&D expenditure. Firms with a larger disbursement in their R&D activities are typically able to acquire more knowledge and learning benefits. Data of annual R&D expenditure (in millions of dollar) is obtained from the CRSP/COMPUSTAT merged database provided by WRDS.

Sales Amount (SALES). The fourth control variable is the natural logarithm of a firm's annual sales amount. Firms with a larger sales amount possess larger financial resources, which could have an impact on their motivation and ability to acquire knowledge from outside sources. Data of annual sales amounts (in millions of dollar) are obtained from CRSP/COMPUSTAT merged database provided by WRDS.

Alliances of firms (ALLIANCE). Prior studies have shown that firms could enhance their learning and innovative performance by collaborating with strategic alliance partners (e.g. Stuart, 2000; Ahuja and Katila, 2001). To rule out the alternative explanation for learning benefits, I include the fifth control variable that measures a firm's alliances. This variable is measured by the number of cumulative alliances a firm has formed in the three years prior to the year of observation (Alliance_3). For sensitivity tests, I also use the number of alliances that a firm has formed in the prior two years as an alternative measure for this construct (Alliance_2). Alliance data in the biotechnology industry is obtained from the Recombinant Capital (Recap) alliances database[11]. For alliances in the semiconductor industry, I use a dataset containing alliances information in the information technology and communication (ITC) industry[12].

Co-investor networks (NETWORK). Social networks can enhance a firm's both explorative and exploitative learning outcome. Networks are vital to the

[11] Recap (www.recap.com) provides detailed information on alliances, earned alliance revenues, product sales, employment agreements, company profiles and capitalization in the biotechnology industry.
[12] The dataset was used in: Soh & Roberts, 2003. Networks of Innovators: A Longitudinal Perspective. Research Policy, 32 (9): 1537-1717

discovery of new entrepreneurial opportunities (Burt, 1992), as well as to exchange high-quality and fine-grained information and to establish trust-based governance (Uzzi, 1997). In the context of CVC investment, networks can be formed when several firms invest in a same venture, i.e. the relationship of being a co-investor. As a co-investor of the venture, a firm would be able to access a broader spectrum of information that the network provides. The breadth and heterogeneity of an organization's direct and indirect ties within the network could provide it additional sources of information. Thus, a firm can improve its ability to recognize and respond to new technological and market opportunities in the investment process and consequently enhance its explorative learning. At the same time, networks are also able to enhance firms' exploitative learning from CVC. By engaging in repeated formal and informal interactions within the network, firms are able to better absorb information and have a deeper understanding of applying specific technological and market knowledge. Therefore, co-investor networks have an impact on both explorative and exploitative learning from CVC investment.

Co-investor networks are measured by the number of cumulative co-investors a focal corporate investor has in the year of observation. Information on co-investment relationships is obtained from the SDC database.

Investment industry (INDSUTRY). The industry that a firm operates in is related with its innovation behavior (Nobel and Birkinshaw, 1998). Some innovation-related factors, such as technological opportunity and the availability of critical complementary assets, are strongly associated with industry sectors. This can directly affect the learning benefits a firm gains from CVC investments. I use a dummy variable to control this industry effect. The variable is coded as one (1) if the investment deal is in the biotechnology industry. For investments in the

semiconductor industry, the dummy variable is coded as zero (0).

Company age (COM_AGE). Lastly, the age of invested companies could affect an investing firm's learning outcome as well. Ventures in different stages possess different amounts of resources, knowledge bases and capabilities which would have impact on a firm's knowledge exploration and exploitation from the investments. To measure company ages, I collect data from the Web of Science/BIOSIS Review/ISI Proceedings to get each company's first scientific publication year, which is regarded as age one for the company. The corresponding value of company age for each observation (COM_AGE1) is based on this year. A second measure (COM_AGE2) is also developed for sensitivity tests. It is based on the application year of the first patent applied by the company. Similarly, the age value is then assigned to each observation based on this year.

4.3. METHOD

The hypotheses developed in Chapter 3 identify two dependent variables: explorative learning and exploitative learning. Hypotheses 1-6 predict how the relationship characteristics between investors and investees affect the explorative and exploitative learning benefits from CVC investments. I examine a sample of 516 firm-company pairs in the period from 1978 to 2002. Empirical validation of the hypotheses is done through a cross-sectional time series model.

A regression approach is used to test these hypotheses. In each regression model the dependent variable is regressed against a vector of explanatory variables including both hypothesized effects and control variables. A longitudinal research design is used, which pools the sample over firm-company pairs (i) and over time (t). As mentioned before, all independent variable are lagged by two years. The regression model

explaining the explorative learning can be written as follows:

$$EXPLORE_{it} = \beta_0 + \beta_1 Diverse_{it-2} + \beta_2 Techrel_{it-2} + \beta_3 Mktrel_{it-2} + \beta_4 Tie_{it-2} * Diverse_{it-2} + \beta_5 Tie_{it-2} * Techrel_{it-2} + \beta_6 Tie_{it-2} * Mktrel_{it-2} + \beta_7 Size_{it-2} + \beta_8 Firm\_age_{it-2} + \beta_9 R\&D_{it-2} + \beta_{10} Sales + \beta_{11} Alliance_{it-2} + \beta_{12} Network_{it-2} + \beta_{13} Industrydummy + \beta_{14} Com\_age_{it-2} + \varepsilon_{it-2}$$

The regression model explaining the exploitative learning can be written as follows:

$$EXPLOIT_{it} = \beta_0 + \beta_1 Diverse_{it-2} + \beta_2 Techrel_{it-2} + \beta_3 Mktrel_{it-2} + \beta_4 Tie_{it-2} * Diverse_{it-2} + \beta_5 Tie_{it-2} * Techrel_{it-2} + \beta_6 Tie_{it-2} * Mktrel_{it-2} + \beta_7 Size_{it-2} + \beta_8 Firm\_age_{it-2} + \beta_9 R\&D_{it-2} + \beta_{10} Sales + \beta_{11} Alliance_{it-2} + \beta_{12} Network_{it-2} + \beta_{13} Industrydummy + \beta_{14} Com\_age_{it-2} + \varepsilon_{it-2}$$

Given the dependant variables (Explore & Exploit) are integer numbers based on patent counts in a given year, a Poisson model is selected to address the discrete nature of the dependant variables. One of the important assumptions for Poisson distribution is that the mean and variance are equal. By checking each independent variable's mean and variance, I did not find severe violation of this assumption. A likelihood ratio test also showed that the data did not violate the Poisson regression model assumptions. Therefore, using the Poisson model to test the hypotheses is appropriate in this study. To test the robustness, I also include alternative measures of some key variables in the model to verify the sensitivity of the results.

I test my hypotheses with hierarchical regression analysis to determine the amount of additional variance that is explained by the independent variables after controls. I enter control variables in step one and then add independent variables one by one until the full model is reached.

In summary, I adopt a Poisson model with lagged independent variables to test my hypotheses using a cross-sectional time series dataset with hierarchical regression analysis. For the sensitivity tests, I also adopt alternative measures for some key

constructs in the model. Stata 8.2, a statistical software package, is used for testing all the regression models. In the next chapter, I will report the results of these tests.

CHAPTER 5. RESULTS

In this chapter I report the results of the hypotheses testing. First, I report the descriptive statistics and second, I present the results of hierarchical regression analysis using Poisson models. The third section presents the sensitivity tests by reporting results using alternative key measures. The last section summarizes the key results of the statistical tests.

5.1. DESCRIPTIVE STATISTICS

Table 5.1 reports descriptive statistics and the correlation matrix for all variables. On average, the sample firms applied for approximately nine patents each year under new patent classes compared to the previous five years (the mean of "Explore" is 8.83). For "exploitative" patents, the firms introduced about thirty-seven patents under old patent classes for each year (the mean of "Exploit" is 37.26).

In the correlation matrix, the correlations between independents variables are not deemed high enough to warrant the problem of multicollinearity (except in the case of two pairs of measurements: Alliance_2& Alliance 3; Techrel1 & Techrel2). Since in the regression models only one measure is used, the high correlations would not create severe problems.

5.2. RESULTS OF REGRESSION ANALYSIS

In this section, I first present the results of hierarchical regression predicting explorative learning. Followed by the results on explorative learning, the results on exploitative learning are presented. All results are based on Poisson models.

In each table of regression results, Model 1 is the base model only including control variables. Model 2 to 6 test the hypotheses of main effects (i.e. Hypothesis 1,

3, and 4). Model 7 to 15 include the interaction terms and test Hypothesis 2, 5 and 6. The rest of the models add main effects and interaction terms one by one until the full model is reached. The same reporting patterns are used in the sensitivity tests in the next section.

5.2.1. Results on Explorative Learning

Table 5.2 presents the Poisson regression models predicting explorative learning. In baseline Model 1, firm size, firm age, R&D expense, sales, number of alliances, co-investor network, industry dummy and company age are included as control variables. Among these control variables, two of them are significant ("Alliance" with coefficient of 0.002, $p<0.05$; and "Network" with coefficient of 0.367, $p<0.001$).As expected, the more alliances the corporate investors have and the larger the co-investor networks, the more explorative learning benefits the firm gains.

Model 2 tests Hypothesis 1a, predicting the more market diverse CVC investment is the more explorative learning benefits an investor firm gains. After including control variables as applied in the baseline model, the positive and significant coefficient of the variable "Diverse" $\beta=0.151$, $p<0.01$) provides strong support for Hypothesis 1a.

Model 3 and 4 test Hypothesis 3a, which predicts an inverted U relationship between technological relatedness and explorative learning benefits a firm gains. The results of Model 3 show that the coefficient of technological relatedness is at a significant level with a positive sign ($\beta=0.189$, $p<0.01$), indicating that more explorative learning takes place when the investing firm is more technologically related to the invested company. However, the results of Model 4 suggest that after a certain point, the relationship becomes a negative one, supported by the significant

negative sign of the square term of technological relatedness (β= -0.476, p<0.01). The results suggest an inverted U relationship and therefore Hypothesis 3a is supported.

Hypothesis 4a predicts the same inverted U relationship between market relatedness and explorative learning. Model 5 and 6 test this hypothesis, and the results do not support it. Rather, the positive sign in Model 5 (coefficient of "Mktrel" is 0.384, p<0.01) suggests that more explorative learning takes place when the markets are closely related.

Hypothesis 2a proposes a positive moderating effect of tie strength on the relationship between investment diversification and explorative learning. In other words, the positive relationship between market diversification and explorative learning will be strengthened the stronger the tie strength is. Measuring tie strength in three different dimensions (duration, frequency and intensity), I test Hypothesis 2a in model 7, 8, and 9. The results of Model 7 suggests that the duration of investment has a positive moderating effect on explorative learning, but the effect is not significant. In Model 8 I use frequency as the tie strength measure. The results suggest that the frequency itself has a significant positive relationship with explorative learning (β= 0.151, p<0.01). However, its moderating effect is negative (coefficient of "Diverse*Fqy" is -0.016, p<0.01) . In Model 9 the results suggest that the intensity level of tie strength between the investor and investee has a significant positive moderating effect on explorative learning (coefficient of "Diverse*Ity" is 0.270, p<0.01). Therefore, the results of model 7 to 9 provide partial support for Hypothesis 2a.

The results of Hypothesis 5a, which predicts the enhancing effect of tie strength on the relationship between technological relatedness and explorative learning, are presented in Model 10, 11 and 12. The results of Model 11 suggest the frequency of

tie strength has a negative moderating effect on explorative learning (β=-0.060, p<0.01). Model 10 and 12 do not provide support to the hypothesis either.

The results of the moderating effect of tie strength on market relatedness and explorative learning (Hypothesis 6a) are shown in Model 13 to 15. Overall, the results do not provide support for the enhancing role of tie strength as hypothesized. Again, Model 14 suggests that there is a negative moderating effect of frequency on explorative learning (β=0.070, p< 0.01).

Model 16 through 20 add the variable of each main effect hypothesis and interaction terms one by one. Model 16 provides support for Hypothesis 1a (a positive relationship between investment diversification and explorative learning) and Hypothesis 3a (an inverted U relationship between technological relatedness and explorative learning). Model 17 presents the full model for all the main effect hypotheses. It confirms the above results and a positive relationship between market relatedness and explorative learning (Hypothesis 4a). Based on the full model for all the main effect hypotheses, Model 18 to 20 add the interaction terms between main effect and tie strength. Model 18 and 19 provide partial support for Hypothesis 2a but no support for Hypothesis 5a, suggesting the moderating effect of duration and intensity level of ties on the relationship between market diversification and explorative learning. In addition, it also suggests a negative moderating effect of the frequency of ties. Finally, Model 20 includes all the hypotheses, whose results are consistent with the previous models, yet provide no support for Hypothesis 6a (moderating effect of tie strength on market relatedness and explorative learning).

5.2.2. Results on Exploitative Learning

The Poisson regression models predicting exploitative learning are reported in

Table 5.3. Model 1 reports the baseline model where control variables are included. The positive and significant coefficient of firm size (β=0.286, $p<0.01$), firm age (β=0.005, $p<0.1$), sales (β=0.295, $p<0.01$), number of alliances (β=0.008, $p<0.01$) and co-investor network (β=0.165, $p<0.01$)are as expected. Interestingly, the negative sign of R&D expenses indicates that more R&D expenses would not necessarily bring more exploitative learning benefits to the firm.

Hypothesis 1b proposes that more market diversification in CVC investments would lead to less exploitative learning benefits for the investing firm. Model 2 tests this hypothesis, and its significant positive sign provides (β=-0.007, $p<0.1$) support for the hypothesis.

Hypothesis 3b predicts that an investing firm gains more exploitative learning benefits from a company that is more technologically related. The positive and significant sign in Model 3 supports this hypothesis (β=1.095, $p<0.01$). Moreover, the results of Model 4 indicate there is no inverted U relationship as in the explorative learning.

Hypothesis 4b focuses on the role of market relatedness to exploitative learning. Model 5 tests this hypothesis and the positive and significant sign of the coefficient (β=2.571, $p<0.1$) provides support to Hypothesis 4b. Model 6 further confirms this result.

Model 7 to 9 test Hypothesis 2b, which predicts that the negative relationship between investment diversification and exploitative learning is weakened by a stronger tie between the two firms. Results from Model 7 suggest that the relationship between diversification and exploitative learning is negative as hypothesized (the coefficient of “Diverse” is -0.025, $p<0.01$), and that investment duration weakens this relationship (the coefficient of “Diverse*Dur” is 0.003, $p<0.01$). This result provides

support for H2b. However, Model 8 and 9 indicate the frequency and intensity of ties do not have a hypothesized moderating effect on the relationship. Rather, the results suggest that stronger ties strengthen the negative relationship between investment diversification and exploitative learning. Overall, the results of these three models provide partial support for Hypothesis 2b.

The results of Hypothesis 5b, which predicts an enhancing effect of tie strength on the relationship between technological relatedness and exploitative learning, are presented in Model 10, 11 and 12. The positive and significant sign of the interaction term (duration of tie) in Model 10 provides support for H5b ($\beta=0.029$, $p<0.01$). When using frequency of tie as in Model 11, the results suggest the moderating effect is negative.

With regard to the moderating effect on market relatedness and exploitative learning (Hypothesis 6b), the results are shown in Model 13 to 15. Overall, these results are the same as with technological relatedness. Model 13 provides support for the enhancing role of longer duration of ties as hypothesized ($\beta=0.011$, $p<0.05$). Model 14 indicates a negative moderating effect on exploitative learning when using the frequency of tie as the tie strength measure.

Model 16 to 20 add the variable of each main effect hypothesis and interaction terms one by one. Model 17 presents the full model for all the main effect hypotheses of exploitative learning. Consistent with previous results, Hypothesis 1b (diversification of investment), Hypothesis 3b (technological relatedness) and Hypothesis 4b (market relatedness) are supported. Finally, based on the full model for all the main effect hypotheses, Model 18 to 20 add interaction terms between main effects and tie strength. Model 18 provides partial support for Hypothesis 2b, suggesting a moderating effect of duration of ties on the relationship between market

diversification and exploitative learning benefit. Model 19 also suggests the duration of ties can strengthen the positive relationship between technological relatedness and exploitative learning. Finally, Model 20 includes all the hypotheses and its results are consistent with the previous models. The results, however, provide no support for Hypothesis 6b (the moderating effect of tie strength on market relatedness and exploitative learning).

5.3. RESULTS OF SENSITIVITY TESTS

The robustness of the results is tested in this section. I use several alternative measures of the key variables to test the sensitivity of the results. For the control variable "Alliance", I use the number of alliances a firm has formed in the previous two years in the sensitivity tests (compared with alliances in prior three years in the original tests). For the age of companies, I use the alternative measure based on patent information (compared with publication information). Besides, I also include one key independent variable "technological relatedness", using its alternative continuous measures based on patent data instead of publication data.

Table 5.4 presents the sensitivity test results on explorative learning. Overall, the results based on the alternative measures exhibit a very similar pattern to the original results reported in the Table 5.2. Model 2 to 6 test the main effect hypotheses. The results are consistent with the previous results, providing support for Hypothesis 1a (a positive relationship between market diversification and explorative learning), Hypothesis 3a (an inverted U relationship between technological relatedness and explorative learning), and suggesting a positive relationship between market relatedness and explorative learning (Hypothesis 4a). In the models from Model 7 to Model 15, which include the interaction terms, the results are consistent with the

original results too. They confirm the moderating effect of tie strength (as in duration of tie and intensity of tie) on the relationship between market diversification and explorative learning, providing partial support for Hypothesis 2a. These results are further confirmed in Model 16 to 20 which include both the main hypotheses and interaction terms.

Results of sensitivity tests on exploitative learning are reported in Table 5.5. Overall, the pattern is similar to the original results in Table 5.3. Model 2 provides support for Hypothesis 1b, suggesting a negative relationship between market diversification and exploitative learning. Model 3 and 4 provide support for Hypothesis 3b (a positive relationship between technological relatedness and exploitative learning), and Model 5 and 6 for Hypothesis 4b (a positive relationship between market relatedness and exploitative learning). Finally, in models including the interaction terms, consistent with previous results, the results provide partial support for Hypothesis 2b, 5b and 6b, suggesting the duration of ties has a positive moderating effect on exploitative learning.

5.4. SUMMARY

Table 5.6 (presented at the end of this chapter) summarizes all the hypotheses and the corresponding results from the statistical analysis. Similarly, Figure 5.1 reports the hypotheses model of this study with the statistic results. Hypothesis 1 predicts that the market diversification of CVC investments has a positive relationship with explorative learning, but a negative relationship with exploitative learning. The results of the regression models support both hypothesis 1a and hypothesis 1b.

Hypothesis 2 proposes a moderating effect of tie strength on the relationship between investment diversification and learning benefits. The regression results show

a positive moderating effect of tie strength on both explorative learning and exploitative learning when using the duration of ties as the measurement. In other words, it provides support that the longer duration of ties between the investor-investee, the more learning benefits the investing firm would gain from investing in diverse markets. Therefore, hypothesis 2a and hypothesis 2b are partially supported.

Hypothesis 3 predicts that technological relatedness has an inverted U relationship with explorative learning, but a positive relationship with exploitative learning. The results provide support for both hypothesis 3a and hypothesis 3b.

Hypothesis 4 further predicts the effect of market relatedness on knowledge exploration and exploitation. The results do not provide support for hypothesis 4a, i.e. an inverted U relationship between market relatedness and explorative learning. Rather, the results suggest the relationship is positive. However, the predicted positive relationship with exploitative learning is confirmed and therefore hypothesis 4b is supported.

Finally, Hypothesis 5 and 6 predict the moderating effect of tie strength on the relationship between technological/market relatedness and the learning benefits. The results provide partial support for Hypothesis 5b and Hypothesis 6b, suggesting a stronger tie could enhance the exploitative learning benefits gained from investing in ventures that are technologically and market related. However, the results do not provide support for Hypothesis 5a or Hypothesis 6a. The moderating effect of tie strength is not found on the relationship between relatedness and explorative learning.

Table 5.1. Descriptive Statistics and Correlation Matrix[a,b,c]

	Mean	S.D.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.
1. Explore	8.83	14.17	1																														
2. Exploit	37.26	110.25	.762	1																													
3. Size	16239.66	28456.24	.234	.205	1																												
4. Firm_Age	10.97	13.07	-.007	.010	.194	1																											
5. R&D	926.84	1306.70	.165	.041	.541	.278	1																										
6. Sales	105.74	194.66	.081	.015	.277	.234	.813	1																									
7. Alliance_2	12.50	30.59	.056	.009	.089	.144	.410	.279	1																								
8. Alliance_3	15.95	39.81	.059	.008	.091	.147	.412	.278	.996	1																							
9. Network	0.55	0.98	.798	.554	.162	-.016	.196	.153	-.069	-.064	1																						
10. Industry	0.47	0.50	-.048	-.072	-.103	-.015	-.088	-.111	.346	.344	-.267	1																					
11.Com_age1	4.48	2.97	-.009	-.009	-.058	.147	-.080	-.108	.022	.034	.039	-.019	1																				
12.Com_age2	4.23	3.34	-.052	-.045	-.124	.139	-.129	-.124	.006	.014	.028	-.030	.857	1																			
13. Diverse (DVS)	2.99	1.98	.634	.377	.133	.059	.280	.175	.381	.381	.452	.270	-.038	-.078	1																		
14. Duration(DUR)	3.66	2.33	.038	.040	-.078	.060	-.115	-.127	.007	.017	.060	.030	.661	.287	.003	1																	
15.Frequency (FQY)	1.96	1.44	.206	.187	-.145	-.036	-.059	-.035	.189	.190	.139	.352	.209	.045	.349	.370	1																
16. Intensity (ITY)	0.03	0.16	-.025	-.032	.077	.027	.088	.053	.065	.063	-.015	-.060	-.051	-.025	-.007	-.056	-.048	1															
17.Dur_Avg	3.66	2.02	.042	.046	-.089	.065	-.134	-.148	.007	.018	.056	.047	.580	.240	.011	.863	.361	-.013	1														
18.Fqy_Avg	1.95	1.34	.214	.199	-.159	-.036	-.074	-.045	.182	.183	.157	.358	.183	.048	.380	.337	.935	-.053	.385	1													
19.ITY_Avg	0.03	0.11	-.040	-.045	.117	.051	.140	.083	.110	.112	-.036	-.043	-.028	-.029	.009	-.018	-.075	.661	-.021	-.078	1												
20. Techrel_1	0.23	0.33	.477	.457	-.027	-.095	-.046	-.006	.085	.080	.425	.188	.029	-.051	.420	.083	.466	-.057	.098	.495	-.074	1											
21. Techrel_2	0.29	0.36	.515	.515	-.029	-.100	-.063	-.007	.082	.079	.463	.250	.000	-.042	.462	.107	.525	-.060	.125	.545	-.067	.880	1										
22. Mktrel	0.28	0.35	.251	.267	-.154	-.051	-.102	-.059	.168	.169	.222	.202	.072	.109	.276	.087	.318	-.026	.121	.357	-.039	.403	.479	1									
23. DVS*Dur_Avg	11.00	9.56	.519	.325	.045	.074	.105	.020	.297	.304	.378	.234	.296	.070	.745	.483	.527	-.012	.566	.568	-.001	.412	.462	.322	1								
24. DVS*Fqy_Avg	6.84	8.65	.456	.290	-.043	-.025	.083	.048	.275	.274	.363	.373	.060	-.030	.753	.179	.749	-.040	.210	.806	-.049	.525	.562	.383	.757	1							
25.DVS*Ity_Avg	0.08	0.32	.016	-.041	.128	.063	.238	.156	.321	.326	-.013	.055	.001	-.025	.208	-.008	-.057	.514	-.010	-.054	.795	-.061	-.059	.017	.130	.033	1						
26.TR_1*DUR	0.89	1.66	.391	.365	-.036	-.053	-.060	-.042	.073	.075	.365	.149	.258	.053	.338	.425	.542	-.063	.357	.546	-.056	.806	.709	.368	.559	.522	-.048	1					

27.TR_1*FRQ	0.66	1.36	.331	.331	-.071	-.057	-.020	.006	.153	.152	.286	.299	.100	-.004	.393	.194	.742	-.067	.201	.740	-.080	.820	.720	.393	.488	.718	-.077	.795	1	
28.TR_1*ITY	0.00	0.04	.033	.036	.014	-.011	.044	.071	.000	-.002	.069	-.026	-.030	-.014	.019	-.040	-.044	.432	.015	-.014	.165	.084	.062	.051	.021	-.007	.219	.016	-.002	1	
29.MR*DUR	1.11	1.87	.223	.221	-.126	-.012	-.085	-.058	.136	.142	.225	.151	.330	.199	.221	.484	.440	-.047	.412	.449	-.036	.355	.412	.772	.468	.397	.006	.574	.440	.015	1
30.MR*FRQ	0.72	1.35	.255	.260	-.122	-.034	-.056	-.021	.178	.179	.223	.288	.136	.071	.348	.233	.722	-.049	.251	.727	-.066	.484	.545	.757	.480	.669	-.041	.541	.689	-.007	.765	1
31.MR*ITY	0.01	0.07	.020	.001	-.005	.005	.029	.016	.051	.054	.041	-.009	-.018	-.019	.054	-.045	-.036	.562	.008	-.015	.306	.011	.015	.116	.045	.008	.352	-.008	-.026	.568	.043	.021	1

a. All descriptive statistics reported from non-transformed values.
b. For Mean and S.D, number of observation N=2666, except Size (2178), R&D (1908), Sales (1900), Com_age1 (2417), Com_age2 (1120), Techrel_2 (2145).
c. Significant at the 0.001 level (two-tailed test) when coefficients of pairwise correlation > |0.072|.

Table 5.2. Poisson Regression Model Predicting Explorative Learning [a,b,c,]

Variables	Model																			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Constant	1.286***	1.270***	1.223***	1.113***	1.138***	1.139***	1.345***	1.052***	1.269***	1.197***	1.119***	1.224***	1.116***	1.061***	1.151***	1.059***	0.951***	0.924***	0.884***	0.864***
	(0.175)	(0.161)	(0.171)	(0.170)	(0.173)	(0.174)	(0.170)	(0.156)	(0.160)	(0.175)	(0.170)	(0.170)	(0.174)	(0.173)	(0.173)	(0.153)	(0.154)	(0.155)	(0.151)	(0.153)
Controls																				
Size[d]	0.025	-0.026	0.016	0.015	0.026	0.026	-0.037	-0.027	-0.008	0.024	0.012	0.015	0.029	0.023	0.026	-0.036	-0.028	-0.035	-0.029	-0.031
	(0.045)	(0.043)	(0.045)	(0.044)	(0.045)	(0.045)	(0.044)	(0.042)	(0.043)	(0.045)	(0.044)	(0.045)	(0.044)	(0.044)	(0.044)	(0.042)	(0.042)	(0.042)	(0.041)	(0.041)
Firm_Age	-0.003	-0.003	-0.002	-0.002	-0.004	-0.003	-0.002	-0.004	-0.003	-0.003	-0.002	-0.002	-0.004	-0.003	-0.004	-0.002	-0.003	-0.003	-0.003	-0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
R&D[d]	0.058	0.055	0.077	0.087	0.069	0.068	0.072	0.055	0.028	0.069	0.087	0.079	0.062	0.071	0.068	0.091	0.089	0.088	0.085	0.087
	(0.075)	(0.072)	(0.074)	(0.074)	(0.074)	(0.074)	(0.072)	(0.070)	(0.072)	(0.074)	(0.074)	(0.074)	(0.074)	(0.074)	(0.074)	(0.070)	(0.070)	(0.070)	(0.069)	(0.069)
Sales[d]	-0.008	0.012	-0.017	-0.024	-0.014	-0.014	0.005	0.008	0.024	-0.015	-0.023	-0.017	-0.009	-0.013	-0.013	-0.008	-0.010	-0.011	-0.013	-0.012
	(0.037)	(0.035)	(0.037)	(0.037)	(0.037)	(0.037)	(0.036)	(0.034)	(0.035)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.034)	(0.034)	(0.034)	(0.033)	(0.033)
Alliance[e]	0.002**	0.001	0.002**	0.002***	0.002**	0.002**	0.001	0.001	0.001	0.002**	0.002**	0.002**	0.002**	0.001***	0.002***	0.001*	0.001*	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Network	0.367***	0.259***	0.365***	0.364	0.362***	0.362***	0.254***	0.255***	0.261***	0.364***	0.363***	0.364***	0.362***	0.362	0.362	0.254***	0.250***	0.252***	0.250***	0.251***
	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.013)	(0.013)	(0.013)
Industry	0.020	-0.237***	0.011	0.002	-0.010	-0.012	-0.217***	-0.367***	-0.248***	-0.006	-0.036	0.010	-0.025	-0.045	-0.024	-0.268***	-0.285***	-0.363***	-0.432***	-0.436***
	(0.087)	(0.079)	(0.084)	(0.082)	(0.085)	(0.085)	(0.081)	(0.078)	(0.079)	(0.084)	(0.085)	(0.084)	(0.085)	(0.086)	(0.085)	(0.073)	(0.073)	(0.073)	(0.071)	(0.071)
Com_Age[f]	0.004	0.015***	0.003	0.003***	0.004	0.004	0.035***	0.001	0.015***	-0.022	-0.002	0.003	-0.022	0.000**	0.004***	0.013***	0.013***	0.022**	-0.019	-0.019
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.009)	(0.005)	(0.005)	(0.016)	(0.006)	(0.005)	(0.016)	(0.006)	(0.005)	(0.005)	(0.005)	(0.009)	(0.013)	(0.013)
Main effects																				
Diverse (H1a)		0.151***					0.143***	0.202***	0.147***							0.154***	0.153***	0.183***	0.182***	0.183***
		(0.008)					(0.010)	(0.011)	(0.008)							(0.008)	(0.008)	(0.012)	(0.013)	(0.013)
Techrel[g] **(H3a)**			0.189***	0.729***						0.238***	0.392***	0.184***				0.851***	0.793***	0.762***	0.924***	0.903***
			(0.053)	(0.167)						(0.070)	(0.094)	(0.053)				(0.163)	(0.163)	(0.161)	(0.166)	(0.167)
Techrel[2] **(H3a)**				-0.476***												-0.531***	-0.514***	-0.513***	-0.528***	-0.530***
				(0.140)												(0.138)	(0.137)	(0.136)	(0.141)	(0.142)
Mktrel (H4a)					0.384***	0.300							0.453***	0.516***	0.371		0.322*	0.176	0.155	0.187
					(0.080)	(0.185)							(0.087)	(0.096)	(0.081)		(0.183)	(0.182)	(0.182)	(0.184)
Mktrel[2] **(H4a)**						0.107											-0.038	0.035	0.040	0.069
						(0.213)											(0.203)	(0.201)	(0.199)	(0.202)

Tie strength																			
Duration						0.033*			0.038**								0.044***	0.048***	
(Dur)						(0.017)			(0.017)								(0.017)	(0.018)	
Frequency							0.056***			0.058***							0.106***	0.114***	
(Fqy)							(0.019)			(0.020)							(0.026)	(0.028)	
Intensity								-0.245			-0.580						-0.114	-0.221	
(Ity)								(0.231)			(0.284)						(0.203)	(0.255)	
Dur_Avg			-0.040***												-0.060***	-0.064***	-0.067***		
			(0.014)												(0.014)	(0.016)	(0.016)		
Fqy_Avg				0.151***											0.155***	0.082***	0.088***		
				(0.021)											(0.022)	(0.027)	(0.028)		
Ity_Avg					-1.289***										-0.945**	-0.988**	-0.901**		
					(0.401)										(0.386)	(0.398)	(0.414)		
Interactions																			
Diverse*Dur			0.003												0.007***	0.010***	0.010***		
(H2a)			(0.002)												(0.002)	(0.002)	(0.002)		
Diverse*Fqy				-0.016***											-0.020***	-0.023***	-0.023***		
(H2a)				(0.003)											(0.004)	(0.004)	(0.004)		
Diverse*Ity					0.270***										0.211**	0.225**	0.207**		
(H2a)					(0.091)										(0.089)	(0.090)	(0.094)		
TechRel*Dur						-0.011										-0.029**	-0.024*		
(H5a)						(0.010)										(0.013)	(0.014)		
TechRel*Fqy							-0.060***									-0.008	-0.007		
(H5a)							(0.022)									(0.025)	(0.026)		
TechRel*Ity								0.241								0.019	-0.011		
(H5a)								(0.398)								(0.365)	(0.376)		
MktRel*Dur									-0.020**								-0.007		
(H6a)									(0.010)								(0.014)		
MktRel*Fqy										-0.070***							-0.018		
(H6a)										(0.025)							(0.031)		
MktRel*Ity											0.846						0.286		
(H6a)											(0.558)						(0.448)		
Log-likelihood	-4497.08	-4295.50	-4490.68	-4484.95	-4485.77	-4485.65	-4291.17	-4268.66	-4290.44	-4488.75	-4486.03	-4490.13	-4482.30	-4481.01	-4483.94	-4276.35	-4268.61	-4235.62	-4215.97	-4215.06
Wald chi-square	1267.70	1697.32	1285.45	1308.47	1380.15	1380.62	1701.79	1789.29	1716.10	1291.48	1300.72	1287.95	1316.85	1316.48	1318.77	1777.61	1829.06	1944.60	2022.86	2027.87

Note:

a. *p<0.1; **p<0.05; ***p<0.01, all two-tailed tests.
b. Cell entries are coefficient estimates. Numbers in parentheses are standard errors.
c. No.of observation = 1731; No. of groups = 315.
d. Logarithmic transformation.
e. Used Alliance_3 (number of cumulative alliances a firm formed in the prior 3 years).
f. Used Com_age1 (based on publication data).
g. Used Techrel_1 (based on publication data).

Table 5.3. Poisson Regression Model Predicting Exploitative Learning [a,b,c,]

Variables	Model																			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Constant	4.539***	4.527***	3.732***	4.085***	4.142***	4.136***	4.672***	3.791***	4.455***	4.048***	3.233***	3.752***	4.378***	3.602***	4.166***	3.728***	3.494***	3.422***	3.421***	3.196***
	(0.163)	(0.163)	(0.149)	(0.154)	(0.163)	(0.164)	(0.168)	(0.154)	(0.163)	(0.156)	(0.143)	(0.150)	(0.170)	(0.157)	(0.165)	(0.149)	(0.153)	(0.155)	(0.156)	(0.158)
Controls																				
Size[d]	0.286***	0.292***	0.327***	0.307***	0.201***	0.202***	0.293***	0.307***	0.318***	0.303***	0.361***	0.328***	0.204***	0.254***	0.202***	0.329***	0.247***	0.215***	0.202***	0.210***
	(0.024)	(0.025)	(0.024)	(0.024)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.024)	(0.024)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.026)	(0.026)	(0.026)
Firm_Age	0.005*	0.005*	-0.001	-0.001	-0.006**	-0.006**	0.004	0.008*	0.004	-0.001	0.003	-0.001	-0.007*	0.001	-0.006**	-0.001	-0.010***	-0.006**	-0.005*	-0.004
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
R&D[d]	-0.738***	-0.738***	-0.742***	-0.745***	-0.665***	-0.666***	-0.766***	-0.700***	-0.771***	-0.726***	-0.722***	-0.743***	-0.679***	-0.652***	-0.666***	-0.742***	-0.738***	-0.629***	-0.612***	-0.610***
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.042)	(0.043)	(0.043)
Sales[d]	0.295***	0.294***	0.267***	0.285***	0.280***	0.280***	0.319***	0.239***	0.310***	0.268***	0.247***	0.268***	0.282***	0.259***	0.281***	0.267***	0.295***	0.214***	0.220***	0.226***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Alliance[e]	0.008***	0.008***	0.007***	0.007***	0.009***	0.009***	0.009***	0.005***	0.009***	0.007***	0.004***	0.007***	0.010***	0.006***	0.009***	0.007***	0.008***	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Network	0.165***	0.169***	0.154***	0.155***	0.128***	0.128***	0.176***	0.145***	0.169***	0.156***	0.140***	0.154***	0.129***	0.117***	0.128***	0.156***	0.122***	0.117***	0.115***	0.113***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Industry	-0.805***	-0.796***	-0.765***	-0.796***	-1.064***	-1.061***	-0.827***	-1.462***	-0.810***	-0.847***	-1.374***	-0.788***	-1.141***	-1.522***	-1.087***	-0.762***	-1.028***	-1.389***	-1.509***	-1.534***
	(0.157)	(0.157)	(0.135)	(0.139)	(0.148)	(0.147)	(0.157)	(0.141)	(0.157)	(0.136)	(0.121)	(0.135)	(0.150)	(0.137)	(0.149)	(0.135)	(0.130)	(0.123)	(0.120)	(0.118)
Com_Age[f]	-0.002	-0.002	0.002	0.002	0.007**	0.007**	-0.020***	-0.059***	-0.002	-0.110***	-0.059***	0.002	-0.114***	-0.050***	0.007**	0.002	0.009***	-0.024***	-0.093***	-0.093***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.004)	(0.004)	(0.013)	(0.004)	(0.004)	(0.014)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.013)	(0.013)
Main effects																				
Diverse (H1a)		-0.007*					-0.025***	0.080***	-0.009**							-0.003	-0.001	0.055	0.062*	0.069*
		(0.004)					(0.006)	(0.006)	(0.004)							(0.008)	(0.004)	(0.007)	(0.007)	(0.007)
Techrel[g] **(H3a)**			1.095***	-0.113						0.949***	1.228***	1.097***				1.094***	0.943***	0.806***	0.948***	0.917***
			(0.030)	(0.104)						(0.039)	(0.055)	(0.030)				(0.030)	(0.030)	(0.031)	(0.057)	(0.058)
Techrel^2**(H3a)**				1.008***																
				(0.084)																
Mktrel (H4a)					2.571***	2.625***							2.524***	2.340***	2.571		2.332***	2.013***	1.940***	2.102***
					(0.055)	(0.125)							(0.058)	(0.062)	(0.055)		(0.055)	(0.056)	(0.056)	(0.063)
Mktrel^2**(H4a)**						-0.080														
						(0.166)														

Tie strength																			
Duration						0.097***		0.119***									0.030**	0.048***	
(Dur)						(0.013)		(0.014)									(0.015)	(0.015)	
Frequency							0.284***		0.246***								0.150***	0.173***	
(Fqy)							(0.011)		(0.011)								(0.014)	(0.017)	
Intensity								-0.500		-0.493							-0.608*	-0.574	
(Ity)								(0.404)		(0.593)							(0.355)	(0.462)	
Dur_Avg		0.006***													-0.053***	-0.033***	-0.037***		
		(0.007)													(0.007)	(0.008)	(0.008)		
Fqy_Avg			0.384***												0.329***	0.247***	0.267***		
			(0.010)												(0.010)	(0.013)	(0.013)		
Ity_Avg				0.647											1.545***	1.413***	1.376**		
				(0.434)											(0.425)	(0.425)	(0.428)		
Interactions																			
Diverse*Dur		0.003***													0.009***	0.008***	0.007***		
(H2a)		(0.001)													(0.001)	(0.001)	(0.001)		
Diverse*Fqy			-0.020***												-0.024***	-0.025***	-0.026***		
(H2a)			(0.002)												(0.002)	(0.002)	(0.002)		
Diverse*Ity				-0.308***											-0.310***	-0.296**	-0.293**		
(H2a)				(0.109)											(0.107)	(0.107)	(0.007)		
TechRel*Dur						0.029***										0.028***	0.041***		
(H5a)						(0.005)										(0.007)	(0.007)		
TechRel*Fqy							-0.063***									-0.066***	-0.079***		
(H5a)							(0.012)									(0.013)	(0.013)		
TechRel*Ity								-0.136								-0.109	-0.028		
(H5a)								(0.320)								(0.321)	(0.324)		
MktRel*Dur									0.011**								-0.042***		
(H6a)									(0.005)								(0.007)		
MktRel*Fqy										-0.043***							-0.020		
(H6a)										(0.013)							(0.017)		
MktRel*Ity											-0.333						-0.185		
(H6a)											(1.351)						(0.957)		
Log-likelihood	-10848.81	-10847.07	-10145.03	-10072.56	-9687.62	-9687.50	-10831.08	-9710.88	-10824.86	-10094.36	-9402.77	-10143.78	-9647.70	-9098.08	-9686.57	-10144.77	-9186.01	-8506.08	-8426.01	-8393.08
Wald chi-square	1693.55	1696.00	3005.52	3139.47	3815.21	3816.84	1725.81	3733.46	1737.04	3124.25	4313.28	3008.53	3871.86	4890.72	3818.84	3004.59	4770.19	5982.40	6176.75	6227.99

Note:

a. *p<0.1; **p<0.05; ***p<0.01, all two-tailed tests.
b. Cell entries are coefficient estimates. Numbers in parentheses are standard errors.
c. No.of observation = 1731; No. of groups = 315.
d. Logarithmic transformation.
e. Used Alliance_3 (number of cumulative alliances a firm formed in the prior 3 years).
f. Used Com_age1 (based on publication data).
g. Used Techrel_1 (based on publication data).

Table 5.4. Sensitivity Tests Predicting Explorative Learning [a,b,c,]

Variables	Model																			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Constant	1.246***	1.335***	1.038***	1.042***	0.967***	0.985***	1.428***	0.906***	1.338***	1.020***	0.951***	1040***	1.020***	0.917***	0.973***	1.084***	0.794***	0.531*	0.459	0.482
	(0.350)	(0.318)	(0.352)	(0.353)	(0.346)	(0.343)	(0.315)	(0.301)	(0320)	(0.358)	(0.350)	(0350)	(0.345)	(0.341)	(0.345)	(0.321)	(0.314)	(0.294)	(0.298)	(0.298)
Controls																				
Size[d]	0.007	-0.045	0.029	0.029	0.031	0.022	-0.046	-0.006	0.023	0.016	0.056	0.024	0.035	0.044	0.028	-0.017	0.002	0.044	0.051	0.060
	(0.096)	(0.091)	(0.095)	(0.095)	(0.095)	(0.095)	(0.090)	(0.087)	(0.093)	(0.097)	(0.093)	(0.095)	(0.096)	(0.094)	(0.095)	(0.089)	(0.088)	(0.084)	(0.083)	(0.083)
Firm_Age	-0.004	-0.004	-0.004	-0.004	-0.007	-0.0074	-0.004	-0.007	-0.004	-0.003	-0.005	-0.004	-0.006	-0.007	-0.007	-0.004	-0.008	-0.009*	-0.008	-0.009*
	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.005)	(0.005)	(0.005)
R&D[d]	0.175	0.146	0.167	0.167	0.157	0.165	0.153	0.081	0.110	0.191	0.135	0.173	0.156	0.140	0.162	0.134	0.120	0.059	0.043	0.033
	(0.156)	(0.148)	(0.155)	(0.155)	(0.154)	(0.154)	(0.146)	(0.141)	(0.151)	(0.157)	(0.151)	(0.155)	(0.155)	(0.152)	(0.154)	(0.145)	(0.143)	(0.138)	(0.136)	(0.135)
Sales[d]	-0.067	-0.026	-0.077	-0.077	-0.068	-0.069	-0.028	-0.012	-0.011	-0.086	-0.076	-0.080	-0.073	-0.067	-0.067	-0.038	-0.039	-0.030	-0.031	-0.029
	(0.074)	(0.069)	(0.074)	(0.074)	(0.073)	(0.073)	(0.068)	(0.065)	(0.070)	(0.075)	(0.071)	(0.074)	(0.073)	(0.072)	(0.073)	(0.068)	(0.067)	(0.063)	(0.062)	(0.061)
Alliance[e]	0.002	0.001	0.003*	0.003*	0.002	0.002	0.001	0.001	0.001	0.003	0.004**	0.003*	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Network	0.323***	0.241***	0.332***	0.332***	0.315***	0.314***	0.260***	0.230***	0.243***	0.329***	0.338***	0.332***	0.312***	0.320***	0.315***	0.250***	0.233***	0.262***	0.263***	0.254***
	(0.019)	(0.022)	(0.020)	(0.020)	(0.020)	(0.019)	(0.024)	(0.023)	(0.022)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.022)	(0.023)	(0.026)	(0.027)	(0.028)
Industry	-0.130	-0.275**	-0.167	-0.167	-0.102	-0.100	-0.268**	-0.486	-0.269*	-0.151	-0.307	-0.157	-0.090	-0.190	-0.090	-0.315**	-0.281**	-0.410**	-0.472***	-0.466***
	(0.147)	(0.110)	(0.143)	(0.143)	(0.141)	(0.139)	(0.133)	(0.130)	(0.137)	(0.145)	(0.146)	(0.143)	(0.141)	(0.145)	(0.142)	(0.131)	(0.124)	(0.120)	(0.122)	(0.121)
Com_Age[f]	-0.031***	-0.006	-0.037***	-0.037***	-0.028**	-0.028***	-0.011	-0.014	-0.007	-0.023***	-0.048***	-0.037***	-0.015	-0.036***	-0.029***	-0.011	-0.006	-0.009	-0.007	-0.010
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.014)	(0.010)	(0.010)	(0.018)	(0.011)	(0.010)	(0.018)	(0.011)	(0.010)	(0.010)	(0.010)	(0.013)	(0.014)	(0.013)
Main effects																				
Diverse (H1a)		0.119***					0.082***	0.198***	0.113***							0.120***	0.125***	0.166***	0.187***	0.194***
		(0.015)					(0.020)	(0.021)	(0.016)							(0.015)	(0.015)	(0.024)	(0.025)	(0.026)
Techrel[g] **(H3a)**			0.426***	0.379*						0.613***	0.391**	0.431***				0.670*	0.492*	0.616*	0.709	0.741
			(0.136)	(0.369)						(0.227)	(0.245)	(0.136)				(0.363)	(0.360)	(0.352)	(0.465)	(0.462)
Techrel^2 **(H3a)**				0.064												-0.3255***	-0.050***	-0.126	-0.192	-0.130***
				(0.465)												(0.456)	(0.456)	(0.446)	(0.461)	(0.460)
Mktrel (H4a)					0.524***	0.887*							0.425**	0.503***	0.508***		1.095***	0.922***	0.831**	0.746**
					(0.140)	(0.369)							(0.172)	(0.176)	(0.142)		(0.352)	(0.342)	(0.337)	(0.342)
Mktrel^2 **(H4a)**						-0.451											-0.619	-0.637*	-0.588	-0.700*
						(0.421)											(0.393)	(0.377)	(0.372)	(0.384)
Tie strength																				

Duration									-0.010			-0.032						-0.047*	-0.070**
(Dur)									(0.020)			(0.022)						(0.026)	(0.029)
Frequency										0.058***			0.050					0.145***	0.150***
(Fqy)										(0.022)			(0.036)					(0.039)	(0.045)
Intensity											0.312			-0548				0.366	-1.130
(Ity)											(0.540)			(0.708)				(0.466)	(1.395)
Dur_Avg							-0.035**										-0.083***	-0.041	-0.026
							(0.022)										(0.023)	(0.029)	(0.030)
Fqy_Avg								0.211***									0.242***	0.139***	0.131***
								(0.034)									(0.036)	(0.046)	(0.046)
Ity_Avg									-1.272								-0.069	-0.044	-0.083
									(0.927)								(0.899)	(0.921)	(0.214)
Interactions																			
Diverse*Dur							0.011***										0.019***	0.018***	0.016***
(H2a)							(0.004)										(0.005)	(0.005)	(0.005)
Diverse*Fqy								-0.019***									-0.034***	-0.037***	-0.035***
(H2a)								(0.005)									(0.007)	(0.007)	(0.007)
Diverse*Ity									0.297								-0.017	-0.046	0.083
(H2a)									(0.215)								(0.211)	(0.213)	(0.214)
TechRel*Dur										-0.037								0.002	-0.009
(H5a)										(0.038)								(0.043)	(0.044)
TechRel*Fqy											0.015***							-0.012	-0.025
(H5a)											(0.050)							(0.054)	(0.054)
TechRel*Ity												-0. 793						-0.536	2.607
(H5a)												(2.402)						(1.867)	(3.320)
MktRel*Dur													0.026						0.047*
(H6a)													(0.023)						(0.028)
MktRel*Fqy														-0.016					-0.012
(H6a)														(0.047)					(0.052)
MktRel*Ity															0.992				1.639
(H6a)															(1.108)				(1.457)
Log-likelihood	-1325.26	-1296.01	-1320.44	-1320.43	-1318.40	-1317.84	-1291.94	-1275.92	-1295.02	-1319.53	-1316.40	-1320.26	-1317.23	-1316.58	-1318.00	-1290.57	-1279.22	-1252.69	-1245.03	-1242.78
Wald chi-square	341.56	402.02	355.07	354.92	366.79	367.39	412.38	484.98	404.66	355.60	375.40	355.98	369.93	376.84	368.93	419.16	472.13	595.20	644.19	661.67

Note:
a. *p<0.1; **p<0.05; ***p<0.01, all two-tailed tests.
b. Cell entries are coefficient estimates. Numbers in parentheses are standard errors.
c. No.of observation = 487; No. of groups = 129.
d. Logarithmic transformation.
e. Used Alliance_2 (number of cumulative alliances a firm formed in the prior 2 years).
f. Used Com_age2 (based on patent data).
g. Used Techrel_3 (based on continuous construct derived from patent data).

Table 5.5. Sensitivity Tests Predicting Exploitative Learning [a,b,c,]

Variables	Model																			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Constant	3.744 ***	3.090***	3.484***	3.497***	2.675***	3.482***	3.361***	2.564***	2.568***	3.011***	3.162***	3.348***	2.976***	2.465***	2.679***	2.892***	2.191***	1.950***	2.087***	2.194***
	(0.412)	(0.433)	(0.406)	(0.407)	(0.393)	(0.438)	(0.426)	(0.395)	(0.429)	(0.415)	(0.385)	(0.408)	(0.395)	(0.379)	(0.394)	(0.424	(0.408)	(0.379)	(0.374)	(0.378)
Controls																				
Size[d]	-0.215***	-0.013**	-0.107***	-0.103***	-0.068***	-0.062	-0.077	-0.065	0.121*	-0.058	0.023	-0.081***	-0.033	0.076***	-0.068***	0.068	0.094	0.013***	-0.008	0.004
	(0.069)	(0.071)	(0.070)	(0.070)	(0.068)	(0.070)	(0.071)	(0.069)	(0.073)	(0.070)	(0.067)	(0.070)	(0.068)	(0.067)	(0.068)	(0.071)	(0.070)	(0.069)	(0.069)	(0.069)
Firm_Age	0.003	0.010**	-0.000	-0.000	-0.016***	-0.015***	-0.007	0.013**	0.011**	-0.001	-0.000	-0.000	-0.020***	-0.016***	-0.016***	0.007	-0.012**	-0.008	-0.008	-0.010*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
R&D[d]	0.469***	0.386***	0.362***	0.353***	0.227**	0.104	0.347***	0.318***	0.251**	0.351***	0.176*	0.345***	0.153	0.036	0.226**	0.302***	0.157	0.108	0.096	0.079
	(0.106)	(0.108)	(0.107)	(0.108)	(0.106)	(0.107)	(0.107)	(0.106)	(0.108)	(0.108)	(0.105)	(0.107)	(0.107)	(0.105)	(0.106)	(0.109)	(0.108)	(0.106)	(0.106)	(0.106)
Sales[d]	-0.105*	-0.147***	-0.053	-0.047	-0.016	0.047	-0.047	-0.089	-0.099*	-0.050	-0.018	-0.056	-0.001	0.023	-0.015	-0.102*	-0.028	0.038	0.048	0.060
	(0.054)	(0.055)	(0.055)	(0.055)	(0.053)	(0.054)	(0.055)	(0.054)	(0.055)	(0.055)	(0.053)	(0.055)	(0.054)	(0.053)	(0.053)	(0.056)	(0.055)	(0.052)	(0.053)	(0.053)
Alliance[e]	0.000	0.002*	-0.004***	-0.004***	-.004***	0.006***	0.001	-0.003**	0.004***	-0.004***	-0.002	-0.004***	0.008***	0.006***	0.004***	-0.001	0.003**	-0.002	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Network	0.084***	0.178***	0.069***	0.068***	0.046***	0.042***	0.163***	0.137***	0.190***	0.063***	0.072***	0.069***	0.041***	0.045***	0.046***	0.160***	0.102***	0.033**	0.035**	0.030**
	(0.010)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)	(0.012)	(0.012)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)	(0.014)	(0.015)	(0.015)
Industry	-0.688***	-0.481**	-0.541**	-0.538**	-0.769***	-0.900**	-0.620**	-1.200**	-0.544**	-0.523**	-0.507**	-0.522**	-0.855**	1.375**	-0.777**	-0.397	-0.563**	-1.194***	-1.459***	-1.406**
	(0.234)	(0.244)	(0.236)	(0.237)	(0.216)	(0.266)	(0.258)	(0.222)	(0.241)	(0.237)	(0.223)	(0.240)	(0.219)	(0.212)	(0.218)	(0.246)	(0.224)	(0.212)	(0.210)	(0.212)
Com_Age[f]	-0.079***	-0.118***	-0.065***	-0.064***	-0.047***	-0.046***	-0.186***	-0.135***	-0.117***	-0.090***	-0.128***	-0.063***	-0.073***	-0.108***	-0.047***	-0.104***	-0.068***	-0.090***	-0.073***	-0.073***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.011)	(0.007)	(0.007)	(0.019)	(0.007)	(0.007)	(0.019)	(0.007)	(0.007)	(0.007)	(0.007)	(0.012)	(0.018)	(0.018)
Main effects																				
Diverse (H1a)		-0.144***					-0.069***	-0.059***	-0.153***							-0.135***	-0.089***	0.120***	0.145***	0.142***
		(0.009)					(0.012)	(0.013)	(0.009)							(0.009)	(0.009)	(0.014)	(0.015)	(0.015)
Techrel[g] **(H3a)**			0.906***	1.102***						0.368***	1.156***	0.951***				0.751***	0.503***	0.396***	0.854***	0.895***
			(0.084)	(0.245)						(0.128)	(0.166)	(0.085)				(0.084)	(0.085)	(0.088)	(0.177)	(0.184)
Techrel^2**(H3a)**				0.258																
				(0.301)																
Mktrel (H4a)					2.621***	0.825**							2.325***	2.124***	2.622***		2.340***	1.950***	1.954***	1.758***
					(0.097)	(0.321)							(0.106)	(0.111)	(0.097)		(0.100)	(0.101)	(0.102)	(0.119)
Mktrel^2**(H4a)**						0.546														
						(0.502)														
Tie strength																				

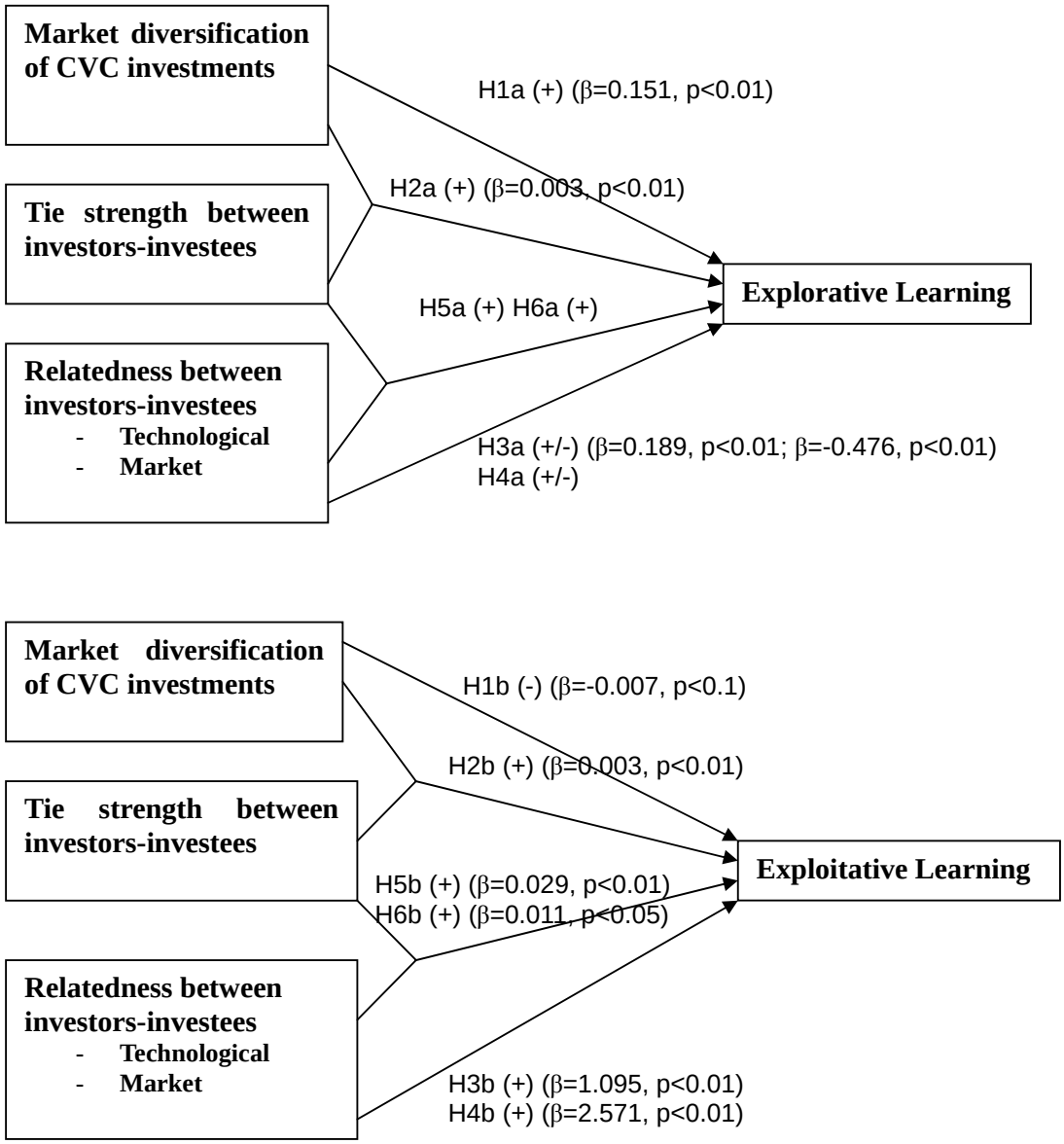
Duration (Dur)										-0.107*** (0.019)		-0.029 (0.0209)						-0.080 (0.022)	-0.081*** (0.024)
Frequency (Fqy)											0.316*** (0.013)		0.193*** (0.023)					0.200*** (0.021)	0.137*** (0.028)
Intensity (Ity)												-0.708 (0.780)		0.113 (1.483)				-1.193* (0.667)	-2.698* (1.541)
Dur_Avg							0.174*** (0.013)										0.074*** (0.014)	0.127*** (0.016)	0.134*** (0.016)
Fqy_Avg								0.489*** (0.017)									0.404*** (0.018)	0.267*** (0.023)	0.249*** (0.023)
Ity_Avg									-0.717 (0.954)								1.324 (0.921)	1.949** (0.935)	1.947** (0.937)
Interactions																			
Diverse*Dur (H2a)							-0.020*** (0.002)										-0.021*** (0.003)	-0.021*** (0.003)	-0.021*** (0.003)
Diverse*Fqy (H2a)								-0.040*** (0.003)									-0.018*** (0.003)	-0.022*** (0.004)	-0.020*** (0.004)
Diverse*Ity (H2a)									-0.113 (0.241)								-0.355 (0.232)	-0.493** (0.235)	-0.496** (0.236)
TechRel*Dur H5a)										-0.107*** (0.019)								0.016 (0.023)	0.015 (0.024)
TechRel*Fqy (H5a)											-0.068** (0.032)							0.090** (0.038)	0.097** (0.038)
TechRel*Ity (H5a)												8.052*** (1.227)						7.367*** (1.221)	7.595 (0.236)
MktRel*Dur (H6a)													0.098*** (0.014)						-0.005 (0.018)
MktRel*Fqy (H6a)														0.150*** (0.028)					0.106*** (0.032)
MktRel*Ity (H6a)															-0.513 (2.625)				2.553 (2.682)
Log-likelihood	-3399.23	-3262.80	-3339.85	-3339.49	-3008.77	-2947.71	-3158.75	-2825.35	-3236.51	-3323.51	-2981.29	-3317.29	-2983.84	-2694.73	-3008.74	-3222.09	-2933.92	-2537.93	-2463.50	-2456.60
Wald chi-square	392.53	657.15	502.76	504.38	1096.75	1139.67	870.37	1488.39	711.71	529.70	1224.60	543.34	1134.75	1715.17	1097.31	733.42	1241.98	1989.08	2171.62	2191.45

Note:
a. *p<0.1; **p<0.05; ***p<0.01, all two-tailed tests.
b. Cell entries are coefficient estimates. Numbers in parentheses are standard errors.
c. No.of observation =487; No. of groups = 129.
d. Logarithmic transformation.
e. Used Alliance_2 (number of cumulative alliances a firm formed in the prior 2 years).
f. Used Com_age2 (based on patent data).
g. Used Techrel_3 (based on continuous construct derived from patent data)..

Table 5.6. Proposed Effects and the Results

Variables	Proposed signs	Results	Hypotheses
Explorative learning			
H1a Diversification of investment	+	+	Supported
H2a Diversification * Tie strength	+	+ (Duration of ties)	Partially supported
H3a Technological relatedness	+/- (inverted U)	+/- (inverted U)	Supported
H4a Market relatedness	+/- (inverted U)	+	Rejected
H5a Technological relatedness * Tie strength	+	/	Not supported
H6a Market relatedness * Tie strength	+	/	Not supported
Exploitative learning			
H1b Diversification of investment	-	-	Supported
H2b Diversification * Tie strength	+	+ (Duration of ties)	Partially supported
H3b Technological relatedness	+	+	Supported
H4b Market relatedness	+	+	Supported
H5b Technological relatedness * Tie strength	+	+ (Duration of ties)	Partially supported
H6b Market relatedness * Tie strength	+	+ (Duration of ties)	Partially supported

Figure 5.1. Hypotheses and Results



CHAPTER 6. DISCUSSION

6.1. DISCUSSION & IMPLICATION

In this study, I examined the determinants of knowledge exploration and exploitation in CVC investment. This section discusses the findings of the study and provides insights concerning the determinants as well as the implications for investing firms.

The results in the previous chapter highlighted the impact of market diversification of investments, relatedness between the investor and investee, and tie strength on the investing firm's learning benefits. I will discuss each determinant one by one as follows.

6.1.1. Market Diversification of Investments

The results of the regression models suggest that the CVC investments in more diverse markets lead to more explorative learning in the investing firm. Moreover, the results also indicate that investing in a large number of different industry domains could decrease the exploitative learning benefits for the corporate investors. So overall, there is a tradeoff between explorative and exploitative learning outcome when corporate investors diversify the markets in their investment portfolio.

This finding provides evidence for some previous literature suggesting that the main strategic objective of CVC investment for corporate investors is to gain a window of new technologies and business models (e.g. McNally, 1997; McKinsey & Co, 1998; Chesbrough, 2002). By investing in multiple industries, corporate investors are exposed to different industry domains with different knowledge bases. This allows corporate investors to have a larger knowledge space and to explore a more diverse set of emerging technologies and markets.

According to this finding, the implication for the corporate investors is that the degree of market diversification of CVC investments should depend on the type of learning objective they have. On the one hand, if the corporate investor aims to explore knowledge, it is better to diverse their investment portfolio by investing in ventures operating in different industry domains, so that the corporate can have a larger body of new knowledge to search and acquire. Through a wide range of knowledge exposure, the investing firm can better absorb the related knowledge and create new knowledge that it was previously not familiar or expertized in. On the other hand, if the primary objective is to exploit the existing technologies or markets, the firm should not invest in too many different ventures operating in different industries. In addition, if the firm wants to both explore and exploit knowledge from investing in new ventures, in order to find a balance between these two types of learning objectives, it is beneficial for the firm to find an optimal level of market diversification in its CVC investments.

6.1.2. Relatedness

The results show that technological relatedness between the investing firm and invested company has an inverted U relationship with explorative learning and a positive relationship with exploitative learning. The results also indicate that market relatedness has a positive relationship with both exploitative learning and explorative learning benefits.

Theoretically, this finding supports the argument that similar knowledge facilitates the integration of each partner's knowledge base (e.g. Kogut and Zander, 1992) and provides evidence that similarity in knowledge bases can increase the learning benefits among partners (Lane and Lubatkin, 1998). Moreover, the finding

also provides support for the argument that if the knowledge of two parties is too closely related, little learning might take place (Ahuja & Katila, 2001).

The findings suggest that it is highly valuable to invest in companies that are technologically related to the investors if the firm wants to explore and exploit knowledge. By investing in a company that has the similar technological knowledge base, the investing firm is more likely to gain both explorative and exploitative learning benefits from the investment. However, the firm should be aware that if the two knowledge bases are too similar with each other, it could hinder the firm's ability to explore new knowledge. Therefore, the investing firm needs to have a moderate level of technological relatedness with the investee in order to balance both explorative and exploitative learning. For market consideration, it is beneficial for a firm to invest in another company that is operating in a similar market, so that the corporate investor would be able to better explore and exploit knowledge from this investment relationship.

6.1.3. Tie Strength and Social Networks

In addition to investment diversification and relatedness, I also investigated the impact of tie strength (duration, frequency and intensity of ties) between investors and investees on the learning outcome from CVC investment. I found that the duration of ties can enhance both the explorative and exploitative learning benefits obtained from diverse investments. In addition, longer duration of investment relationships also strengthen the exploitative learning benefit obtained from related investments.

The results do not provide support for the role of frequency of ties as in enhancing learning benefits. Rather, they suggest the frequency of ties has a negative impact on the relationship between relatedness and learning outcome. Considering I

use investment rounds to measure frequency of ties, this result might indicate that corporate investors who continually invest in ventures with financial needs are not likely to gain learning benefits through CVC investments.

For the level of intensity of ties (as measured by board interlock), the results do not provide support for a positive moderating effect either. This could be due to the reason of lack of data variation. Of 2666 observations in the sample, only 74 of them have board interlock and are given a value of one (1) and the remaining receive a value of zero (0). Another possible explanation is that the data reported in the SDC platinum database may not be up-to-date and complete.

Apart from examining the impact of tie strength, I also included the co-investor networks in the controls. As expected, the results suggest that firms gain more learning benefits from larger co-investor networks.

From the network perspective on inter-organizational learning, the above finings provide evidence that closer social interaction is an important facilitator of knowledge transfer (Bresman et al., 1999; Yli-Renko et al. 2001). In addition, they also support the notion that organizations can produce more innovative knowledge if they occupy a central network position (Tsai, 2001).

The implication of these findings is clear: it is valuable for a corporate investor to maintain a close interaction level with the invested company. Since social interaction serves to increase the relative capacity and effectiveness of the corporate in recognizing and adapting external knowledge from the investees, longer duration of the investment relationship allows the corporate investor to gain additional learning benefits from the CVC investment activities.

Further, the findings also suggest that a corporate investor would more likely to gain learning benefits by syndicating its CVC investment with other investors. A

larger co-investor network provides opportunities to access information stemming from having a central brokering position beyond what the firm could acquire if being the only investor. Therefore, the firm is more likely to gain insights of other firm's investment experiences and thus gain learning benefits from the investment activities.

6.2. LIMITATION & FUTURE RESEARCH

Several limitations of this thesis indicate avenues for future research. First, this thesis only investigates a limited number of determinants of knowledge exploration and exploitation in the context of CVC investment. Future research should further explore other determinants and examine other influencing factors that might have an impact on learning from CVC investments. For example, there could be more dimensions in relatedness other than the technological and market relatedness that this study examined.

Secondly, the measures of some variables can be improved to better test the robustness of my findings. In particular, other measures could be developed for technological relatedness besides using information on patents and scientific publications. For market relatedness, this study uses SIC code for proximity. However, an industry code is not sufficient to measure the market relatedness between two firms. Future research should develop other measures that could more precisely measure the market relatedness. In addition, future research needs to develop better measures of tie strength in terms of frequency and intensity of ties.

Thirdly, this study only tests hypotheses on the sample of two industries: the biotechnology and the semiconductor industry. In particular, it does not include the computer related industries, which comprise about 50% of the total CVC deals since the 1970's (NVCA, 2005). Therefore, future research should expand the research

scope to other industries to have a better understanding of how firms learn from CVC investments.

Finally, another area for future improvement of research on CVC investment is the methodology. This study mainly uses secondary data sources to test the hypotheses, which may introduce noise to the tests because of the possible existence of inaccurate data. Future research should be encouraged to use hybrid methodologies such as the combination of case studies, questionnaire surveys and secondary databases.

CHAPTER 7. CONCLUSION

7.1. MAIN FINDINGS

This thesis investigates the determinants of knowledge exploration and exploitation in CVC investment. I create a research model comprised of various relational factors in the CVC activities, and examine the effects of these influencing factors on corporate investor's explorative and exploitative learning benefits.

The findings of this thesis provide evidence that market diversification of investment, relatedness between investor-investee and network effects have impact on learning outcomes from CVC investments. I found that the more diverse the CVC investment scope, the more explorative learning benefits a corporation gains. In explaining the effect of technological and market relatedness on corporate learning, I found that both help increase knowledge exploration and exploitation for corporate investors. However, too much technological relatedness may have a negative impact on explorative learning for the investing firm.

Further, by examining the tie strength and network effect on learning from CVC, I found that longer investment relationships tend to enhance the learning benefit from diverse investments. Also, a longer duration of ties helps to enhance the positive relationship between relatedness and exploitative learning benefits. Moreover, the explorative and exploitative learning for an investing firm increases with the size of its co-investor network.

One particular interesting finding here is that the same determinant with different degree could lead to different learning outcome in terms of being explorative and exploitative. The results suggest that the CVC investments in more diverse markets lead to more explorative learning in the investing firm. However, the results also indicate that investing in a large number of different industry domains could decrease

the exploitative learning benefits for the corporate investors. Similar tradeoff also exists between the technological relatedness and learning benefits. The results show that technological relatedness between the investing firm and invested company has an inverted U relationship with explorative learning and a positive relationship with exploitative learning. In other words, when there is too much technological overlap between the investing firm and the investee company, the relatedness does not help the corporate investor to explore knowledge.

In summary, this thesis is an empirical test on the determinants of corporate learning in the context of CVC investment. The findings provide evidence of the effects of investment diversification, relatedness between investor-investee, and network effect on knowledge exploration and exploitation from CVC investments.

7.2. CONTRIBUTION

This thesis has four main contributions. First, it extends our understanding of CVC activities by examining corporate investor's learning outcome from an inter-organizational learning perspective. Previous studies on CVC mainly focused on either financial returns to investing firms (e.g. Gompers and Lerner, 1998) or examined the benefits such as IPO value from the invested venture's perspective (e.g. Maula and Murray, 2001). Few studies have examined the learning benefits from the corporate investor's perspective.

Second, by applying explorative-exploitative learning framework, it contributes to learning literature by examining the determinants of explorative versus exploitative learning outcomes in the context of CVC. Previous studies have examined various forms of inter-organizational learning activities such as strategic alliances, joint ventures and mergers & acquisitions, yet few studies have made a distinction between

explorative and exploitative learning, nor rigorously investigated what factors have an impact on explorative versus exploitative learning outcomes. In addition, this study also examines the tradeoff effect of the certain determinants on different learning outcomes.

Third, this thesis enriches the literature on how firm learn through CVC investment by integrating multiple perspectives from both strategic management and social network theory. By drawing from relevant literatures such as organizational learning, business diversification, strategic alliances and social network theory, this study provides insights for how different organizational factors may drive the different learning outcomes stemming from CVC investment relationship.

Finally, from an empirical standpoint, this thesis provides managerial implications for corporations participating in CVC activities. CVC investment managers who plan to make investments in new ventures and those who have already engaged in CVC activities can benefit from understanding how the determinants of knowledge exploration and exploitation have an impact on corporate learning benefits. Categorization of learning outcomes and the corresponding investment strategies can help corporate investors to better harvest their investment benefits, and maintain a relationship with the invested ventures that is conducive to knowledge exploration and exploitation.

(End)

BIBLIOGRAPHY

Aernoudt R., San Jose A. 2003. Executive forum: early stage finance and corporate venture—two worlds apart? *Venture capital*, 5(4): 277-286

Ahuja G. 2000. The duality of collaboration. *Strategic Management Journal*, 21(3): 317-343

Ahuja G., Katila R. 2001. Technological acquisitions and the innovation performance of acquiring firms: a longitudinal study. Strategic Management Journal, 21: 197-220

Almaida P, Kogut B. 1999. Localization of knowledge and the mobility of engineers in regional networks. Management Science, 45(7):905-917.

Argyris, C., Schön D, 1996. *Organizational learning II: Theory, method and practice*, Reading: Addison-Wesley.

Bannock Consulting. 2000. *Corporate venturing in Europe*: A study for the European commission DGXIII EIMS 98/176. www.bannock.co.uk

Baum, J. A. C.; Calabrese, T., and Silverman, B. S., 2000. Don't go it alone: alliance network composition and startups' performance in Canadian biotechnology. *Strategic Management Journal*, 21(3): 267-294.

Bourdieu P, 1985. The forms of capital. In *Handbook of theory and research for the socialolgy of education*. Richardson JG(ed.). Greenwood: New York, NY: 241-258.

Bresman H., Birkinshaw J., Nobel R. 1999. Knowledge Transfer in International Acquisitions, Journal of International Business Studies, 30 (3): 439-462

Burt R. 1992. *Structural Holes*. Cambridge, MA: Harvard University Press.

Burt R. 2000. The Network Structure of Social Capital. R.I. Sutton, B.M. Staw, eds. *Research in Organizational Behavior, Vol. 22*. Greenwich, CT, JAI Press.

Burt R. 2004. Structural holes and good ideas. *American Journal of Sociology*, 110 (2): 349-399.

Business Wire, 1998. Nokia launches Nokia Ventures. 4/24/1998

Chatterjee S., Blocher J.D. 1992. Measurement of firm diversification: Is it robust? *Academy of Management Journal*, 35:874-888

Chesbrough, H.W. 2000. Designing corporate ventures in the shadow of private venture capital. *California Mgmt Review*, 42(3): 31-49

Chesbrough H.W. 2002. Making sense of corporate venture capital. *Harvard Business Review*, 80 (3): 90-100

Cockburn I., Henderson R. 1998. Absorptive capacity, coauthoring behavior, and the

organization of research in drug discovery. *The Journal of Industrial Economics,* 46(2): 157-183

Cohen W., Levinthal D. 1989. Innovation and learning: the two faces of R&D. *The Economic Journal*, 99:569-596.

Cohen W., Levinthal D. 1990. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1): 128-152

Cohen W., Levinthal D. 1994. Fortune favors the prepared firm. Management Science, 40(2): 227-251.

Coleman, J. 1990. *The Foundations of Social Theory*. Cambridge, MA: Harvard University Press

Coopey J,1996. Crucial gaps in 'the learning organization: Power, politics and ideology' in *How organizations learn*. K. Starkey (ed.). London: Thomson.

Deeds D.L, Hill C. W., 1996. Strategic alliances and the rate of new product development. *Journal of Business Venturing*, 11:41-55.

Dyer J.H., Singh H. 1998. The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23(4): 660-679

Eisenhardt, K.M. and J.A. Martin. 2000. Dynamic capabilities: what are they? *Strategic Management Journal*, 21 (10-11), 1105–1121.

Ernst & Young , 2002. *Corporate venture capital report*. www.ey.com

Ferrary M. 2003. Managing the disruptive technologies life cycle by externalizing the research, *International Journal of Technology Management*, 25 (1/2): 165-180

Finkelstein S., Haleblian J. 2002. Understanding acquisition performance: the role of transfer effects. *Organization Science*, 13(1), 36-47

Fox-Wolfgramm S, Boal S, and Hunt J., 1998. Organizational adaptation to institutional change: A comparative study of first-order change in prospector and defender banks'. *Administrative Science Quarterly*, 43: 87-126.

Glaister K. W., Buckley, P.J., 1996. Strategic motives for inter-national alliance formation. *Journal of Management Studies*, 33(3), 301-332.

Gomes-Casseres, B. 1994. Group versus group: how alliance networks compete. *Harvard Business Review*, 72(4): 62-74.

Gompers P., Lerner J.1998. The determinates of CVC success: Organizational structure, incentives and complementarities. *NBER working paper*, No. W6725

Granovetter M. 1973. The strength of weak ties. *American Journal of Sociology*, 78:

1360-1380.

Granovetter M, 1982. The strength of weak ties: a network theory revisited. In P.V. Marsden & N. Lin (Eds). *Social structure and network analysis*: 105-130. Beverly Hills, CA: Sage.

Granstrand O, Bohlin E., Oskarsson C, & Sjoberg N. 1992. External technology acquisition in large multi-technology corporations. *R&D Management*, 22(2): 111-133.

Greene W. 2000. Econometric Analysis. Prentice_Hall Inc. Upper Saddle River, NJ.

Griliches Z. 1984. Patent and productivity. NBER: Chicago, IL.

Griliches Z. 1990. Patent statistics as economic indicators: a survey. *Journal of Economic Literature*, 28(4): 1661–1707.

Gulati R. 1995. Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal*, 36(1): 85-112.

Gulati, R., Westphal, J. D. 1999. Cooperative or controlling? The effects of CEO-board relations and the content of interlocks on the formation of joint ventures. *Admin. Science Quarterly*, 44(3): 473-506.

Gupta, A.K., V. Govindarajan. 2000. Knowledge Management's Social Dimension: Lessons from Nucor Steel. *Sloan Management Rev.* 42, 71-80.

Hagedoorn J., Duysters G. 2002. The effect of mergers and acquisitions on the technological performance of companies in a high-tech environment. *Technology Analysis & Strategic Management*, 14(1): 67-85

Hagedoorn, J, Duysters G, 2002. Learning in dynamic inter -firm networks –The efficacy of quasi-redundant contacts. *Organization Studies*, 23 (4):525-548

Haleblian J., Finkelstein S. 1999. The influence of organizational acquisition experience on acquisition performance: A behavioral learning perspective. *Administrative Science Quarterly*, 44(1): 29-56

Hamel, G. 1991. Competition for competence and interpartner learning within international strategic alliances. *Strategic Management Journal,* 12:83-103.

Hansen M.T. 2002. Knowledge networks: Explaining effective knowledge sharing in multiunit companies. *Organization Science*, 13(3): 232-248

Haunschild, P. R. 1993. Interorganizational imitation: The impact of interlocks on corporate acquisition activity. *Administrative Science Quarterly*, 38(4): 564-592.

Helfat, C.E. 1994. Evolutionary trajectories in petroleum firm R&D. *Management Science*, 40(12), 1720-1747

Henderson R. Cockburn I. 1996. Scale, Scope, and Spillovers: The Determinants of Research Productivity in Drug Discovery. *RAND Journal of Economics*, 27(Spring): 32-59.

Hitt, M.A., Hoskisson R.E., and Kim H.1997. International Diversification: Effects on Innovation and Firm Performance in Product Diversified Firms. *Academy of Management Journal*, 40: 767–798.

Jaffe A. 1986. Technological opportunity and spillovers of R&D: Evidence from firms' patents, profits and market value. *American Economic Review*, 76(5): 984-1001.

Kale P, Singh H, Perlmutter H. 2000. Learning and protection of proprietary assets in strategic alliances: building relational capital. *Strategic Management Journal*, 21:217-237

Katila R. 2002. New product search overtime: past ideas in their prime? *Academy of Management Journal*, 45(5), 995-1010.

Keil T. 2001. External corporate venturing: initial conditions, learning processes and knowledge management. Working paper.

Keil T, Laamanen T, 1995. Technology transfer through technology driven acquisitions: an explorative study. Working paper.

Kogut B, 1988. Joint ventures: theoretical and empirical perspectives. *Strategic Management Journal,* 9(4): 319-332.

Kogut B., Zander U. 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3(3): 383-397

Kogut B, Zander U. 1996. What Firms Do? Coordination, Identity, and Learning. *Organization Science*, 7(5):502-518.

Koza, M. P., Lewin, A. Y., 1998. The co-evolution of strategic alliances. *Organization Science*, 9(3): 255-264.

Krackhardt, D., 1992. The strength of strong ties: the importance of philos in organizations. In N. Nohria & R. G. Eccles (Eds.). Networks and organizations: structure, form and action: 216-239. Boston: Havvard Business School Press

Kumar R, Nti K.O., 1998. Differential learning and interaction in alliance dynamics: a process and outcome discrepancy model. *Organization Science,* 9(3): 356-367.

Lam A, 1997. Embedded firms, embedded knowledge: Problems of collaboration and knowledge transfer in global cooperative ventures. *Organization Studies*, 18(6): 973-996.

Lane D, 2000. Intel Capital: the Berkeley networks investment. Harvard Business School case study, # 9-600-069.

Lane P.J., Lubatkin M. 1998. Relative absorptive capacity and interoorganizational learning. *Strategic Management Journal*, 19(5): 461-477

Lane P.J., Salk J.E., Lyles M.A. 2001. Absorptive capacity, learning, and performance in international joint ventures. *Strategic Management Journal,* 22:1139-1161

Larson A. 1992. Network dyads in entrepreneurial settings: A study of the governance of exchange relationships. *Administrative Science Quarterly*, 37: 76-104

Levinthal DA, March JG. 1993. The myopia of learning. *Strategic Management Journal*, Winter Special Issue 14: 95–112.

Lin, N. 1999. Building a network theory of social capital. *Connections* 22 (1), 28-51.

Lucent Technologies, 1999. Lucent Technologies forms subsidiary, Lucent Venture Partners; Venture capital fund to invest in emerging technologies (press released on 18/02/1998). http://www.lucent.com/press/0298/980218.cob.html

March J.G., 1991. Exploration and exploitation in organizational learning. *Organization Science,* 2(1): 71-87.

Marsden, P. V., Campbell, K. E. 1984. Measuring tie strength. *Social Forces*, 62: 428-501.

Maula M., Murray G. 2001. Corporate venture capital and the creation of US public companies: the impact of sources of venture capital on the performance of portfolio companies. *Creating value: winners in the new business environment*.164-188. Blackwell Pub (2002): Malden, MA.

McGrath, R.G., 2001. Exploratory learning, innovative capacity and managerial oversight. *Academy of Management Journal*, 44(1):118-131.

McKinsey & Co, 2003. Corporate venture capital: Window on the world. http://www.altassets.com/casefor/sectors/2003/nz3705.php

McNally, K., 1997. *Corporate Venture Capital: Bridging the Equity gap in the small business sector*, Routledge: London

Miller, D. 1996. A Preliminary Typology of Organizational Learning: Synthesizing the Literature. *Journal of Management*, 22(3): 485-505.

Miner A., Mezias S, 1996. Ugly duckling no more: Pasts and futures of organizational learning research. *Organization Science,* 7(1): 88-99.

Mitchell W., Singh K, 1992. Incumbents' use of pre-entry alliances before expansion into new technical subfields of an industry. *Journal of economic behavior and Organization*, 18: 347-372.

Mowery D.C., Oxley J.E., Silverman B. S. 1996. Strategic alliances and interfirm

knowledge transfer. *Strategic Management Journal*, 17: 77-91

Nahapiet J., Ghoshal S. 1998. Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23(2): 242-266

National Venture Capital Association (NVCA), www.nvca.com

Pandya A., Rao N. 1998. Diversification and firm performance: an empirical evaluation. *Journal of Financial and Strategic Decisions*, 11(2): 67-81

Pisano G. 1990. The R&D boundaries of the firm: an empirical analysis. *Administrative Science Quarterly*, 35: 53–176.

Pisano, G. 1991. The governance of innovation: vertical integration and collaborative arrangements in the bio-technology industry. *Research Policy,* 15: 237-249

Podolny J.M., and Stuart T.E. (1995), A role-based ecology of technological change. *American Journal of Sociology*, 100:1224-1260

Powell W., Koput K.& Smith- Doerr D. 1996. Interorganizational collaboration and the locus of innovation: network of learning in biotechnology. *Administrative Science Quarterly*, 41: 116-145

Rice M.P., O'Connor G.C., Leifer R., McDermott C.M., Standish-Kuon T. 2000. Corporate venture capital models for promoting radical innovation. J*ournal of Marketing Theory and Practice*, 8 (3): 1-10

Ring P.S. Van de Ven A.H. 1994. Developmental processes of cooperative interorganizational relationships. *Academy of Management Review*, 19(1): 90-118

Rivkin J.W. 2001. Reproducing knowledge: Replication without imitation at moderate complexity. *Organization Science*, 12(3): 274-293

Rogers, E.M. 1995. *Diffusion of innovations* (4th ed.). New York: Free Press.

Rothaermal F. 2001. Incumbent's advantage through exploiting complementary assets via interfirm cooperation. *Strategic Management Journal*, 22: 687-699

Rothaermal F., Deeds D, 2004. Exploration and exploitation alliances in biotechnology: a system of new product development. *Strategic Management Journal*, 25: 201–221

Rumelt, R. P. 1974. *Strategy, structure, and economic performance*. Harvard University Press, Cambridge, MA.

Senge, P, 1990. *The fifth discipline: The art & practice of the learning organization*. New York: Doubleday.

Shan W., Walker G., Kogut B., 1994. Interfirm cooperation and start-up innovation in the biotechnology industry. *Strategic Management Journal*, 15: 387-394.

Sharma P, Chrisman J. 1999. Toward a reconciliation of the definitional issues in the field of corporate entrepreneurship. *Entrepreneurship Theory and Practice*, 1999 Spring: 11-27

Shenkar O., Li J. 1999. Knowledge search in international cooperative ventures. *Organization Science*, 10(2): 134-143

Siegel R., Seigel E., & MacMilan I. 1988. Corporate venture capitalists: Autonomy, obstacles and performance. *Journal of Business Venturing*, 3: 233-247

Silver D. 1993. *Strategic Partnering*. McGraw-Hill: New York, NY

Silverman B.S. 1999. Technological resources and the direction of corporate diversification: toward an integration of the resource-based view and transaction cost economics. *Management Science*, 45(8): 1109-1124

Sorrentino M., Willianms M.L. 1995. Relatedness and corporate venturing-does it really matter. *Journal of Business Venturing*, 10(1): 59-73

Stuart T. 2000. Interorganizational alliances and the performance of firms: a study of growth & innovation rates in a hi-technology industry. *Strategic Management Journal*, 21(8): 791-811

Stuart T., Podolny J. 1996. Local search and the evolution of technological capabilities. *Strategic Management Journal*, 17: 21-38

Sykes H.B. 1990. CVC: Strategies for success. *Journal of business venturing*, 5(1): 37-47

Thornhill S., Amit R. 2001. A dynamic perspective of internal fit in corporate venturing. *Journal of Business Venturing*, 16(1): 25-50

Trajtenberg M. 1990. *Economic Analysis of Product Innovation: The Case of CT Scanners*. Harvard University Press: Cambridge, MA.

Tsai, W. and Ghoshal S. 1998. Social capital and value creation: The role of intrafirm networks. *Academy of Management Journal*, 41: 464-476.

Tsai, W. 2001. Knowledge transfer in intraorganizational networks: effects of network position and absorptive capacity on business unit innovation and performance. *Academy of Management Journal*, 44(5): 996-1004

Uzzi, B. 1996. The sources and consequences of embeddedness for the economic performance of organizations: The network effect. *American Sociological Review*, 61(August): 674–698.

Uzzi, B. 1997; "Social structure and competition in interfirm networks: The paradox of embeddedness", *Administrative Science Quarterly*, Vol 42, pp. 35-67.

Vanhaverbeke W, Duysters G, and Noorderhaven N., 2002. External technology sourcing through alliances or acquisitions: an analysis of the application specific integrated circuits industry. *Organization Science*, 13(6): 714-733.

Veugelers, R. 1997. Internal R&D expenditures and external technology sourcing. *Research Policy*, 303-315.

Villalonga, B., & McGahan, A. M. 2003. Does the value generated by acquisitions, alliances and divestitures differ? *(Working paper)*.

Weick K, and Westley F, 1996. "Organizational learning: Affirming an oxymoron" in *Handbook of organization studies*. S. Clegg, C. Hardy, and W. Nord (eds). London: Sage.

Westphal, J. D., Seidel, M. D. L., & Stewart, K. J. 2001. Second-order imitation: Uncovering latent effects of board network ties. *Administrative Science Quarterly*, 46(4): 717-747.

Winters T.E., Murfin D.L. 1988. Venture capital investing for corporate development objectives. *Journal of Business Venturing*, 3(3): 207-223

Yli-Renko H., Autio E., Sapienza H.J. 2001. Social capital, knowledge acquisition, and knowledge exploitation in technology based young firms. *Strategic Management Journal* (special issue): 587-613

Yoshino, M. Y., Rangan U.S. *Strategic Alliances: An Entrepreneurial Approach to Globalization*. Boston, Massachusetts: Harvard Business School Press, 1995.

Zahra S.A, Ireland R.D, Hitt M.A. 2000. International expansion by new venture firms: International diversity, mode of market entry, technological learning and performance. *Academy of Management Journal*.

APPENDIX A

A-1. LIST OF INVESTING FIRMS:

No.	Firm Name	No.	Firm Name
1	3Com Ventures	42	Control Data Corporation
2	Abbott Laboratories	43	Cooper Development Co.
3	Acma Australia Pty Ltd.	44	Cowen Biotech Ltd.
4	ADC Telecommunications, Inc.	45	CP Ventures Inc.
5	Affymetrix, Inc.	46	CPC International Inc.
6	AlliedSignal, Inc.	47	CPT Holdings Inc.
7	Altera Corporation	48	Crossroad Systems
8	Amena-Retevision Movil SA	49	Crystal Systems Solutions Ltd.
9	American Cyanamid	50	Cypress Semiconductor Corp.
10	American Express	51	Data General Corporation
11	American Hospital Supply Corp.	52	Dekalb Agriresearch
12	American Linen Supply Co.	53	Diagnostic Products Corp.
13	Ameritech Development Corp.	54	Digital Equipment Corp.
14	Renaissance Tech.	55	The Walt Disney Co.
15	Analog Devices Enterprises	56	Dow Chemical Company, The
16	Analogic Corp.	57	DU Pont
17	Anschutz Investment Company	58	Eastman Kodak Co, Inc.
18	Asachi Keiki Co. Ltd.	59	Elan Corporation PLC
19	Asahi Chemical Industry Co., Ltd.	60	Electro-Science Corp.
20	AT&T	61	Electrolux Corporation
21	August Systems Corp.	62	ELF Technologies
22	Banner Industries	63	Eli Lilly & Company
23	Becton, Dickinson & Co.	64	Elron Technologies
24	BIOMEC Inc.	65	Cabletron Systems, Inc.
25	BMW Technologies Inc.	66	Ericsson Business Innovation AB.
26	Boehringer Mannheim Corp	67	Evans and Sutherland
27	Borg-Warner Security Corp.	68	Exxon Enterprises
28	Bristol-Myers Company	69	Fairchild Camera and Instrument
29	British Petroleum	70	Farley Inc.
30	BRM Capital	71	Fenwick & West LLP
31	BSI Industries	72	Flextronics International Ltd.
32	C. Itoh & Co. Ltd.	73	Foster Industries, Inc.
33	Canon, Inc.	74	Fuji Bank, Limited
34	Cendant Corporation	75	Fujitsu Ltd.
35	Centocor Corporation	76	G.D. Searle Division
36	ChevronTexaco Venture Equities	77	Genentech Corporatio
37	CIBC Bank, CIBC Resourcing	78	General Atom/Toshiba Corp.
38	Cisco Systems, Inc.	79	General Electric Credit Corp.
39	Comcast Interactive Capital	80	General Instrument Corporation
40	Comstellar Technologies, Inc.	81	General Motors
41	Conexant Systems, Inc.	82	General Signal Corporation

83 Getty OIL Company
84 Gillette Co
85 DAMAC Ventures
86 Glyko Biomedical, Ltd.
87 Gould Inc.
88 Guidant Corporation
89 Harris Corp. (Semiconductor Division
90 Heizer Corporation
91 Hewlett-Packard
92 Compaq Computer Corp.
93 Hillman
94 Hoechst Celanese Corporation
95 Hybritech Incorporated
96 Hyundai Venture Investment Corp.
97 IBM Corporation
98 Infotechnology
99 Innova Corp
100 Institution of Immunology
101 Integrated Device Technology Inc.
102 Intelligent Systems Corporation
103 Invacare Corporation
104 Itochu Corporation
105 Johnson & Johnson
106 Kanematsu-Gosho Ltd.
107 Kebo LAB AB
108 Kimball Manufacturing
109 Kopvenco Inc. (Koppers Co.)
110 Kyocera International, Inc.
111 LG Electronics
112 Litton Industries
113 Lotus Development Corporation
114 LSI Logic Corporation
115 Lubrizol Business Development Co.
116 Manufacturers Life Insurance Co.
117 Marion Merrill Dow
118 Martin Marietta Investments, Inc.
119 Marubeni Corporation
120 Matsushita Electric Corporation
121 MCM Capital Group, Inc.
122 MedImmune
123 Medtronic, Inc.
124 Merck & Co.
125 Microsoft Corporation
126 Microwave Technology
127 Minnesota Mining & Manufacturing
128 Mitsui & Co.
129 Molex, Inc.
130 Monsanto Corp.
131 National Bank of Canada
132 National Distillers
133 National Iron and Steel Mill
134 National Semiconductor
135 Neoplux Capital
136 Nissho Electronics
137 Norsk Hydro
138 Nortel Networks Corporation
139 Northern Pacific Capital Corp.
140 Northern Telecom Ltd.
141 NYNEX Technology Investments
142 Olin Corporation
143 Oracle Venture Fund
144 Otsuka Pharmaceutical Co
145 Oxford Instruments Group PLC
146 Pacific Telecom
147 Pacnat Company
148 Pernovo Corp. (Perstorp
149 Pfizer Inc
150 Philips Venture Capital Fund B.V.
151 Polaroid Corporation
152 Proctor & Gamble
153 Purdue Pharma L.P.
154 Questec Enterprises, Inc.
155 Raychem Corporation
156 RCA
157 RCT BioVentures NE LLC
158 Repligen Corp.
159 Rhone Poulenc
160 Rockwell International
161 Rodal Corp.
162 Rohm and Haas Company.
163 SAIC Venture Capital Corp.
164 Sandoz Ltd.
165 Schering-Plough Corp.
166 Schlumberger Limited
167 Seagate Technology Inc
168 Sensormatic Electronics Corp.
169 Sepracor Inc.
170 Shanghai Industrial Holdings Ltd.
171 Shanghai Land Holdings Ltd.
172 Sharp Corporation
173 Shaw Ventures Ltd.
174 Shinsho Corporation
175 Siemens Corporation
176 Siemens Venture Capital GmbH

177 Sigma Resources
178 SISIR International Pte Ltd.
179 Smith Kline Beecham Corp.
180 Sony Corporation
181 Standard Microsystems Corp.
182 Standard OIL
183 Standard OIL of California
184 Sumitomo Cement Company, Ltd.
185 Sumitomo Corporation
186 Sumitomo Metal Industries
187 Sun Microsystems, Inc.
188 Syntex Corporation
189 Sysorex
190 Tandem Computers, Inc.
191 Tata Enterprises
192 Taub-Tech Ventures
193 TDK Corporation
194 Technology Asia Ventures Sdn Bhd
195 Teck Research Inc.
196 Tektronix Development Co
197 Telefonica
198 Tellabs Inc.
199 Tenax Corporation
200 TI Ventures
201 Time, Inc.
202 Tosco Corporation
203 Trident Microsystems, Inc.
204 TRW Inc.
205 TVI Corporation
206 Ultramar PLC
207 United Computer and Technology
208 Velocity Capital Management LLC
209 VentureBank@PNC
210 Votorantim Venture Capital Ltd
211 Wang Development and Investment Corp.
212 Weston Investment Co.
213 Williams Communications Group
214 WorldCom Ventures

A-2. LIST OF INVESTED COMPANIES:

No.	Company Name	No.	Company Name
1	360networks, Inc.	42	Applied Molecular Evolution, Inc.
2	Accelrys, Inc.	43	Applied Optoelectronics Technology
3	Acelo Semiconductor, Inc.	44	Applied Superconetics
4	Aclara BioSciences Inc.	45	ARC International PLC
5	Acorda Therapeutics, Inc.	46	Argonaut Technologies, Inc.
6	Actel Corporation	47	Aronex Pharmaceuticals, Inc.
7	Adaptive Silicon, Inc	48	Array Biopharma, Inc
8	Advanced Genetic Sciences, Inc	49	Ashvattha Semiconductor, Inc.
9	Advanced Power Technology, Inc	50	Associated Biomedic Systems, Inc.
10	Advanced Tissue Sciences, Inc	51	Asyst Technologies, Inc.
11	Advancell	52	ATEQ Corp.
12	Aerie Networks, Inc	53	Athena Neurosciences, Inc.
13	Aetna Communication Laboratories	54	AtheroGenics, Inc.
14	Agensys, Inc.	55	Atheros Communications, Inc
15	Agile Therapeutics, Inc.	56	Athersys Inc.
16	Agility Communications, Inc.	57	Austek Microsystems, Ltd.
17	Agilix Corporation	58	AuthenTec, Inc.
18	Agouron Pharmaceuticals, Inc.	59	Vector Pharmaceuticals, Inc.
19	Agricultural Genetics Company	60	Axsun Technologies, Inc
20	Agridyne Technologies, Inc.	61	BaySpec, Inc.
21	Alchemia Pty., Ltd.	62	Be Here Corporation
22	Alellyx Applied Genomics	63	Benchmarq Microelectronics, Inc.
23	Alien Technology Corporation	64	Benzing Technologies, Inc.
24	Allos Therapeutics, Inc.	65	Berlex Biosciences
25	AltaRex Corp.	66	Bermai, Inc.
26	Altera Corporation	67	Besco Inc.
27	Altus Corporation	68	Beyond Genomics, Inc.
28	Alvesta Corporation	69	BI, Inc.
29	AmberWave Systems Corporation	70	Bio-Diagnostics, Inc.
30	American Bionetics, Inc.	71	Bio Logicals, Inc.
31	Amgen, Inc.	72	Biogen, Inc.
32	Analog Devices, Inc.	73	BioMarin Pharmaceutical, Inc.
33	Anamartic Ltd.	74	Biomedical Diagnostics
34	Angenics, Inc.	75	Biopure Corporation
35	APEX Semiconductor, Inc.	76	Biotechnology Development Corp.
36	Aphton Corporation	77	Bipolar Integrated Technology Inc.
37	Apollon, Inc.	78	Blaze Network Products, Inc.
38	Applied Biosystems, Inc.	79	British Bio-Technology Group PLC
39	Applied Biotechnology, Inc.	80	C.P. Clare Corporation
40	Applied Micro Circuits Corp.	81	Calient Networks
41	Applied Microsystems Corp.	82	California Micro Devices, Inc.

83 Caliper Technologies Corp.
84 Cambridge BioTech Corporation
85 Cambridge Biotechnology
86 Candescent Technologies Corp.
87 Canji, Inc.
88 CardioFocus, Inc.
89 Celetronix
90 Celgene Corporation
91 Cellontech Co Ltd
92 CENiX, Inc.
93 CentrePath
94 Cepheid, Inc.
95 Cetus Corporation
96 Chameleon Systems, Inc.
97 Chemgen, Inc.
98 Chromatis Networks, Inc.
99 ChromaVision Medical Systems Inc.
100 Cidra Corporation
101 Circe Biomedical, Inc.
102 Clinical Sciences, Inc.
103 Clinicor, Inc.
104 Codata Systems Corporation
105 Collaborative Research, Inc
106 Compulaser, Inc.
107 Contrex, Inc.
108 Corixa Corporation
109 Creative BioMolecules, Inc.
110 Credence Systems Corp.
111 Critical Therapeutics, Inc.
112 Crop Genetics International Corp.
113 Cross-Check Technology, Inc.
114 Crystal Semiconductor Corp
115 Crystalvision Inc.
116 Crysteco, Inc.
117 Cybernetic Data Products, Inc.
118 Cyrano Sciences, Inc.
119 Cytogen Corporation
120 Cytotech, Inc.
121 Daehan Bio Link Company, Ltd.
122 Dallas-Semiconductor Corp
123 Datavision, Inc.
124 Dialog Semiconductor GmbH
125 DigiLens, Inc.
126 Dionex Corporation
127 Dixy Company Ltd.
128 DNA Link, Inc.
129 DNA Plant Technology
130 DNA Research Innovations, Ltd.
131 Dolch American Instruments
132 Ecogen, Inc.
133 Electron Beam Corp.
134 Electronic Systems Products, Inc.
135 Embrex, Inc
136 Energy Conversion Devices, Inc
137 Engenics, Inc.
138 EntoMed SA
139 Environmental Processing Inc
140 Enzo Biochem
141 Enzytech, Inc
142 Eos Biotechnology, Inc.
143 Eotec Corporation
144 Epicyte Pharmaceutical, Inc.
145 Epid
146 Erndex
147 Exelixis, Inc.
148 Fairchild Semiconductor Int'l Inc.
149 FiberNet Telecom Group, Inc.
150 Flight Dynamics, Inc.
151 Focus Company Ltd.
152 Focus Semiconductor Systems, Inc.
153 FormFactor, Inc.
154 FST Inc. (FKA: Fine Semiconduc
155 Gain Electronics
156 Galileo Pharmaceuticals, Inc.
157 GE Novasensor Inc.
158 Gen-Probe, Inc.
159 Genaissance Pharmaceuticals, Inc.
160 Genelabs Technologies, Inc.
161 GeneMedix PLC
162 Genentech, Inc.
163 General Ionex Corporation
164 Genetic Systems Diagnostics Partners
165 Genetics Institute, Inc.
166 Genex Corporation
167 Genoa Corporation
168 Genome Networks, Inc.
169 Genomics Collaborative, Inc.
170 Genomine, Inc.
171 Genoptix, Inc.
172 GES Pharmaceutical Inc
173 GigaBit Logic, Inc.
174 GLC Associates
175 Gliatech, Inc.
176 Glycan Pharmaceuticals Inc

177 Glycomed, Inc.
178 Graffinity Pharmaceutical Design GmbH
179 Graviton, Inc.
180 Greyhawk Systems, Inc.
181 Harwal Electrical Industries Pty Ltd
182 Hem Research, Inc.
183 Hybrigenics SA
184 I-Cube, Inc.
185 Icoria, Inc.
186 IDEC Pharmaceuticals Corp
187 IKOS Systems, Inc
188 Illumina, Inc.
189 Imalux Corporation
190 ImmuLogic Pharmaceutical Corp
191 Immunicon Corporation
192 Immunomed Corporation
193 Immusol, Inc
194 In2Gen Co., Ltd
195 Incara
196 InfiMed Therapeutics, Inc.
197 InGenuity Systems, Inc.
198 Innergy Power Corp.
199 Innov Holding Company
200 Integrated Device Technology
201 Integrated Micromachines, Inc.
202 Integrated Telecom Express, Inc.
203 Intellon Corporation
204 Interactive Silicon, Inc.
205 Interamics, Inc.
206 InterMune, Inc.
207 International Biotechnologies Inc.
208 International Canine Genetics
209 International Microelectronic
210 Invitron Corporation
211 iPhotonics, Inc.
212 Ista Pharmaceuticals, Inc.
213 JGKB Photonics, Inc.
214 Kaylex, Inc.
215 Kelsius, Inc.
216 Kinetek Systems, Inc.
217 KOR Electronics, Inc.
218 Koronis Pharmaceuticals
219 Lamina Ceramics, Inc.
220 Level One Communications, Inc.
221 Life Technologies, Inc.
222 LifeSpan BioSciences, Inc.
223 LifeSpex, Inc.
224 LightLogic, Inc.
225 Lightwave Technologies, Inc.
226 Lineo, Inc.
227 LipoGen, Inc.
228 LocalMed, Inc
229 Locus Pharmaceuticals, Inc.
230 Luxtron Corporation
231 MacroNex, Inc.
232 Martek Biosciences Corporation
233 Matrix Semiconductor, Inc.
234 Mech-El Industries, Inc.
235 MediaQ, Inc.
236 Mediopia International Co Ltd
237 Mellanox Technologies, Inc.
238 Message Pharmaceuticals, Inc.
239 Metabolex, Inc.
240 MetaProbe LLC
241 Metris Therapeutics, Ltd.
242 Micro Linear Corporation
243 Micro Technology, Inc.
244 Microbeam, Inc.
245 Microfabrica, Inc.
246 Microgenics Corporation
247 Micron Custom Manufacturing Inc.
248 Microscale Company, Ltd.
249 Millennium Systems, Inc.
250 Molecular Biosystems, Inc.
251 Molecular Devices Corp
252 Molecular Genetics, Inc.
253 Monoclonal Antibodies, Inc.
254 Morrow Electronics, Inc.
255 Mosaic Systems, Inc.
256 MultiLink Technology Corp.
257 Myco Pharmaceuticals
258 Mycogen Corporation
259 MystiCom, Ltd.
260 Nanogen, Inc.
261 Navarro Networks
262 nCHIP, Inc.
263 NEC Eluminant Technologies, Inc.
264 NeoRx Corporation
265 Neose Technologies, Inc.
266 Ness Display Corporation
267 NetEffect, Inc.
268 NeuroControl Corporation
269 Neurocrine Biosciences, Inc.
270 NeXagen, Inc.

271 Nitgen Technologies
272 Norak Biosciences, Inc.
273 Nova Pharmaceutical Corp
274 Novalux, Inc.
275 Novellus Systems, Inc
276 November
277 NPS Pharmaceuticals, Inc.
278 NxtWave Communications
279 Ocean Genetics
280 Omex Corporation
281 Oncodiagnostics, Inc.
282 Oncor, Inc.
283 Optillion, Inc.
284 Opto-Electronic Center
285 Orchid Biosciences, Inc.
286 Oren Semiconductor Inc
287 Ortel Corporation
288 OSI Pharmaceuticals, Inc.
289 Pacific Lithium Limited
290 PacketLight Networks, Ltd.
291 Panelvision Corporation
292 Paradigm Technology, Inc.
293 Paradygm Science & Technologie
294 Passave Technologies, Inc
295 Peak Systems
296 Peptor, Ltd.
297 Perlegen Sciences, Inc.
298 Phaethon Communications, Inc.
299 Phospho-Energetics, Inc.
300 PhotoBioChem NV
301 Photodyne, Inc.
302 Picolight, Inc.
303 PinPoint Corp
304 Planar Systems, Inc.
305 Plastic Logic, Ltd.
306 Pliant Systems, Inc.
307 Pluto Technologies International,Inc.
308 PMC-Sierra, Inc.
309 Power Integrations, Inc.
310 Powerline GES Pty Ltd
311 Procept, Inc.
312 Proconics International, Inc.
313 ProCyte Corporation
314 ProQuip, Inc.
315 Provac, Inc.
316 PSI Star Corporation
317 PTC Therapeutics, Inc.
318 Quake Technologies, Inc.
319 Quantum Bridge Communications
320 Quantum Effect Devices, Inc
321 Quidel Corporation
322 Renalogics
323 Renalogies
324 Replicon NeuroTherapeutics, Inc
325 Repligen Corporation
326 RF Solutions, Inc
327 RiboGene, Inc.
328 Rigel Pharmaceuticals, Inc
329 Saber Equipment Corp.
330 Safer, Inc.
331 SandCraft, Inc.
332 Saratoga Semiconductor Corp
333 Security Tag Systems
334 Sekonix Company, Ltd.
335 Semiconductor Manufacturing Corp.
336 Sensym Inc.
337 Shaman Pharmaceuticals, Inc.
338 ShareWave, Inc.
339 Sheldahl, Inc.
340 Sherwood Enterprises, Inc.
341 SiByte, Inc.
342 SICOR, Inc.
343 Silicon Light Machines
344 Silicon Power Cube
345 Silicon Wave, Inc.
346 SkyTune Corporationa
347 Sonics, Inc.
348 Sphinx Pharmaceuticals Corp
349 Spiration, Inc.
350 Standard MEMS, Inc.
351 Sterix Ltd
352 StratumOne Communications, Inc
353 Substrate Technologies, Inc.
354 Sungene Technologies Corp
355 Sunyang Tech Co., Ltd.
356 Support Technologies, Inc.
357 Suprex Corporation
358 Surface Mounted Technology Corp
359 SVO Enterprises Corporation
360 Symphony Pharmaceuticals, Inc.
361 Synaptic Pharmaceutical Corp
362 Synbiotics Corporation
363 Synergen, Inc.
364 Synergy Semiconductor Corp

365 Synopsys, Inc.
366 Syntro Corporation
367 Tamul Multimedia Company, Ltd.
368 Telecruz Technology, Inc.
369 Telios Pharmaceuticals, Inc.
370 Telmos, Inc.
371 Tensilica, Inc.
372 TerraGen Discovery
373 Tessera Technologies, Inc.
374 Test Systems, Inc.
375 Therion Biologics Corporation
376 Thesys Memory Products Corp
377 TissueInformatics, Inc.
378 Touch Activated Switch Arrays
379 Transgenics, Inc.
380 Transmeta Corporation
381 Trega Biosciences, Inc.
382 Trine Pharmaceuticals, Inc.
383 Triplex Pharmaceutical Corp
384 Trophix Pharmaceuticals, Inc.
385 Tropic Networks, Inc.
386 U.S. Genomics, Inc.
387 Ultra Diagnostics Corporation
388 Ultro Lighting International Pte
389 Unistructure, Inc.
390 Unitive Electronics, Inc.
391 Variagenics, Inc.
392 Vascular Architects, Inc.
393 VaxGen, Inc.
394 Vega Vista, Inc
395 Verax Corporation
396 Versicor, Inc.
397 Vitelic Corporation
398 Vitesse Semiconductor Corp
399 VLSI Technology, Inc.
400 VTC, Inc.
401 WaferScale Integration, Inc
402 WAVICS, Inc.
403 Xcat, Inc.
404 XCellsyz, Ltd.
405 XDI Innovations
406 Xenogen Corporation
407 Xenova Group PLC
408 Xilinx, Inc.
409 XOMA Corporation
410 Xytronyx, Inc.
411 ZBD Displays Ltd
412 Zhone Technologies
413 Zight Corporation
414 Zolo Technologies, Inc.
415 Zoran Corporation
416 Zylin Corporation
417 Zynaxis, Inc.
418 Zyomyx, Inc.

APPENDIX B

B-1. SIC AND BUSINESS DESCRIPTION OF INVESTOR-INVESTEE PAIRS:

Firm Name	Firm_ SIC_ Primary	Firm_ SIC_ Secondary	Company Name	Com_ SIC_ Primary	Com_Description	Com_ SIC_ Secondary	Mkt _rel
3Com Ventures	3577	3571,7376,7379	Silicon Wave, Inc.	3674	Provides silicon ASIC solutions for communication equipment.	7373	0.25
Abbott Laboratories	2834	2833,3821,5047	Aronex Pharmaceuticals, Inc.	2836	Develops anti-infective and cancer therapeutics.	3356	0.75
Abbott Laboratories	2834	2833,3821,5047	LocalMed, Inc	8731	Develops innovative catheter systems to deliver therapeutics agents.	2836	0
Abbott Laboratories	2834	2833,3821,5047	Metabolex, Inc.	2834	Develops and discovers new drugs for type 2 diabetes.	3823,3845,3825	1
Abbott Laboratories	2834	2833,3821,5047	RiboGene, Inc.	2834	Develops therapeutic compounds designed to combat infections.	7373	1
Acma Australia Pty Ltd.	5045	6719,7379,7372,5722	Harwal Electrical Industries Pty Ltd	3573	Designs and manufactures switchboard installations.	5139	0
ADC Telecommunications, Inc.	3661	3669,7372,7379	PacketLight Networks, Ltd.	3674	Develops optical systems.	8731	0.5
Affymetrix, Inc.	8731	/	Eos Biotechnology, Inc.	2936	Develops therapeutic antibody based drugs.	3826	0
Affymetrix, Inc.	8731	/	Orchid Biosciences, Inc.	8071	Develops computer micro-engineering technology for drug design.	8731	0.25
Affymetrix, Inc.	8731	/	Perlegen Sciences, Inc.	2836	Provides genetics research.	7379	0
AlliedSignal, Inc.	3724	3728,3511,3822,3823,3824,2821,2824,3714,3292	Genetics Institute, Inc.	2836	Develops recombinant DNA human pharmaceutical products.	8731	0
Altera Corporation	3674	7372	I-Cube, Inc.	3674	Develops several types of CMOS integrated circuits.	5139	1
Altera Corporation	3674	/	Tensilica, Inc.	3629	Develops application-tailored microprocessors.	7371,6794	0.5
Amena-Retevision Movil SA	2833	/	Advancell	2835	Develops in vitro cellular technology for the pharmaceutical industry.	2899,3821,3826,8731	0.75
Amena-Retevision Movil SA	2833	/	XCellsyz, Ltd.	2835	Produces novel human cell based technologies for drug discovery.	5065	0.75
American Cyanamid	8071	/	Cytogen Corporation	2834	Develops biomedical systems for imaging and treating cancers.	2836	0
American Cyanamid	8071	/	Ecogen, Inc.	2834	Developing microbial and viral biological pest controls.	3087	0
American Cyanamid	8071	/	Embrex, Inc	2836	Develops technology of poultry embryo growth stimulants.	3087	0
American Cyanamid	8071	/	XOMA Corporation	2836	Develops genetically-engineered monoclonal antibodies.	5045,5065,3672,7372	0
American Express	6021	6022,6029,6035,6036,6153,6159,6081,6082	Calient Networks	3832	Develops intelligent, all-photonic switching systems and software.	2835	0
American Express	6021	6022,6029,6035,6036,6153,6159,6081,6082	Quidel Corporation	2835	Manufactures and markets medical diagnotic test kits.	7373	0
American Express	6021	6022,6029,6035,6036,6153,6159,6081,6082	Silicon Power Cube	3674	Manufactures high power solid state switching modules.	7373	0
American Hospital Supply Corp.	2835	/	Bio-Diagnostics, Inc.	2835	Develops instrumentation to analyze certain blood chemistries.	3569,3821	1
American Linen Supply Co.	3990	/	Molecular Genetics, Inc.	721	Engaged in research and development relating to hybrid corn.	3841	0.25
Ameritech Development Corp.	4813	4812,2741,7382,4841	Advanced Power Technology, Inc	3674	Manufactures semiconductors for high power and high frequency control.	2899,3821,3826,8731	0
Ameritech Development Corp.	4813	4812,2741,7382,4841	Aetna Communication Laboratories	3832	Provides fiber optic packaged voice devices.	2899,3821,3826,8731	0
Ameritech Development Corp.	4813	4812,2741,7382,4841	Level One Communications, Inc.	3661	Designs and markets specialty semiconductor chips.	8731	0
Ameritech Development Corp.	4813	4812,2741,7382,4841	Microbeam, Inc.	3674	Manufactures scientific instruments and semiconductor equipment.	3823,3845,3825	0
Ameritech Development Corp.	4813	4812,2741,7382,4841	Pliant Systems, Inc.	3832	Manufactures and markets fiber optic systems for phone companies.	3613,3577,3823	0
Ameritech Development Corp.	4813	4812,2741,7382,4841	ShareWave, Inc.	3674	Develops semiconductor technology for wireless home networking products.	7373	0
Ameritech Development Corp.	4813	4812,2741,7382,4841	Unistructure, Inc.	3573	Manufactures multi-layer printed circuit assemblies.	7371,6794	0
Analog Devices Enterprises	3674	/	Altera Corporation	3674	Manufactures semi-custom erasable programmable logic devices.	3577	1
Analog Devices Enterprises	3674	/	Axsun Technologies, Inc	3674	Manufactures optical components for the telecommunications industry.	3569,3821	1
Analog Devices Enterprises	3674	/	Bipolar Integrated Technology Inc.	3674	Designs VLSI integrated circuits.	2835	1
Analog Devices Enterprises	3674	/	GigaBit Logic, Inc.	3674	Manufactures ultra high-speed gallium arsenide integrated circuits.	5139	1
Analog Devices Enterprises	3674	/	Photodyne, Inc.	3825	Manufactures fiber optic testing equipment and other products.	7379	0.25
Analog Devices Enterprises	3674	/	Test Systems, Inc.	3811	Makes loaded and bare-board testers.	7371,6794	0.25
Analogic Corp.	3825	7382,3577,7011	Telmos, Inc.	3674	Manufactures ICs using DMOs, CMOs and precision analog arrays.	2834	0.25
Anschutz Investment	6282	/	Chromatis Networks, Inc.	3669	Develops an automated intelligent	2879	0

Company							
Anschutz Investment Company	6282	/	Tropic Networks, Inc.	3832	microscope system. Operates as an optical networking company.	7371,6794	0
Anschutz Investment Company	6282	/	Zolo Technologies, Inc.	3832	Develops and manufactures optical networking subsystems.	3661,3229	0
Asachi Keiki Co. Ltd.	3390	/	Crystal Semiconductor Corp	3674	Develops integrated circuits with analog/digital functions.	3566,5065	0.25
Asachi Keiki Co. Ltd.	3390	/	Luxtron Corporation	3822	Manufactures ultra-sensitive thermometers for industrial and medical use.	3823,3845,3825	0.25
Asahi Chemical Industry Co., Ltd.	2899	5039,2834	Circe Biomedical, Inc.	2834	Develops bioartificial organs and biomedical systems.	3827	0.5
Asahi Chemical Industry Co., Ltd.	2899	5039,2834	Crystal Semiconductor Corp	3674	Develops integrated circuits with analog/digital functions.	3566,5065	0
AT&T	4813	7389,7375,8999,7379	Paradigm Technology, Inc.	3674	Develops advanced semiconductor devices for high-speed RAMs.	8731	0
August Systems Corp.	3825	/	Micron Custom Manufacturing Inc.	3573	Operates as an electronics manufacturing services provider.	3823,3845,3825	0.25
Banner Industries	5941	3452,3589,3674,6512,7997,3728	Benchmarq Microelectronics, Inc.	3500	Designs, tests, & markets integrated circuits and semiconductor components.	3569,3821	0
Becton, Dickinson & Co.	3841	3842,3826,3845	Applied Biosystems, Inc.	3826	Develops genetic machinery and chemical products.	2836,8731	0.5
Becton, Dickinson & Co.	3841	3842,3826,3845	Luxtron Corporation	3822	Manufactures ultra-sensitive thermometers for industrial and medical use.	3823,3845,3825	0.5
Becton, Dickinson & Co.	3841	3842,3826,3845	Nanogen, Inc.	3826	Develops proprietary DNA sequencing technology from the Salk Institute.	3841	0.5
Becton, Dickinson & Co.	3841	3842,3826,3845	OSI Pharmaceuticals, Inc.	2834	Develops products for the detection, monitoring and treatment of cancer.	8731	0
Becton, Dickinson & Co.	3841	3842,3826,3845	Quidel Corporation	2835	Manufactures and markets medical diagnotic test kits.	7373	0
Becton, Dickinson & Co.	3841	3842,3826,3845	Sensym Inc.	3674	Manufactures low-cost pressure sensors.	7373	0.25
BIOMEC Inc.	2899	/	Imalux Corporation	5047	Develops medical imaging equipment and devices.	5139	0
BIOMEC Inc.	2899	/	NeuroControl Corporation	3842	Develops FES technology to restore paralyzed muscles and limbs.	2836,8731	0
BMW Technologies Inc.	3711	3751	Dolch American Instruments	3674	Manufactures logic analyzers for complex microprocessor architectures.	3087	0.25
Boehringer Mannheim Corp	2834	/	XOMA Corporation	2836	Develops genetically-engineered monoclonal antibodies.	5045,5065,3672,7372	0.75
Borg-Warner Security Corp.	3714	3585	PMC-Sierra, Inc.	3674	Manufactures standard and application-specific integrated circuits.	3613,3577,3823	0.25
Bristol-Myers Company	2834	2844,5122,3842	Procept, Inc.	2843	Develops immunotherapeutic and diagnostic pharmaceuticals.	3613,3577,3823	1
British Petroleum	2911	1311	Dallas-Semiconductor Corp	3674	Manufactures customized CMOS products using late implementation.	3625,3571,3579,3676,3572,3661,3674,3679,3669,3643	0
BRM Capital	6172	/	Passave Technologies, Inc	3573	Develops digital signal processing (DSP) cores for semiconductor industry.	8731	0
BSI Industries	2891	/	Agensys, Inc.	8732	Develops targeted cancer therapeutics.	2899,3821,3826,8731	0
C. Itoh & Co. Ltd.	5171	5172	Repligen Corporation	2856	Produces recombinant proteins.	7373	0
Cabletron Systems, Inc.	3661	7376	CentrePath	7373	Designs fiber optic networking products addressing bandwidth bottlenecking.	2879	0
Canon, Inc.	3579	3555,3861	Energy Conversion Devices, Inc	3674	Develops technologies involving amorphous semiconductors.	8731,3499,3827,3674	0.25
Cendant Corporation	7011	7514,6162,6411,6531,7515,,6163,7374	ShareWave, Inc.	3674	Develops semiconductor technology for wireless home networking products.	7373	0
Centocor Corporation	2834	/	Apollon, Inc.	2836	Develops and commercializes nucleic acid based vaccines.	2836,8731	0.75
Centocor Corporation	2834	/	ChromaVision Medical Systems Inc.	3827	Develops an automated intelligent microscope system.	2879	0
Centocor Corporation	2834	/	Variagenics, Inc.	2836	Develops and commercializes pharmacogenomics products.	7371,6794	0.75
ChevronTexaco Venture Equities	1311	2911,4612,4924,5172,1222,1221,2865,4911,1321	Illumina, Inc.	3826	Develops tools for the large-scale analysis of genetic variation & function	5139	0
ChevronTexaco Venture Equities	1311	2911,4612,4924,5172,1222,1221,2865,4911,1321	Microfabrica, Inc.	3672	Develops micro-machining process technology.	3823,3845,3825	0
ChevronTexaco Venture Equities	1311	2911,4612,4924,5172,1222,1221,2865,4911,1321	Xenogen Corporation	8731	Develops biochemical reporters that monitor biological events.	2835	0
CIBC Bank, CIBC Resourcing	6021	6022,6029,6081,6082	Variagenics, Inc.	2836	Develops and commercializes pharmacogenomics products.	7371,6794	0
Cisco Systems, Inc.	3661	/	Acelo Semiconductor, Inc.	3674	Creates semiconductors for fiber optic telecommunications.	3827,7389,3577	0.5
Cisco Systems, Inc.	3661	/	BaySpec, Inc.	3229	Designs, manufactures and markets fiber-optic components and modules.	3569,3821	0.25
Cisco Systems, Inc.	3661	/	CENiX, Inc.	3679	Designs and manufactures high-speed optoelectronic interfaces.	2879	0.5
Cisco Systems, Inc.	3661	/	Cidra Corporation	8711	Designs and manufactures optical components and modules for	3827	0

					networks.		
Cisco Systems, Inc.	3661	/	Integrated Micromachines, Inc.	3679	Develops high performance components for optical switching applications.	3674	0.5
Cisco Systems, Inc.	3661	/	iPhotonics, Inc.	8711	Provides outsourced services for fiber optic system and subsystem OEMs.	8731	0
Cisco Systems, Inc.	3661	/	Lamina Ceramics, Inc.	3573	Manufactures ceramic printed circuit boards based on a metal substrate.	8731	0.25
Cisco Systems, Inc.	3661	/	LightLogic, Inc.	3663	Develops optoelectronic components and subsystems.	8731	0.75
Cisco Systems, Inc.	3661	/	MystiCom, Ltd.	3573	Develops digital signal processing (DSP) cores for semiconductor industry.	3841	0.25
Cisco Systems, Inc.	3661	/	Navarro Networks	3674	Designs high-performance VLSI integrated circuits	3841	0.25
Cisco Systems, Inc.	3661	/	Novalux, Inc.	3669	Manufactures photonic systems for semiconductor manufacturing.	8731	0.75
Cisco Systems, Inc.	3661	/	Optillion, Inc.	3674	Develops and manufactures fibre-optic ethernet transceivers.	8731	0.75
Cisco Systems, Inc.	3661	/	Phaethon Communications, Inc.	3674	Develops Fiber Optic networking systems.	7379	0.75
Cisco Systems, Inc.	3661	/	Picolight, Inc.	3832	Produces and sells fiber-optic components.	3699	0.25
Cisco Systems, Inc.	3661	/	Quake Technologies, Inc.	3674	Develops physical layer chips for high speed optical networking.	7373	0.5
Cisco Systems, Inc.	3661	/	Quantum Effect Devices, Inc	3571	Manufactures microprocessors for embedded systems applications.	7373	0.25
Cisco Systems, Inc.	3661	/	SandCraft, Inc.	3571	Develops and markets superscalar microprocessors for communications.	7373	0.25
Cisco Systems, Inc.	3661	/	ShareWave, Inc.	3674	Develops semiconductor technology for wireless home networking products.	7373	0.5
Cisco Systems, Inc.	3661	/	SiByte, Inc.	3571	Development and manufacturing of microprocessor solutions.	7373	0.75
Cisco Systems, Inc.	3661	/	StratumOne Communications, Inc	3669	Develops integrated semiconductor technology.	8731	0.75
Cisco Systems, Inc.	3661	/	Tensilica, Inc.	7371	Develops application-tailored microprocessors.	6794	0
Cisco Systems, Inc.	3661	/	Vega Vista, Inc	7371	Operates a fabless semiconductor company.	6794	0
Cisco Systems, Inc.	3661	/	Zhone Technologies	5045	Develops, manufactures and markets telecommunications network equipment.	5065,3672,7372	0
Comcast Interactive Capital	4841	7375	Quantum Bridge Communications	3663	Provides carrier class Fiber to the Premises (FTTP) equipment.	7373	0
Compaq Computer Corp.	3577	3571,5049,3674,7379,7373,3572,6153	Candescent Technologies Corp.	3830	Licenses technology for high-definition flat panel displays.	3675,3672,3676	0.25
Compaq Computer Corp.	3577	3571,5049,3674,7379,7373,3572,6153	Intellon Corporation	3573	Develops integrated circuits, subsystems and development tools.	3674,3669	0.75
Compaq Computer Corp.	3577	3571,5049,3674,7379,7373,3572,6153	Transmeta Corporation	3571	Manufactures and designs VLSI chips for wireless mobile devices.	7371,6794	0.75
Comstellar Technologies, Inc.	5160	/	Ashvattha Semiconductor, Inc.	5065	Provides integrated radio frequency chips.	8071	0.25
Conexant Systems, Inc.	3674	3661	Tensilica, Inc.	3629	Develops application-tailored microprocessors.	7371,6794	0.5
Control Data Corporation	3670	/	Micro Technology, Inc.	3674	Manufactures high performance peripheral controller devices.	3823,3845,3825	0.75
Control Data Corporation	3670	/	VTC, Inc.	3674	Manufactures analog semiconductors for the disk drive industry.	5065	0.75
Cooper Development Co.	3851	3841,3827	XOMA Corporation	3672	Develops genetically-engineered monoclonal antibodies.	3672,7372	0.25
Cowen Biotech Ltd.	2836	/	Repligen Corporation	2856	Produces recombinant proteins.	7373	0.5
CP Ventures Inc.	3624	2821,2221,3469	Austek Microsystems, Ltd.	3620	Manufactures custom semiconductors and circuit board subsystems.	3569,3821	0.75
CPC International Inc.	7380	/	Syntro Corporation	2834	Develops biotechnology for animal health and specialty chemicals.	2834	0
CPT Holdings Inc.	7379	/	Xcat, Inc.	3800	Manufactures integrated logic and fault simulation accelerator systems.	5065	0
Crossroad Systems	3577	3572	NetEffect, Inc.	3674	Develops chips for networking and storage applications.	2836,8731	0.25
Crystal Systems Solutions Ltd.	7371	/	Sonics, Inc.	3674	Develops communication subsystems to connect Intellectual Property cores.	7373	0
Cypress Semiconductor Corp.	3674	/	Alvesta Corporation	3832	Designs and manufactures full-duplex, 10Gb/s optical transceivers.	3577	0.25
Cypress Semiconductor Corp.	3674	/	Silicon Light Machines	3679	Develops light valve technology for use in projection displays.	7373	0.75
DAMAC Ventures	6799	/	Blaze Network Products, Inc.	3832	Develops optical transceiver products and optical sub-assemblies.	2835	0
DAMAC Ventures	6799	/	Chameleon Systems, Inc.	3674	Develops semiconductors for reconfigurable communications platforms.	2879	0
DAMAC Ventures	6799	/	Cidra Corporation	8711	Designs and manufactures optical components and modules for networks.	3827	0
DAMAC Ventures	6799	/	PinPoint Corp	5063	Develops devices used for tracking personnel within healthcare facilities.	3699	0
DAMAC Ventures	6799	/	Silicon Wave, Inc.	3674	Provides silicon ASIC solutions for communication equipment.	7373	0
DAMAC Ventures	6799	/	Standard MEMS, Inc.	3674	Manufactures Micro Electro Mechanical Systems (MEMS) for high	8731	0

					technology.		
Data General Corporation	3575	3577,3669	Actel Corporation	3674	Manufactures programmable integrated circuits using fusible link technology	2899,3821,3826,8731	0.25
Data General Corporation	3575	3577,3669	Power Integrations, Inc.	3674	Develops integrated circuits to interface and control high voltages.	3613, 3577,3823	0.25
Dekalb Agriresearch	2836	/	Life Technologies, Inc.	3826	Produces research enzymes for the genetic engineering market.	8731	0
Diagnostic Products Corp.	3842	3841,2835	Monoclonal Antibodies, Inc.	2835	Develops hybridoma cell lines and manufactures monoclonal antibodies.	3841	0
Digital Equipment Corp.	3571	3577,7373,3572	Synergy Semiconductor Corp	3679	Manufactures high-performance ECL and BICMOS products.	2834	0.5
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	Alchemia Pty., Ltd.	8731	Develops a new technology for the manufacture of carbohydrates.	5122	0
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	Alien Technology Corporation	3573	Develops electronic display technology.	3577	0
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	AmberWave Systems Corporation	7379	Supplies strained silicon technology for the semiconductor industry.	3577	0
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	Collaborative Research, Inc	8737	Develops biotechnology products in the medical, agricul. & indus. fields.	3827	0.25
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	Dionex Corporation	3826	Manufactures ion chromatography systems used for ID of ionic contaminants.	3087	0.25
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	DNA Research Innovations, Ltd.	3826	Develops automated DNA extraction instuments.	3087	0
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	Epicyte Pharmaceutical, Inc.	2836	Develops medical therapies for diseases affecting mucous membranes.	3826	0
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	Genetics Institute, Inc.	2836	Develops recombinant DNA human pharmaceutical products.	8731	0
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	Graffinity Pharmaceutical Design GmbH	2834	Develops chemical microarrays for use in post genomic drug discovery.	5139	0
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	JGKB Photonics, Inc.	3674	Operates as a fabless optical component company.	8731	0
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	Plastic Logic, Ltd.	3573	Develops plastic circuits for mass applications.	3613,3577,3823	0
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	PSI Star Corporation	3679	Develops etching processes for printed circuit boards.	2844	0
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	XDI Innovations	3674	Develops specially engineered electronic products and semiconductors.	5065	0
Dow Chemical Company, The	2821	3086,2879,2865,2869,2819,2899	ZBD Displays Ltd	3679	Develops liquid crystal display technology.	5045,5065,3672,7372	0
DU Pont	2821	2819,2221,2075,2048,3069,2231,2842,2834,0119	Greyhawk Systems, Inc.	3573	Manufactures high information content, large area displays.	5139	0
DU Pont	2821	2819,2221,2075,2048,3069,2231,2842,2834,0119	Hem Research, Inc.	8731	Dvlps Ampligen, potentially therapeutic agent for treatment of AIDS, cancer	5139	0
DU Pont	2821	2819,2221,2075,2048,3069,2231,2842,2834,0119	Molecular Biosystems, Inc.	3845	Engages in applied molecular biology R&D of diagnostic products.	3825	0
Eastman Kodak Co, Inc.	3861	3577	Be Here Corporation	3569	Develops panoramic still-image camera lens system.	3821	0.25
Eastman Kodak Co, Inc.	3861	3577	Cytogen Corporation	2834	Develops biomedical systems for imaging and treating cancers.	2836	0
Eastman Kodak Co, Inc.	3861	3577	NeoRx Corporation	2835	Develops antibody agents for use in the treatment of cancer.	2836, 8731	0
Elan Corporation PLC	3861	5122	Acorda Therapeutics, Inc.	3861	Develops therapeutic products to restore spinal cord functionality.	2899,3821,3826,8731	1
Elan Corporation PLC	3861	5122	Athersys Inc.	3861	Develops therapeutic products.	3569, 3821	1
Elan Corporation PLC	3861	5122	Beyond Genomics, Inc.	3861	Develops a systems biology platform.	3569, 3821	1
Elan Corporation PLC	3861	5122	Incara	3861	Develops catalytic antioxidant compounds for cancer therapies.	5139	1
Electrolux Corporation	7372	6719,4899	Touch Activated Switch Arrays	3100	Develops a unique system of controls which eliminates mechanical components	7371, 6794	0
Electro-Science Corp.	2810	/	Electronic Systems Products, Inc.	3861	Manufactures radio communications equipment, simulation components, etc.	3087	0
Electro-Science Corp.	2810	/	Immunomed Corporation	2834	Develops immunological drugs for the veterinary industry.	5139	0.5
ELF Technologies	2999	/	Advanced Power Technology, Inc	3674	Manufactures semiconductors for high power and high frequency control.	2899,3821,3826,8731	0
ELF Technologies	2999	/	Agridyne Technologies, Inc.	721	Develops botanical insecticides and plant growth enhancement products.	8731,5122	0
ELF Technologies	2999	/	Angenics, Inc.	2835	Develops in vitro monoclonal antibody diagnostic tests.	2836,8731	0
ELF Technologies	2999	/	Crop Genetics International Corp.	721	Produces improved plant products	3566,5065	0

					using DNA technologies.		
ELF Technologies	2999	/	Embrex, Inc	2836	Develops technology of poultry embryo growth stimulants.	3087	0
ELF Technologies	2999	/	Enzytech, Inc	2834	Develops value-added products for healthcare, food and chemicals.	3826	0
ELF Technologies	2999	/	Kinetek Systems, Inc.	3826	Develops separation systems for the biotechnology industry.	8731	0
ELF Technologies	2999	/	Martek Biosciences Corporation	2865	Develops nutritionals and pharmaceuticals derived from microalgae.	3823,3845,3825	0
ELF Technologies	2999	/	Microgenics Corporation	5951	Develops medical diagnostic test kits for clinical laboratories.	3823,3845,3825	0
ELF Technologies	2999	/	Saber Equipment Corp.	3600	Develops novel integrated fuel dispensing systems.	7373	0
ELF Technologies	2999	/	Safer, Inc.	721	Manufactures non-toxic, non-petrochemical insecticides and fungicides.	7373	0
ELF Technologies	2999	/	Shaman Pharmaceuticals, Inc.	3800	Develops pharmaceuticals by isolating active compounds in tropical plants.	7373	0
ELF Technologies	2999	/	Sphinx Pharmaceuticals Corp	2835	Develops lipid-based diagnostics and therapeutics for various diseases.	7373	0
ELF Technologies	2999	/	Telios Pharmaceuticals, Inc.	3826	Develops products to aid cardiovascular wound and tissue healing.	2834	0
Eli Lilly & Company	2834	2833,2869,8099	Agouron Pharmaceuticals, Inc.	2834	Develops pharmaceuticals for the health care and food industries.	8731,5122	1
Eli Lilly & Company	2834	2833,2869,8099	Athena Neurosciences, Inc.	2834	Develops diagnostics and therapeutics for neurological disorders.	3569,3821	1
Eli Lilly & Company	2834	2833,2869,8099	BI, Inc.	2750	Mfrs. electronic identification systems and components.	3569,3821	0.25
Eli Lilly & Company	2834	2833,2869,8099	Glycomed, Inc.	2834	Develops therapeutic drugs based on complex carbohydrates.	5139	1
Eli Lilly & Company	2834	2833,2869,8099	Kelsius, Inc.	3826	Developing biological sensors for in vivo and in vitro purposes.	8731	0
Eli Lilly & Company	2834	2833,2869,8099	NeXagen, Inc.	2834	Develops a new class of pharmaceuticals based on RNA molecules.	2836,8731	1
Eli Lilly & Company	2834	2833,2869,8099	Verax Corporation	3826	Manufactures proteins and continuous fermentation systems.	7371,6794	0
Elron Technologies	7372	6719,4899	Oren Semiconductor Inc	3674	Develops digital-TV demodulation ICs for US and worldwide markets.	8731	0
Elron Technologies	7372	6719,4899	Zoran Corporation	3674	Designs digital signal processing (DSP) chips and system processors.	7372	0
Ericsson Business Innovation AB.	3661	/	Dialog Semiconductor GmbH	3674	Manufactures mixed signal Application specific Integrated Circuits (ASIC).	7371	0.5
Evans and Sutherland	7372	3674	Mosaic Systems, Inc.	3674	Designs electrically programmable silicon semiconductors.	3841	0
Evans and Sutherland	7372	3674	VLSI Technology, Inc.	3674	Manufactures customized very large scale integrated CMOS semiconductors.	5065	0
Exxon Enterprises	1311	2911,5541,4412,4612,2821,2869,1222,1021,4911	Epid	3573	A low-cost flat panel display to replace CRTs.	3826	0
Exxon Enterprises	1311	2911,5541,4412,4612,2821,2869,1222,1021,4911	Erndex	3674	Manufactures photo diodes.	3826	0
Exxon Enterprises	1311	2911,5541,4412,4612,2821,2869,1222,1021,4911	Kaylex, Inc.	3830	Developing liquid crystal displays.	8731	0
Exxon Enterprises	1311	2911,5541,4412,4612,2821,2869,1222,1021,4911	Opto-Electronic Center	3811	Manufactures aluminum-gallium-arsenide laser components.	8731	0
Fairchild Camera and Instrument	5941	3452,3589,3674,6512,7997,3728	Microgenics Corporation	3823	Develops medical diagnostic test kits for clinical laboratories.	3845,3825	0
Farley Inc.	6531	/	Exelixis, Inc.	8731	Develops pre-clinical models to assess and validate human gene function.	3826	0
Fenwick & West LLP	3674	/	FormFactor, Inc.	3679	Develops microsprings used to interconnect electronic packages to PCB's.	3826	0.5
Fenwick & West LLP	3674	/	Transmeta Corporation	3571	Manufactures and designs VLSI chips for wireless mobile devices.	7371,6794	0.25
Flextronics International Ltd.	3672	3679	Celetronix	3679	Provides electronic and optical manufacturing services.	3845	0.75
Flextronics International Ltd.	3672	3679	Unitive Electronics, Inc.	3679	Develops advanced semiconductor wafer processing and packaging technologies	7371,6794	0.75
Foster Industries, Inc.	3651	/	International Microelectronic	8711	Manufactures custom semiconductor integrated circuits.	3674	0
Foster Industries, Inc.	3651	/	Lightwave Technologies, Inc.	8731	Manufactures optical fiber cable for the telecommunications industry.	3832	0
Foster Industries, Inc.	3651	/	LipoGen, Inc.	2835	Develops liposome-based diagnostic test products.	8731	0
Foster Industries, Inc.	3651	/	Suprex Corporation	8731	Develops supercritical fluid chromatography instruments (SFC).	3800,5065	0
Fuji Bank, Limited	6029	/	Telecruz Technology, Inc.	3573	Designs and manufactures integrated circuits for the interactive TV market.	2834	0
Fujitsu Ltd.	3571	3674	Anamartic Ltd.	3571	Manufactures semiconductor-based	2836,8731	1

					storage systems.		
Fujitsu Ltd.	3571	3674	Vitesse Semiconductor Corp	3674	Designs communications integrated circuits for network equipment.	5065	0.25
G.D. Searle Division	3823	/	Biotechnology Development Corp.	3826	Provides medical equipment, disposables, technology & consulting services.	2835	0.75
Genentech Corporatio	2834	/	Glycomed, Inc.	2834	Develops therapeutic drugs based on complex carbohydrates.	5139	1
Genentech Corporatio	2834	/	InterMune, Inc.	2834	Develops products to treat pulmonary and infectious diseases and cancer.	8731	1
Genentech Corporatio	2834	/	Telios Pharmaceuticals, Inc.	8731	Develops products to aid cardiovascular wound and tissue healing.	2834	0
Genentech Corporatio	2834	/	VaxGen, Inc.	2834	Tests and markets HIV vaccine.	7371,6794	1
Genentech Corporatio	2834	/	Verax Corporation	3826	Manufactures proteins and continuous fermentation systems.	7371,6794	0
Genentech Corporatio	2834	/	Xenova Group PLC	2834	Designs and develops novel small molecule drugs from natural sources.	2835	1
General Atom/Toshiba Corp.	3669	3679	Applied Superconetics	3560	Mfrs. superconducting magnetics for magnetic resonance imaging systems.	3600	0.25
General Electric	3511	3724,3651,3632,3634,6141,3641,4833,5047,2821	Sherwood Enterprises, Inc.	3560	Manufacture complex cable systems and sub-assemblies.	7373	0.5
General Instrument Corporation	3674	3629	Cybernetic Data Products, Inc.	4899	Manufactures moving message displays and visual communication systems.	3566,5065	0
General Motors	3711	3713,6141,6331,6159,6163	Agility Communications, Inc.	4813	Develops products for the telecommunications industry.	2899,3821,3826,8731	0
General Signal Corporation	3541	/	Electron Beam Corp.	3699	Mfrs electron-beam lithography equipment for semiconductor processing.	3087	0.25
General Signal Corporation	3541	/	Zylin Corporation	3541	Designs digital signal processing (DSP) chips and system processors.	7372	1
Getty OIL Company	2070	/	Synergen, Inc.	2834	Develops specialty chemicals through genetic engineering.	2834	0.25
Gillette Co	3421	3691,3692,3634,3991,3829,3841,2844,3951,3999	Repligen Corporation	2856	Produces recombinant proteins.	7373	0
Glyko Biomedical, Ltd.	2860	/	BioMarin Pharmaceutical, Inc.	2835	Develops and commercializes carbohydrate enzyme therapeutics.	2835	0.25
Gould Inc.	3692	0723	Altus Corporation	3692	Produces lithium-thionyl chloride power cells.	3577	1
Guidant Corporation	3845	3841	CardioFocus, Inc.	8731	Develops photonic medical devices that treats cardiovascular diseases.	3845	0
Guidant Corporation	3845	3841	Spiration, Inc.	3841	Develops devices for the treatment of pulmonary diseases.	8731	0.75
Harris Corporation	3669	3679	Cross-Check Technology, Inc.	3825	Provides testability solutions for semiconductor designs.	3566,5065	0.25
Harris Corporation	3669	3679	NxtWave Communications	3577	Manufactures digital modulation and de-modulation integrated circuits.	8731	0.25
Harris Corporation	3669	3679	Peak Systems	3577	Develops ion implant monitors for the semiconductor industry.	7379	0.25
Harris Corporation	3669	3679	Synopsys, Inc.	3577	Develops high level design automation software.	2834	0.25
Heizer Corporation	3674	/	Omex Corporation	3573	Develops laser-based optical document storage systems.	8731	0.25
Hewlett-Packard	3577	3571,5049,3674,7379,7373,3572,6153	Caliper Technologies Corp.	3826	Manufactures systems for biochemical analysis.	3675,3672,3676	0.25
Hillman	5084	5072,5039,8711,7389	Agile Therapeutics, Inc.	2834	Develops novel transdermal products addressing women's health.	2899,3821,3826,8731	0
Hoechst Celanese Corporation	2834	/	Berlex Biosciences	2834	Develops human/animal health products and vaccines.	3569, 3821	1
Hoechst Celanese Corporation	2834	/	Celgene Corporation	2834	Develops biocatalysts for the production of fine chemicals.	2879	1
Hoechst Celanese Corporation	2834	/	Nova Pharmaceutical Corp	2834	Develops therapeutic drugs focusing on central nervous system disorders.	8731	1
Hybritech Incorporated	0723	/	Gen-Probe, Inc.	2835	Manufactures medical products based on DNA probe technology.	3826	0
Hyundai Venture Investment Corp.	6799	/	Cellontech Co Ltd	2835	Operates in the biotechnology industry.	2879	0
Hyundai Venture Investment Corp.	6799	/	Daehan Bio Link Company, Ltd.	721	Supplies specific pathogen free (SPF) laboratory animals.	2836	0
Hyundai Venture Investment Corp.	6799	/	Focus Company Ltd.	3679	Manufactures electronic components.	3826	0
Hyundai Venture Investment Corp.	6799	/	FST Inc. (FKA: Fine Semiconduc	3674	Manufactures and supplies pellicle to its clients.	3826	0
Hyundai Venture Investment Corp.	6799	/	Genomine, Inc.	8071	Develops edible vaccine.	5139	0
Hyundai Venture Investment Corp.	6799	/	In2Gen Co., Ltd	2836	Provides preventive and diagnosis medicine system for incurable diseases.	5139	0
Hyundai Venture Investment Corp.	6799	/	Innergy Power Corp.	3600	Develops and manufactures rechargeable batteries for portable computers.	5139	0
Hyundai Venture Investment Corp.	6799	/	Mediopia International Co Ltd	3674	Manufactures thermal plasma scrubbers.	3823,3845,3825	0
Hyundai Venture Investment Corp.	6799	/	Microscale Company, Ltd.	3674	Supplies flip chip bumping services to the semiconductor industry	3823,3845,3825	0
Hyundai Venture Investment Corp.	6799	/	Nitgen Technologies	3674	Designs and develops fingerprint recognition applications.	2836,8731	0

Hyundai Venture Investment Corp.	6799	/	Sunyang Tech Co., Ltd.	3699	Operates as a semiconductor equipment maker.	8731,5065	0
IBM Corporation	3571	3572,3661,7373,7376,7372,6159,7377,5044,3577	Credence Systems Corp.	3825	Manufactures Automatic Test Equipment (ATE) for LSI/VLSI semiconductors.	3566,5065	0.25
IBM Corporation	3571	3572,3661,7373,7376,7372,6159,7377,5044,3577	MultiLink Technology Corp.	3674	Designs and manufactures integrated circuits, modules, and boards.	3841	0.25
Infotechnology	2834	/	American Bionetics, Inc.	2830	Develops instrumentation and supplies for biotechnology industry.	3577	0.75
Infotechnology	2834	/	Associated Biomedic Systems, Inc.	2836	Develops T-cell growth factor and immune interferon technologies.	8071	0.75
Infotechnology	2834	/	Clinical Sciences, Inc.	2835	Produces immunodiagnostic reagents and reagent systems.	3827	0.75
Infotechnology	2834	/	Compulaser, Inc.	3573	Manufactures computer-controlled laser production tools and laser systems.	3827	0
Infotechnology	2834	/	Environmental Processing Inc	7397	Tests and conditions semiconductor circuits.	8731,3499,3827,3674	0
Infotechnology	2834	/	Flight Dynamics, Inc.	5088	Dvlps display systems sold in varying configurations to commercial airlines	3826	0
Innova Corp	3841		Besco Inc.	3670	Developed proprietary ceramic pressure transducers to digitize signals.	3821,3829	0.25
Innova Corp	3841		Focus Semiconductor Systems, Inc.	3826	Manufactures chemical vapor deposition systems for IC production.	3674	0.5
Innova Corp	3841		Luxtron Corporation	3822	Manufactures ultra-sensitive thermometers for industrial and medical use.	3823,3845,3825	0.5
Institution of Immunology	2836	/	IDEC Pharmaceuticals Corp	2836	Develops biopharmaceuticals to treat cancer and immune disorders.	5139	1
Integrated Device Technology Inc.	3674	/	Quantum Effect Devices, Inc	3571	Manufactures microprocessors for embedded systems applications.	7373	0.25
Intelligent Systems Corporation	7372	8243,8093,3821	AtheroGenics, Inc.	2834	Operates a biopharmaceutical company for treatment of chronic diseases.	3569,3821	0
Intelligent Systems Corporation	7372	8243,8093,3821	Renalogies	8731	Develops drugs for treatment of kidney diseases.	7373	0
Intelligent Systems Corporation	7372	8243,8093,3821	RF Solutions, Inc	2834	Develops pharmaceuticals to treat kidney disease.	7373	0
Invacare Corporation	8731	/	NeuroControl Corporation	3674	Provides broadband wireless products for the telecommunications industry.	7373	0
Itochu Corporation	5099	5199	NEC Eluminant Technologies, Inc.	3842	Develops FES technology to restore paralyzed muscles and limbs.	2836,8731	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Aclara BioSciences Inc.	3674	Develops systems for the passive optical network.	3841	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Acorda Therapeutics, Inc.	2835	Develops electronically-controlled microfluidics technology.	2899,3821,3826,8731	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Allos Therapeutics, Inc.	2835	Develops therapeutic products to restore spinal cord functionality.	2899,3821,3826,8731	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Aphton Corporation	2835	Develops and commercializes small molecular drugs.	3577	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Bio Logicals, Inc.	8731	Engaged in products to enhance capabilities of the immune system.	2836,2834	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	British Bio-Technology Group PLC	7391	Develops synthesis capabilities and pilot production of cloned products.	3569,3821	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Cambridge Biotechnology	7391	Develops and manufactures reagents and pharmaceuticals.	2835	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Critical Therapeutics, Inc.	3672	Produces painkillers and obesity treatments.	3675,3676	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Cyrano Sciences, Inc.	7391	Develops therapeutic products for critical care medicine.	3566,5065	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Cytogen Corporation	3826	Develops electronic sensor capable of identifying a spectrum of odors.	3566,5065	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	DigiLens, Inc.	2834	Develops biomedical systems for imaging and treating cancers.	2836	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,38	Enzo Biochem	3674	Designs, manufactures and markets polymer optical components.	7371	0

Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Epicyte Pharmaceutical, Inc.	3826	Research commercial products and processes based on genetic engineering.	3826	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Genaissance Pharmaceuticals, Inc.	2836	Develops medical therapies for diseases affecting mucous membranes.	3826	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Gliatech, Inc.	8071	Operates as a pharmaceutical company.	3826	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Immunicon Corporation	3841	Develops neural regeneration pharmaceuticals and devices.	5139	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Koronis Pharmaceuticals	2835	Develops affinity ferrofluids in combination with magnetic separation.	5139	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	LifeSpex, Inc.	2835	Develops technologies for the prevention and treatment of viral diseases.	8731	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Locus Pharmaceuticals, Inc.	2835	Develops in-vivo medical diagnostic and therapeutic applications.	8731	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Metris Therapeutics, Ltd.	3821	Develops a process to calculate the architecture of a protein's pocket.	8731	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Neose Technologies, Inc.	2835	Develops therapies for benign gynecological diseases.	3823,3845,3825	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Neurocrine Biosciences, Inc.	8731	Discovers and develops complex carbohydrates.	2836	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Peptor, Ltd.	2836	Develops drugs to treat nervous and immune system disorders.	8731	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	PhotoBioChem NV	3841	Discovers and developes novel therapies for the treatment of diseases.	7379	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Replicon NeuroTherapeutics, Inc	3841	Develops drugs to help protect against infectious diseases.	7379	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Rigel Pharmaceuticals, Inc	8071	Operates as a biopharmaceutical company focused on the use of replicons.	7373	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Sterix Ltd	8731	Provides intracellular combinatorial biochemistry research services.	7373	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Trega Biosciences, Inc.	8731	Develops and discovers steriod derivatives.	8731	0
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Trine Pharmaceuticals, Inc.	2835	Develops novel, small molecule drug therapies.	7371,6794	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Trophix Pharmaceuticals, Inc.	2835	Operates a drug development company.	7371,6794	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	U.S. Genomics, Inc.	2836	Develops pharmaceutical products for neurodegenerative diseases.	7371,6794	0.75
Johnson & Johnson	2834	2676,3842,2844,2833,2843,2835,2836,3851,3841	Vascular Architects, Inc.	2836	Operates a genomic informatics company.	7371,6794	0.75
Kanematsu-Gosho Ltd.	5065	/	Benzing Technologies, Inc.	7371	Develops, manufactures, and markets endovascular surgery products.	5047,6794	0
Kebo LAB AB	3678	/	Oncor, Inc.	3674	Manufactures cleaning systems for semiconductor fabrication equipment.	3569,3821	0.75
Kimball Manufacturing	2521	2434,2517,3672,3674	Applied Micro Circuits Corp.	8731	Develops DNA/RNA probes and hybridization systems for cancer detection.	2835	0
Kopvenco Inc. (Koppers Co.)	2819	2869,3569,3743	Ecogen, Inc.	3674	Manufactures semicustom bipolar and BICMOS gate array integrated circuits.	2836,8731	0
Kopvenco Inc. (Koppers Co.)	2819	2869,3569,3743	Engenics, Inc.	3674	Developing microbial and viral biological pest controls.	3087	0
Kopvenco Inc. (Koppers	2819	2869,3569,3743	Eotec Corporation	3826	Engages principally in developing	8731,3499,3	0

Co.)						continuous fermentation processes.	827,3674	
Kopvenco Inc. (Koppers Co.)	2819	2869,3569,3743	Genex Corporation	3832	Manufactures specialty single-mode, large-core, multi-mode fibers.	3826	0
Kyocera International, Inc.	3674	/	Micro Linear Corporation	3674	Develops recombinant DNA technology to commercial products.	5139	1
Kyocera International, Inc.	3674	/	Vitelic Corporation	3573	Manufactures analog/digital semi-custom and custom IC circuits.	3823,3845,3825	0.25
Kyocera International, Inc.	3674	/	WaferScale Integration, Inc	3674	Develops very large scale integration (VLSI) semiconductor products.	7371,6794	1
Kyocera International, Inc.	3674	/	Xilinx, Inc.	3674	Develops non-volatile programmable memory and semi-custom ICs.	5065	1
LG Electronics	3651	3652,3661	Bermai, Inc.	5045	Develops and manufactures digital programmable logic devices	5065,3672,7372	0
LG Electronics	3651	3652,3661	Tessera Technologies, Inc.	3674	Develops semiconductor technology for the broadband wireless industry.	3569,3821	0.5
Litton Industries	2891	/	PMC-Sierra, Inc.	3674	Develops semiconductor packaging technology for electronic products.	7371,6794	0
Lotus Development Corporation	2891	/	Genoptix, Inc.	3674	Manufactures standard and application-specific integrated circuits.	3613,3577,3823	0
LSI Logic Corporation	3674	3672,5065,7371,3572,5045	Adaptive Silicon, Inc	3821	Provides genetic testing and identification services.	5139	0.25
LSI Logic Corporation	3674	3672,5065,7371,3572,5045	IKOS Systems, Inc	3821	Develops programmable logic technology.	2899,3826,8731	0.25
Lubrizol Business Development Co.	2860	/	Altus Corporation	3573	Manufactures PC-based logic validation systems for ASIC testing.	5139	0
Lubrizol Business Development Co.	2860	/	Chemgen, Inc.	2869	Produces lithium-thionyl chloride power cells.	3577	0.75
Lubrizol Business Development Co.	2860	/	Creative BioMolecules, Inc.	2048	Developing proprietary bioprocess and fermentation processes.	2879	0.25
Lubrizol Business Development Co.	2860	/	Genentech, Inc.	2834	Develops human growth factors through genetic engineering.	3566,5065	0.75
Lubrizol Business Development Co.	2860	/	GLC Associates	2860	Develops commercial products with genetic engineering techniques.	8731	1
Lubrizol Business Development Co.	2860	/	Mycogen Corporation	2048	Mfrs specialty and fine chemicals produced via biocatalysis.	5139	0.25
Lubrizol Business Development Co.	2860	/	Ocean Genetics	2860	Develops synthetic bio-pesticides for large crop protection.	3841	1
Lubrizol Business Development Co.	2860	/	Sungene Technologies Corp	2865	Develops marine biotechnology products and research procedures.	8731	0.75
Lubrizol Business Development Co.	2860	/	SVO Enterprises Corporation	2869	Specializes in genetic modification of cereal and oil seed crops.	8731,5065	0.75
Lubrizol Business Development Co.	2860	/	Syntro Corporation	2048	Develops and produces unique vegetable oils and derivatives.	8731,5065	0.25
Manufacturers Life Insurance Co.	6311	6321,6324,6399	PTC Therapeutics, Inc.	2834	Develops biotechnology for animal health and specialty chemicals.	2834	0
Manufacturers Life Insurance Co.	6311	6321,6324,6399	TissueInformatics, Inc.	8731	Operates a biopharmaceutical company.	2844	0
Marion Merrill Dow	8090	/	SICOR, Inc.	8731	Operates as a bioinformatics company.	7371,6794	0.25
Martin Marietta Investments, Inc.	1422	1423,1442,3297	Agridyne Technologies, Inc.	2834	Develops, manufactures and markets multi-source injectable pharmaceuticals.	7373	0
Marubeni Corporation	5113	5111	Substrate Technologies, Inc.	5122	Develops botanical insecticides and plant growth enhancement products.	8731	0.5
Matsushita Electric Corporation	3639	3679	Tensilica, Inc.	3674	Develops and manufactures integrated circuit (IC) substrates.	8731,5065	0.5
MCM Capital Group, Inc.	6199	/	NeuroControl Corporation	3629	Develops application-tailored microprocessors.	7371,6794	0
MedImmune	2836	2834	Applied Molecular Evolution, Inc.	3842	Develops FES technology to restore paralyzed muscles and limbs.	2836,8731	0
Medtronic, Inc.	3845	3841,3842	Advanced Tissue Sciences, Inc	8731	Develops technologies to improve the production of human antibodies.	2836,8731	0
Medtronic, Inc.	3845	3841,3842	Cepheid, Inc.	8731	Provides biological research services.	2899,3821,3826,8731	0
Medtronic, Inc.	3845	3841,3842	Vascular Architects, Inc.	3842	Develops fast, integrated systems for DNA probe essays.	2879	0.75
Merck & Co.	2834	5122	Crop Genetics International Corp.	5047	Develops, manufactures, and markets endovascular surgery products.	7371,6794	0
Merck & Co.	2834	5122	ImmuLogic Pharmaceutical Corp	2834	Produces improved plant products using DNA technologies.	3566,5065	1
Microsoft Corporation	7372	3577,7375,8999	Matrix Semiconductor, Inc.	7380	Develops pharmaceuticals for treatment of infectious diseases.	5139	0.5
Microsoft Corporation	7372	3577,7375,8999	Pluto Technologies International,Inc.	7380	Developed three-dimensional integrated circuits.	3823,3845,3825	0.5
Microsoft Corporation	7372	3577,7375,8999	ShareWave, Inc.	7380	Develops computer-based video storage and networking solutions.	3613,3577,3823	0.5
Microwave Technology	3679	3559	KOR Electronics, Inc.	7373	Develops semiconductor technology for wireless home networking products.	7373	0
Minnesota Mining & Manufacturing	3291	2821,5088,3843,3661,3069,2672,2678,4899,2899	Mosaic Systems, Inc.	2860	Designs electronic systems for government and defense contractors.	8731	0
Minnesota Mining & Manufacturing	3291	2821,5088,3843,3661,3069,2672,2678,4899,2899	Panelvision Corporation	2860	Designs electrically programmable silicon semiconductors.	3841	0
Mitsui & Co.	5099	/	Array Biopharma, Inc	3679	Manufactures thin film, flat panel display screens.	8731	0
Mitsui & Co.	5099	/	Crysteco, Inc.	8731	Develops new small molecule drugs.	8071	0
Mitsui & Co.	5099	/	Gain Electronics	5065	Manufactures highly doped silicon wafers.	3566	0.5
Mitsui & Co.	5099	/	Genome Networks, Inc.	2819	Mfrs gallium arsenide (GAAS)	3826	0

					integrated circuit/custom designed gate arrays		
Mitsui & Co.	5099	/	Graviton, Inc.	8731	Develops drugs for large pharmaceutical companies.	5139	0
Mitsui & Co.	5099	/	Norak Biosciences, Inc.	3674	Provides internet-based monitoring and info management systems services.	5139	0
Mitsui & Co.	5099	/	Powerline GES Pty Ltd	8731	Develops drugs using a single universal fluorescent assay.	2836,8731	0
Molex, Inc.	3678	3679,3496	Sheldahl, Inc.	3674	Designs, develops and manufactures power electronic products.	3613,3577,3823	0.75
Monsanto Corp.	2879	8731	Asyst Technologies, Inc.	3674	Develops semiconductors for automotive and consumer electronics.	7373	0
Monsanto Corp.	2879	8731	Biogen, Inc.	3559	Wholesales mini-environment systems used primarily in cleanrooms.	3569,3821	0
Monsanto Corp.	2879	8731	Invitron Corporation	7699	Develops pharmaceuticals for human healthcare through gentic engineering.	5085	0
Monsanto Corp.	2879	8731	Novellus Systems, Inc	8731	Operates large-scale mammalian cell culture systems.	8731	0
National Bank of Canada	6021	6022,6029,6081,6082	AltaRex Corp.	3573	Manufactures semiconductor chemical vapor deposition equipment.	8731	0
National Distillers	2790	/	Cetus Corporation	2836	Uses antibody based therapeutics for treatment of late stage cancers.	3577	0.25
National Iron and Steel Mill	2790	/	PMC-Sierra, Inc.	2836	Develops anticancer therapeutics and applications of gene probe technology.	2879	0.25
National Semiconductor	3674	5065,3679,7373	Fairchild Semiconductor Int¡¯l Inc.	3679	Manufactures standard and application-specific integrated circuits.	3613, 3577, 3823	0.75
National Semiconductor	3674	5065,3679,7373	MediaQ, Inc.	3674	Manufactures semiconductors devices and photographic equipment.	3826	1
National Semiconductor	3674	5065,3679,7373	Sensym Inc.	3679	Provides silicon system solutions for consumer appliances.	3823, 3845, 3825	0.75
Neoplux Capital	6798	/	DNA Link, Inc.	3674	Manufactures low-cost pressure sensors.	7373	0
Neoplux Capital	6798	/	Sekonix Company, Ltd.	2836	Operates in medical genetics research in Korea.	3087	0
Neoplux Capital	6798	/	Tamul Multimedia Company, Ltd.	3674	Develops and produces plastic optic devices and components.	7373	0
Nissho Electronics	3845	/	Agility Communications, Inc.	3600	Develops multimedia and communication LSI and their application system.	2834	0.25
Norsk Hydro	4900	3365,2899	Canji, Inc.	4813	Develops products for the telecommunications industry.	2899,3821,3826,8731	0.25
Nortel Networks Corporation	4899	/	Aerie Networks, Inc	3800	Develops therapeutics for cancer using tumor suppressor genes.	3675,3672,3676	0
Nortel Networks Corporation	4899	/	CentrePath	4813	Builds a national fiber optics telecommunications network.	2899,3821,3826,8731	0.25
Nortel Networks Corporation	4899	/	FiberNet Telecom Group, Inc.	4813	Designs fiber optic networking products addressing bandwidth bottlenecking.	2879	0.25
Northern Pacific Capital Corp.	6282	/	Morrow Electronics, Inc.	3674	Provides optical fiber network inside class-A commercial buildings.	3826	0
Northern Telecom Ltd.	4899	/	Micro Linear Corporation	4813	Manufactures marine electronics equipment.	3841	0.25
NYNEX Technology Investments	6282	/	Pliant Systems, Inc.	3674	Manufactures analog/digital semi-custom and custom IC circuits.	3823,3845,3825	0
Olin Corporation	3341	3482,3483,3589	International Biotechnologies Inc.	3832	Manufactures and markets fiber optic systems for phone companies.	3613,3577,3823	0.25
Oracle	7372	7371	Genomics Collaborative, Inc.	7380	Manufactures product systems for molecular biology research.	8731	0.5
Oracle	7372	7371	InGenuity Systems, Inc.	7380	Provides DNA and Genetic Research services.	5139	0.5
Otsuka Pharmaceutical Co	2834	/	Ista Pharmaceuticals, Inc.	2836	Conducts gene research in order to develop gene-related drugs.	5139	0.75
Otsuka Pharmaceutical Co	2834	/	Phospho-Energetics, Inc.	8731	Develops contact lens to restore visual acuity.	8731	0
Oxford Instruments Group PLC	3826	6719,3823	DNA Plant Technology	8731	Manufactures nuclear resonance spectrum analysis devices.	7379	0
Oxford Instruments Group PLC	3826	6719,3823	Panelvision Corporation	721	Develops improved varieties of crop, industrial and consumer products.	3087	0
Pacific Telecom	3651	3669	Support Technologies, Inc.	3679	Manufactures thin film, flat panel display screens.	8731	0.5
Pacific Telecom	3651	3669	Thesys Memory Products Corp	3825	Manufactures automatic systems and printed circuit board test equipment.	8731,5065	0.25
Pacnat Company	3825	/	Applied Microsystems Corp.	3674	Manufactures low-cost add-on semiconductor memories for PCs.	7371,6794	0.25
Pernovo Corp. (Perstorp	3825	/	Creative BioMolecules, Inc.	3674	Manufactures and supplies microprocessor development test tools.	2836,8731	0.25
Pfizer Inc	2834	2835,2048	Immusol, Inc	2836	Develops human growth factors through genetic engineering.	3566,5065	0.5
Pfizer Inc	2834	2835,2048	Myco Pharmaceuticals	2836	Develops and discovers biologically relevant therapeutic drugs.	5139	0.5
Philips Venture Capital Fund B.V.	3639	3651,3679	Be Here Corporation	721	Develops drugs derived from fungi and related organisms.	3841	0
Philips Venture Capital Fund B.V.	3639	3651,3679	MystiCom, Ltd.	3861	Develops panoramic still-image camera lens system.	3569,3821	0.25
Philips Venture Capital Fund B.V.	3639	3651,3679	ShareWave, Inc.	3674	Develops digital signal processing (DSP) cores for semiconductor industry.	3841	0.5
Polaroid Corporation	3861	/	Zight Corporation	3674	Develops semiconductor technology for wireless home networking products.	7373	0.25
Proctor & Gamble	2841	2676,2033,2844	Vector Pharmaceuticals, Inc.	3679	Develops high-resolution color	5045,5065,3	0

		,2834,2096,2095,2099			displays.	672,7372	
Purdue Pharma L.P.	2834	/	AltaRex Corp.	2836	Develops live viral vaccines to be used in immunization programs.	3569,3821	0.75
Questec Enterprises, Inc.	2990	/	Innov Holding Company	2836	Uses antibody based therapeutics for treatment of late stage cancers.	3577	0.25
Questec Enterprises, Inc.	2990	/	Proconics International, Inc.	3674	Manufactures mass flow controllers for integrated circuits.	5139	0
Raychem Corporation	3699	/	Interamics, Inc.	3699	Manufactures a highly refined silicon wafer transfer system.	3613,3577,3823	1
Raychem Corporation	3699	/	Luxtron Corporation	3679	Mfrs co-fired custom ceramic multi-layer interconnect products.	3674,3669	0.5
RCA	3823	/	Planar Systems, Inc.	3822	Manufactures ultra-sensitive thermometers for industrial and medical use.	3823,3845,3825	0.75
RCA	3823	/	WaferScale Integration, Inc	3823	Manufactures electroluminescent (EL) components.	3613,3577,3823	1
RCT BioVentures NE LLC	8731	/	InfiMed Therapeutics, Inc.	8900	Develops non-volatile programmable memory and semi-custom ICs.	5065	0.25
RCT BioVentures NE LLC	8731	/	MetaProbe LLC	8731	Develops protein and peptide formulated products.	5139	1
Renaissance Tech.	5045	7372	Crystalvision Inc.	3573	Develops liquid crystal display flat panel for PCs.	3566,5065	0
Repligen Corp.	2836	8071,8731	Glycan Pharmaceuticals Inc	2835	Operates as a development-stage biotechnology company.	3823,3845,3825	0.75
Rhone Poulenc	2836	/	Biomedical Diagnostics	2834	Develop pharmaceuticals based on carbohydrate technology.	5139	0.75
Rhone Poulenc	2836	/	EntoMed SA	2834	Develops and markets biological diagnostic tools.	2835	0.75
Rhone Poulenc	2836	/	Hybrigenics SA	8731	Develops insect-derived antimicrobial peptides.	3499,3827,3674	0
Rockwell International	3679	3812,3674,5045,3845	Micro Linear Corporation	3679	Develops biotechnology and bioinformatics products.	5139	1
Rodal Corp.	3576	/	Cetus Corporation	3674	Manufactures analog/digital semi-custom and custom IC circuits.	3823,3845,3825	0.25
Rohm and Haas Company.	2821	2869,2099,3672,2879	Advanced Genetic Sciences, Inc	2836	Develops anticancer therapeutics and applications of gene probe technology.	2879	0.5
SAIC Venture Capital Corp.	6099	/	Agilix Corporation	721	Develops genetically engineered agricultural products.	2899,3821,3826,8731	0
SAIC Venture Capital Corp.	6099	/	DigiLens, Inc.	8731	Develops functional genomics and proteomics platform technologies.	2899,3821,3826,8731	0
SAIC Venture Capital Corp.	6099	/	LifeSpan BioSciences, Inc.	3674	Designs, manufactures and markets polymer optical components.	7371	0
Sandoz Ltd.	2834	/	Agridyne Technologies, Inc.	8732	Operates as a genomics company.	8731	0
Schering-Plough Corp.	2834	2841,5122	Accelrys, Inc.	721	Develops botanical insecticides and plant growth enhancement products.	8731,5122	0
Schering-Plough Corp.	2834	2841,5122	Biogen, Inc.	2836	Develops pharmaceutical and chemical libraries.	3827,7389,3577	0.75
Schering-Plough Corp.	2834	2841,5122	Molecular Devices Corp	2836	Develops pharmaceuticals for human healthcare through gentic engineering.	5085	0.75
Schering-Plough Corp.	2834	2841,5122	ProCyte Corporation	2836	Develops test delivery systems using silicon sensor technology.	3841	0.75
Schlumberger Limited	2084	2085	Contrex, Inc.	2834	Develops lamin, a synthetic product which aids in wound healing.	2844	0.25
Schlumberger Limited	2084	2085	GE Novasensor Inc.	3823	Manufactures integrated circuit wafer inspection systems.	3566,5065	0
Seagate Technology Inc	3572	3577	Mosaic Systems, Inc.	3600	Supplies silicon-based sensors.	3826	0.25
Sensormatic Electronics Corp.	3669	7382	Datavision, Inc.	3577	Designs electrically programmable silicon semiconductors.	3841	0.25
Sepracor Inc.	2834	8731	Versicor, Inc.	2836	Manufactures centrally-monitored, interactive alarm systems.	7371	0.75
Shanghai Industrial Holdings Ltd.	3560	6719,4499,2834,2131,3714	Semiconductor Manufacturing Corp.	3600	Develops infectious disease therapeutic drugs.	7371,6794	0.25
Shanghai Land Holdings Ltd.	6531	6719	Ness Display Corporation	3699	Operates a holding company that establishes semiconductor facilities.	7373	0
Shanghai Land Holdings Ltd.	6531	6719	WAVICS, Inc.	3600	Manufactures and develops Organic Light-Emitiing Diode Displays (OLED).	2836,8731	0
Sharp Corporation	3663	/	Greyhawk Systems, Inc.	3571	Operates as a fabless semiconductor company.	5065	0.25
Sharp Corporation	3664	/	WaferScale Integration, Inc	3573	Manufactures high information content, large area displays.	5139	0.25
Shaw Ventures Ltd.	3498	1623,3322,5085,8999	360networks, Inc.	3674	Develops non-volatile programmable memory and semi-custom ICs.	5065	0.25
Shinsho Corporation	5051	/	ProQuip, Inc.	3669	Develops high-bandwidth fiber optic communication infrastructures.	3827,7389,3577	0
Siemens Corporation	3613	3621,3844	Graviton, Inc.	3825	Manufactures automatic test equipment for rigid disk media and disk drives.	2844	0
Siemens Venture Capital GmbH	6799	3621,3844	Agility Communications, Inc.	3674	Provides internet-based monitoring and info management systems services.	5139	0
Siemens Venture Capital GmbH	6799	3621,3844	Graviton, Inc.	4813	Develops products for the telecommunications industry.	2899,3821,3826,8731	0
Siemens Venture Capital GmbH	6799	3621,3844	Interactive Silicon, Inc.	3674	Provides internet-based monitoring and info management systems services.	5139	0
Siemens Venture Capital GmbH	6799	3621,3844	LightLogic, Inc.	3674	Manufactures semiconductors and software for better system performance.	3674,3669	0
Siemens Venture Capital GmbH	6799	3621,3844	November	3663	Develops optoelectronic components and subsystems.	8731	0
Siemens Venture Capital GmbH	6799	3621,3844	Zight Corporation	8071	Develops biotechnology for use within molecular medicine.	8731	0

Sigma Resources	7389	/	Saratoga Semiconductor Corp	3679	Develops high-resolution color displays.	5045,5065,3672,7372	0
SISIR International Pte Ltd.	3823	/	Pacific Lithium Limited	3573	Manufactures standard and custom semiconductor chips.	7373	0.25
SISIR International Pte Ltd.	3823	/	Ultro Lighting International Pte	3692	Develops technologies and products for the lithium based market.	8731	0.25
Smith Kline Beecham Corp.	2834	8071	Amgen, Inc.	2836	Designs and develops electronic ballasts.	7371,6794	0.75
Smith Kline Beecham Corp.	2834	8071	Applied Biotechnology, Inc.	2836	Develops and markets molecular biology-based products.	2836,8731	0.75
Smith Kline Beecham Corp.	2834	8071	British Bio-Technology Group PLC	2836	Develops cancer diagnostics, therapeutics and animal vaccines.	2836,8731	0.75
Smith Kline Beecham Corp.	2834	8071	Corixa Corporation	2834	Develops and manufactures reagents and pharmaceuticals.	2835	1
Smith Kline Beecham Corp.	2834	8071	Cytotech, Inc.	2834	Develops cellular-mediated immunity as a treatment for cancer.	3566,5065	1
Smith Kline Beecham Corp.	2834	8071	Gliatech, Inc.	721	Supplies specific pathogen free (SPF) laboratory animals.	2836	0
Smith Kline Beecham Corp.	2834	8071	International Canine Genetics	3841	Develops neural regeneration pharmaceuticals and devices.	5139	0
Smith Kline Beecham Corp.	2834	8071	MacroNex, Inc.	2834	Developing methods to improve the genetic purity of purebred dogs.	8731	1
Smith Kline Beecham Corp.	2834	8071	Message Pharmaceuticals, Inc.	2834	Develops peptides targeted at autoimmune and inflammatory processes.	3823,3845,3825	1
Smith Kline Beecham Corp.	2834	8071	NPS Pharmaceuticals, Inc.	2835	Develops technology for drug discovery focusing on RNA instead of DNA.	3823,3845,3825	0.75
Smith Kline Beecham Corp.	2834	8071	Ocean Genetics	2834	Discovers small molecule drugs.	8731	1
Smith Kline Beecham Corp.	2834	8071	Provac, Inc.	2834	Develops marine biotechnology products and research procedures.	8731	1
Smith Kline Beecham Corp.	2834	8071	Sphinx Pharmaceuticals Corp	2836	Develops vaccines, immunotherapeutics and diagnostic tests.	2844	0.75
Smith Kline Beecham Corp.	2834	8071	Symphony Pharmaceuticals, Inc.	2835	Develops lipid-based diagnostics and therapeutics for various diseases.	7373	0.75
Smith Kline Beecham Corp.	2834	8071	Synaptic Pharmaceutical Corp	3834	Develops therapeutics to regulate ion flow.	8731,5065	0
Smith Kline Beecham Corp.	2834	8071	Synbiotics Corporation	2836	Develops therapeutic products for treatment of nervous system disorders.	8731,5065	0.75
Smith Kline Beecham Corp.	2834	8071	TerraGen Discovery	2835	Mnfrs biomedical products use in human and veterinary healthcare fields.	2834	0.75
Smith Kline Beecham Corp.	2834	8071	Therion Biologics Corporation	2834	Terragen investigates therapeutic properties of microorganisms.	7371,6794	1
Smith Kline Beecham Corp.	2834	8071	Transgenics, Inc.	2836	Develops pharmaceuticals for vaccines for cancer.	7371,6794	0.75
Smith Kline Beecham Corp.	2834	8071	Triplex Pharmaceutical Corp	752	Conducts research at Princeton University focusing on transgenic mice.	7371,6794	0
Smith Kline Beecham Corp.	2834	8071	Ultra Diagnostics Corporation	2834	Develops pharmaceutical compounds that bind to cellular DNA.	7371,6794	1
Smith Kline Beecham Corp.	2834	8071	Zynaxis, Inc.	2835	Produces non-isotopic immunoassays for human in-vitro diagnosic testing.	7371,6794	0.75
Sony Corporation	3651	3679	Dixy Company Ltd.	3679	Develops therapeutic delivery systems and diagnostic products.	7372	0.5
Sony Corporation	3651	3679	SandCraft, Inc.	3679	Designs, mfrs low cost gas plasma displays for industrial, military, etc.	3087	0.5
Sony Corporation	3651	3679	Transmeta Corporation	3571	Develops and markets superscalar microprocessors for communications.	7373	0.25
Sony Corporation	3651	3679	Vitelic Corporation	3571	Manufactures and designs VLSI chips for wireless mobile devices.	7371,6794	0.25
Standard Microsystems Corp.	3674	/	Surface Mounted Technology Corp	3670	Develops very large scale integration (VLSI) semiconductor products.	7371,6794	0.75
Standard OIL	3821	/	Analog Devices, Inc.	3573	Produces printed circuit boards & provides semiconductor assembly services.	8731,5065	0.25
Standard OIL	3821	/	Energy Conversion Devices, Inc	3670	Manufactures precision integrated circuits.	2836,8731	0.25
Standard OIL	3821	/	General Ionex Corporation	3674	Develops technologies involving amorphous semiconductors.	8731,3499,3827,3674	0.25
Standard OIL	3821	/	GigaBit Logic, Inc.	3674	Custom producer of ion beam instruments/ion accelerator products.	8731	0.25
Standard OIL	3821	/	International Microelectronic	3674	Manufactures ultra high-speed gallium arsenide integrated circuits.	5139	0.25
Standard OIL of California	3821	/	Cetus Corporation	3674	Manufactures custom semiconductor integrated circuits.	8731	0
Sumitomo Cement Company, Ltd.	3241	/	Ortel Corporation	2836	Develops anticancer therapeutics and applications of gene probe technology.	2879	0
Sumitomo Corporation	5099	/	Argonaut Technologies, Inc.	3811	Manufactures linear fiber optic products.	8731	0
Sumitomo Corporation	5099	/	Atheros Communications, Inc	3826	Develops instruments and chemicals for medicinal chemistry use.	3356	0
Sumitomo Corporation	5099	/	Galileo Pharmaceuticals, Inc.	3674	Manufactures 802.11A wireless LAN chipsets and software.	3569,3821	0
Sumitomo Corporation	5099	/	GES Pharmaceutical Inc	3834	Develops products for the treatment and prevention of ischemia.	3826	0
Sumitomo Corporation	5099	/	nCHIP, Inc.	2836	Develops neuro-transmitter re-uptake genes for rational drug design.	5139	0
Sumitomo Corporation	5099	/	SkyTune Corporationa	3679	Designs and manufactures advanced silicon circuit board packages.	3841	0
Sumitomo Corporation	5099	/	Zyomyx, Inc.	3670	Manufactures audio/video integrated	7373	0

					circuits for the PC market.		
Sumitomo Metal Industries	3312	/	Mosaic Systems, Inc.	2835	Develops protein biochips to identify inhibitors.	7372	0
Sun Microsystems, Inc.	3571	7373,7371,7372,3575,3572	Graviton, Inc.	3674	Designs electrically programmable silicon semiconductors.	3841	0.25
Sun Microsystems, Inc.	3571	7373,7371,7372,3575,3572	Lineo, Inc.	3674	Provides internet-based monitoring and info management systems services.	5139	0.25
Sun Microsystems, Inc.	3571	7373,7371,7372,3575,3572	Mellanox Technologies, Inc.	3674	Develops, markets and sells embedded Linux system software.	8731	0.25
Syntex Corporation	2836	/	American Bionetics, Inc.	8742	Develops semiconductors to address bandwidth bottlenecking.	3823,3845,3825	0
Syntex Corporation	2836	/	Genelabs Technologies, Inc.	2830	Develops instrumentation and supplies for biotechnology industry.	3577	0.75
Syntex Corporation	2836	/	Genetic Systems Diagnostics Partners	2835	Develops diagnostic and research products for biotechnology.	3826	0.75
Syntex Corporation	2836	/	Xytronyx, Inc.	2835	Engaged in monoclonal antibody technology research.	8731	0.75
Sysorex	2790	/	Integrated Device Technology	2835	Develops biotechnological products for veterinary medicine.	5045,5065,3672,7372	0.25
Tandem Computers, Inc.	3670	/	Anamartic Ltd.	3674	Manufacturers VLSI semiconductors utilizing enhanced CMOS technology.	3674	0.75
Tandem Computers, Inc.	3670	/	Clinicor, Inc.	3573	Manufactures semiconductor-based storage systems.	2836,8731	0.25
Tata Enterprises	3571	5045,7372	Agridyne Technologies, Inc.	3834	Provides commercial research services to drug and medical companies.	3827	0.25
Taub-Tech Ventures	3571	/	GigaBit Logic, Inc.	3834	Develops botanical insecticides and plant growth enhancement products.	8731,5122	0.25
TDK Corporation	3679	3652	Atheros Communications, Inc	3679	Manufactures ultra high-speed gallium arsenide integrated circuits.	5139	1
TDK Corporation	3679	3652	Silicon Wave, Inc.	3679	Manufactures 802.11A wireless LAN chipsets and software.	3569,3821	1
Technology Asia Ventures Sdn Bhd	6799	7359	GeneMedix PLC	3674	Provides silicon ASIC solutions for communication equipment.	7373	0
Teck Research Inc.	1041	1044,1021,1031	Oncodiagnostics, Inc.	2834	Develops and manufactures a range of high value therapeutic proteins	3826	0
Tektronix Development Co	3825	3823,3826	ATEQ Corp.	3679	Producer of biotech genetic engineering systems; and serum pharmaceuticals.	8731	0.25
Tektronix Development Co	3825	3823,3826	Credence Systems Corp.	3569	Develops photolithography equipment for IC fabrication.	3821	0.25
Telefonica	4899	/	California Micro Devices, Inc.	3825	Manufactures Automatic Test Equipment (ATE) for LSI/VLSI semiconductors.	3566,5065	0
Tellabs Inc.	3661	7373,3669	Agility Communications, Inc.	3674	Manufactures high performance electronic components.	3675,3672,3676	0.5
Tellabs Inc.	3661	7373,3669	Calient Networks	4813	Develops products for the telecommunications industry.	2899,3821,3826,8731	0
Tellabs Inc.	3661	7373,3669	PMC-Sierra, Inc.	3832	Develops intelligent, all-photonic switching systems and software.	2835	0.25
Tenax Corporation	3577	/	Mech-El Industries, Inc.	3674	Manufactures standard and application-specific integrated circuits.	3613,3577,3823	0.25
The Walt Disney Co.	4833	4832,7812,4841,7996,7011,4481,5947,2731,6794	NxtWave Communications	3600	Manufactures digital modulation and de-modulation integrated circuits.	8731	0
TI Ventures	6799	/	APEX Semiconductor, Inc.	3699	Manufactures automatic semiconductor bonding equipment.	3823,3845,3825	0
TI Ventures	6799	/	ARC International PLC	3674	Develops DRAM and embedded DRAM products.	2836,8731	0
TI Ventures	6799	/	AuthenTec, Inc.	3571	Develops integrated solutions for system-on-chip (SoC) design.	3356	0
TI Ventures	6799	/	MystiCom, Ltd.	3674	Provides silicon solutions to the biometric and security markets.	3569,3821	0
TI Ventures	6799	/	Zight Corporation	3573	Develops digital signal processing (DSP) cores for semiconductor industry.	3841	0
Time, Inc.	4841	7375,7812,6794,4813,2721,2731	Applied Micro Circuits Corp.	3679	Develops high-resolution color displays.	5045,5065,3672,7372	0
Time, Inc.	4841	7375,7812,6794,4813,2721,2731	Millennium Systems, Inc.	3674	Manufactures semicustom bipolar and BICMOS gate array integrated circuits.	2836,8731	0
Tosco Corporation	3674	5541,5411	Amgen, Inc.	3825	Developed a portable testing device used in the repair of microprocessors.	3823,3845,3825	0.25
Trident Microsystems, Inc.	3674	3577	Integrated Telecom Express, Inc.	3825	Develops and markets molecular biology-based products.	2836,8731	0.25
TRW Inc.	3714	3724,3764,7373,3825,3679,3761,3812,8742	C.P. Clare Corporation	3674	Designs, distributes and sells computer semiconductors.	3674	0.25
TVI Corporation	3812	/	Biopure Corporation	3674	Develops signal electromagnetic and semiconductor switches and relays.	2835	0.25
Ultramar PLC	1311	/	Agricultural Genetics Company	2836	Develops oxygen therapeutic for the healthcare markets.	2835	0
United Computer and Technology	3679	/	Cambridge BioTech Corporation	3836	Operates as a research company to apply molecular biology to plant breeding	8731,5122	0.25
United Computer and Technology	3679	/	Codata Systems Corporation	3836	Develops diagnostics, therapeutics & vaccines using monoclonal antibody.	3672,3676	0.25
United Computer and Technology	3679	/	Security Tag Systems	3836	Manufactures computerized fire detection systems for large buildings.	3827	0.25
Velocity Capital	6799	/	Silicon Wave, Inc.	3800	Manufactures reusable electronic tags	7373	0

Management LLC					for preventing shoplifters.		
VentureBank@PNC	6799	/	iPhotonics, Inc.	3674	Provides silicon ASIC solutions for communication equipment.	7373	0
Votorantim Venture Capital Ltd	6799	/	Alellyx Applied Genomics	8711	Provides outsourced services for fiber optic system and subsystem OEMs.	8731	0
Wang Development and Investment Corp.	6799	/	Applied Optoelectronics Technology	2834	Operates a biotechnology company in Brazil.	8731,5122	0
Wang Development and Investment Corp.	6799	/	Paradygm Science & Technologie	5063	Manufactures automatic test equipment for optoelectronic components.	2836,8731	0
Weston Investment Co.	6799	/	Agridyne Technologies, Inc.	3800	Manufactures spectrometers for use during surgery.	8731	0
Williams Communications Group	4899	/	Icoria, Inc.	721	Develops botanical insecticides and plant growth enhancement products.	8731,5122	0
WorldCom Ventures	6799	7375,7374,4899,7389,8711,8999	Agility Communications, Inc.	4831	Develops functional genomics products focusing on agriculture.	5139	0
WorldCom Ventures	6799	7375,7374,4899,7389,8711,8999	Genoa Corporation	4813	Develops products for the telecommunications industry.	2899,3821,3826,8731	0

Note:
1. Source of information on Firms are mainly from Osiris Database, as well as Lexis/Nexis Academic Database
2. Sources of information on Company are mainly from SDC and CorpTech database, as well as Lexis/Nexis Academic and www.selectory.com (Dun & Bradstreet Database)
3. The variable "market relatedness" is based on the overlaps of 4-digit Primary Standard Industry Codes (SIC) of the investors and investees. The variable receives values 1, 0.75, 0.5 or 0.25 if the firm and company have the same SIC code on four, three, two or one digit level, respectively. If the firm and company have totally different SIC code, then it receives a value of 0.

B-2. SIC DESCRIPTION:

SIC code	Description	Major Group	Description
100	Agricultural Production-Crops	1	Agricultural Production Crops
200	Agricultural Prod-Livestock & Animal Specialties	2	Agriculture production livestock and animal specialties
700	Agricultural Services	7	Agricultural Services
800	Forestry	8	Forestry
900	Fishing, Hunting and Trapping	9	Fishing, hunting, and trapping
1000	Metal Mining	10	Metal Mining
1040	Gold and Silver Ores	10	Metal Mining
1090	Miscellaneous Metal Ores	10	Metal Mining
1221	Bituminous Coal & Lignite Mining	12	Coal Mining
1311	Crude Petroleum & Natural Gas	13	Oil And Gas Extraction
1381	Drilling Oil & Gas Wells	13	Oil And Gas Extraction
1382	Oil & Gas Field Exploration Services	13	Oil And Gas Extraction
1389	Oil & Gas Field Services, NEC	13	Oil And Gas Extraction
1400	Mining & Quarrying of Nonmetallic Minerals (No Fuels)	14	Mining And Quarrying Of Nonmetallic Minerals, Except Fuels
1520	General Bldg Contractors - Residential Bldgs	15	Building Construction General Contractors And Operative Builders
1531	Operative Builders	15	Building Construction General Contractors And Operative Builders
1540	General Bldg Contractors - Nonresidential Bldgs	15	Building Construction General Contractors And Operative Builders
1600	Heavy Construction Other Than Bldg Const - Contractors	16	Heavy Construction Other Than Building Construction Contractors
1623	Water, Sewer, Pipeline, Comm & Power Line Construction	16	Heavy Construction Other Than Building Construction Contractors
1700	Construction - Special Trade Contractors	17	Construction Special Trade Contractors
1731	Electrical Work	17	Construction Special Trade Contractors
2000	Food and Kindred Products	20	Food And Kindred Products
2011	Meat Packing Plants	20	Food And Kindred Products
2013	Sausages & Other Prepared Meat Products	20	Food And Kindred Products
2015	Poultry Slaughtering and Processing	20	Food And Kindred Products
2020	Dairy Products	20	Food And Kindred Products
2024	Ice Cream & Frozen Desserts	20	Food And Kindred Products
2030	Canned, Frozen & Preservd Fruit, Veg & Food Specialties	20	Food And Kindred Products
2033	Canned, Fruits, Veg, Preserves, Jams & Jellies	20	Food And Kindred Products
2040	Grain Mill Products	20	Food And Kindred Products
2050	Bakery Products	20	Food And Kindred Products
2052	Cookies & Crackers	20	Food And Kindred Products
2060	Sugar & Confectionery Products	20	Food And Kindred Products
2070	Fats & Oils	20	Food And Kindred Products
2080	Beverages	20	Food And Kindred Products
2082	Malt Beverages	20	Food And Kindred Products
2086	Bottled & Canned Soft Drinks & Carbonated Waters	20	Food And Kindred Products
2090	Miscellaneous Food Preparations & Kindred Products	20	Food And Kindred Products
2092	Prepared Fresh or Frozen Fish & Seafoods	20	Food And Kindred Products
2100	Tobacco Products	21	Tobacco Products
2111	Cigarettes	21	Tobacco Products
2200	Textile Mill Products	22	Textile Mill Products
2211	Broadwoven Fabric Mills, Cotton	22	Textile Mill Products
2221	Broadwoven Fabric Mills, Man Made Fiber & Silk	22	Textile Mill Products
2250	Knitting Mills	22	Textile Mill Products
2253	Knit Outerwear Mills	22	Textile Mill Products
2273	Carpets & Rugs	22	Textile Mill Products
2300	Apparel & Other Finishd Prods of Fabrics & Similar Matl	23	Apparel And Other Finished Products Made From Fabrics And Similar Materials
2320	Men's & Boys' Furnishgs, Work Clothg, & Allied Garments	23	Apparel And Other Finished Products Made From Fabrics And Similar Materials
2330	Women's, Misses', and Juniors Outerwear	23	Apparel And Other Finished Products Made From Fabrics And Similar Materials
2340	Women's, Misses', Children's & Infants' Undergarments	23	Apparel And Other Finished Products Made From Fabrics And Similar Materials
2390	Miscellaneous Fabricated Textile Products	23	Apparel And Other Finished Products Made From Fabrics And Similar Materials
2400	Lumber & Wood Products (No Furniture)	24	Lumber And Wood Products, Except Furniture
2421	Sawmills & Planting Mills, General	24	Lumber And Wood Products, Except Furniture
2430	Millwood, Veneer, Plywood, & Structural Wood Members	24	Lumber And Wood Products, Except Furniture
2451	Mobile Homes	24	Lumber And Wood Products, Except Furniture
2452	Prefabricated Wood Bldgs & Components	24	Lumber And Wood Products, Except Furniture
2510	Household Furniture	25	Furniture And Fixtures
2511	Wood Household Furniture, (No Upholstered)	25	Furniture And Fixtures
2520	Office Furniture	25	Furniture And Fixtures
2522	Office Furniture (No Wood)	25	Furniture And Fixtures
2531	Public Bldg & Related Furniture	25	Furniture And Fixtures
2540	Partitions, Shelvg, Lockers, & of fice & Store Fixtures	25	Furniture And Fixtures
2590	Miscellaneous Furniture & Fixtures	25	Furniture And Fixtures
2600	Papers & Allied Products	26	Paper And Allied Products
2611	Pulp Mills	26	Paper And Allied Products
2621	Paper Mills	26	Paper And Allied Products
2631	Paperboard Mills	26	Paper And Allied Products
2650	Paperboard Containers & Boxes	26	Paper And Allied Products
2670	Converted Paper & Paperboard Prods (No Contaners/Boxes)	26	Paper And Allied Products
2673	Plastics, Foil & Coated Paper Bags	26	Paper And Allied Products
2711	Newspapers: Publishing or Publishing & Printing	27	Printing, Publishing, And Allied Industries
2721	Periodicals: Publishing or Publishing & Printing	27	Printing, Publishing, And Allied Industries
2731	Books: Publishing or Publishing & Printing	27	Printing, Publishing, And Allied Industries
2732	Book Printing	27	Printing, Publishing, And Allied Industries
2741	Miscellaneous Publishing	27	Printing, Publishing, And Allied Industries
2750	Commercial Printing	27	Printing, Publishing, And Allied Industries
2761	Manifold Business Forms	27	Printing, Publishing, And Allied Industries
2771	Greeting Cards	27	Printing, Publishing, And Allied Industries

2780	Blankbooks, Looseleaf Binders & Bookbindg & Relatd Work	27	Printing, Publishing, And Allied Industries
2790	Service Industries For The Printing Trade	27	Printing, Publishing, And Allied Industries
2800	Chemicals & Allied Products	28	Chemicals And Allied Products
2810	Industrial Inorganic Chemicals	28	Chemicals And Allied Products
2820	Plastic Material, Synth Resin/Rubber, Cellulos (No Glass)	28	Chemicals And Allied Products
2821	Plastic Materials, Synth Resins & Nonvulcan Elastomers	28	Chemicals And Allied Products
2833	Medicinal Chemicals & Botanical Products	28	Chemicals And Allied Products
2834	Pharmaceutical Preparations	28	Chemicals And Allied Products
2835	In Vitro & In Vivo Diagnostic Substances	28	Chemicals And Allied Products
2836	Biological Products, (No Disgnostic Substances)	28	Chemicals And Allied Products
2840	Soap, Detergents, Cleang Preparations, Perfumes, Cosmetics	28	Chemicals And Allied Products
2842	Specialty Cleaning, Polishing and Sanitation Preparations	28	Chemicals And Allied Products
2844	Perfumes, Cosmetics & Other Toilet Preparations	28	Chemicals And Allied Products
2851	Paints, Varnishes, Lacquers, Enamels & Allied Prods	28	Chemicals And Allied Products
2860	Industrial Organic Chemicals	28	Chemicals And Allied Products
2870	Agricultural Chemicals	28	Chemicals And Allied Products
2890	Miscellaneous Chemical Products	28	Chemicals And Allied Products
2891	Adhesives & Sealants	28	Chemicals And Allied Products
2911	Petroleum Refining	29	Petroleum Refining And Related Industries
2950	Asphalt Paving & Roofing Materials	29	Petroleum Refining And Related Industries
2990	Miscellaneous Products of Petroleum & Coal	29	Petroleum Refining And Related Industries
3011	Tires & Inner Tubes	30	Rubber And Miscellaneous Plastics Products
3021	Rubber & Plastics Footwear	30	Rubber And Miscellaneous Plastics Products
3050	Gaskets, Packg & Sealg Devices & Rubber & Plastics Hose	30	Rubber And Miscellaneous Plastics Products
3060	Fabricated Rubber Products, NEC	30	Rubber And Miscellaneous Plastics Products
3080	Miscellaneous Plastics Products	30	Rubber And Miscellaneous Plastics Products
3081	Unsupported Plastics Film & Sheet	30	Rubber And Miscellaneous Plastics Products
3086	Plastics Foam Products	30	Rubber And Miscellaneous Plastics Products
3089	Plastics Products, NEC	30	Rubber And Miscellaneous Plastics Products
3100	Leather & Leather Products	31	Leather And Leather Products
3140	Footwear, (No Rubber)	31	Leather And Leather Products
3211	Flat Glass	32	Stone, Clay, Glass, And Concrete Products
3220	Glass & Glassware, Pressed or Blown	32	Stone, Clay, Glass, And Concrete Products
3221	Glass Containers	32	Stone, Clay, Glass, And Concrete Products
3231	Glass Products, Made of Purchased Glass	32	Stone, Clay, Glass, And Concrete Products
3241	Cement, Hydraulic	32	Stone, Clay, Glass, And Concrete Products
3250	Structural Clay Products	32	Stone, Clay, Glass, And Concrete Products
3260	Pottery & Related Products	32	Stone, Clay, Glass, And Concrete Products
3270	Concrete, Gypsum & Plaster Products	32	Stone, Clay, Glass, And Concrete Products
3272	Concrete Products, Except Block & Brick	32	Stone, Clay, Glass, And Concrete Products
3281	Cut Stone & Stone Products	32	Stone, Clay, Glass, And Concrete Products
3290	Abrasive, Asbestos & Misc Nonmetallic Mineral Prods	32	Stone, Clay, Glass, And Concrete Products
3310	Steel Works, Blast Furnaces & Rolling & Finishing Mills	33	Primary Metal Industries
3312	Steel Works, Blast Furnaces & Rolling Mills (Coke Ovens)	33	Primary Metal Industries
3317	Steel Pipe & Tubes	33	Primary Metal Industries
3320	Iron & Steel Foundries	33	Primary Metal Industries
3330	Primary Smelting & Refining of Nonferrous Metals	33	Primary Metal Industries
3334	Primary Production of Aluminum	33	Primary Metal Industries
3341	Secondary Smelting & Refining of Nonferrous Metals	33	Primary Metal Industries
3350	Rolling Drawing & Extruding of Nonferrous Metals	33	Primary Metal Industries
3357	Drawing & Insulating of Nonferrous Wire	33	Primary Metal Industries
3360	Nonferrous Foundries (Castings)	33	Primary Metal Industries
3390	Miscellaneous Primary Metal Products	33	Primary Metal Industries
3411	Metal Cans	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3412	Metal Shipping Barrels, Drums, Kegs & Pails	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3420	Cutlery, Handtools & General Hardware	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3430	Heating Equip, Except Elec & Warm Air; & Plumbing Fixtures	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3433	Heating Equipment, Except Electric & Warm Air Furnaces	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3440	Fabricated Structural Metal Products	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3442	Metal Doors, Sash, Frames, Moldings & Trim	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3443	Fabricated Plate Work (Boiler Shops)	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3444	Sheet Metal Work	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3448	Prefabricated Metal Buildings & Components	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3451	Screw Machine Products	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3452	Bolts, Nuts, Screws, Rivets & Washers	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3460	Metal Forgings & Stampings	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3470	Coating, Engraving & Allied Services	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3480	Ordnance & Accessories, (No Vehicles/Guided Missiles)	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3490	Miscellaneous Fabricated Metal Products	34	Fabricated Metal Products, Except Machinery And Transportation Equipment
3510	Engines & Turbines	35	Industrial And Commercial Machinery And Computer Equipment
3523	Farm Machinery & Equipment	35	Industrial And Commercial Machinery And Computer Equipment
3524	Lawn & Garden Tractors & Home Lawn & Gardens Equip	35	Industrial And Commercial Machinery And Computer Equipment
3530	Construction, Mining & Materials Handling Machinery & Equip	35	Industrial And Commercial Machinery And Computer Equipment
3531	Construction Machinery & Equip	35	Industrial And Commercial Machinery And Computer Equipment
3532	Mining Machinery & Equip (No Oil & Gas Field Mach & Equip)	35	Industrial And Commercial Machinery And Computer Equipment
3533	Oil & Gas Field Machinery & Equipment	35	Industrial And Commercial Machinery And Computer Equipment
3537	Industrial Trucks, Tractors, Trailors & Stackers	35	Industrial And Commercial Machinery And Computer Equipment
3540	Metalworkg Machinery & Equipment	35	Industrial And Commercial Machinery And Computer Equipment
3541	Machine Tools, Metal Cutting Types	35	Industrial And Commercial Machinery And Computer Equipment
3550	Special Industry Machinery (No Metalworking Machinery)	35	Industrial And Commercial Machinery And Computer Equipment
3555	Printing Trades Machinery & Equipment	35	Industrial And Commercial Machinery And Computer Equipment

3559	Special Industry Machinery, NEC	35	Industrial And Commercial Machinery And Computer Equipment
3560	General Industrial Machinery & Equipment	35	Industrial And Commercial Machinery And Computer Equipment
3561	Pumps & Pumping Equipment	35	Industrial And Commercial Machinery And Computer Equipment
3562	Ball & Roller Bearings	35	Industrial And Commercial Machinery And Computer Equipment
3564	Industrial & Commercial Fans & Blowers & Air Purifing Equip	35	Industrial And Commercial Machinery And Computer Equipment
3567	Industrial Process Furnaces & Ovens	35	Industrial And Commercial Machinery And Computer Equipment
3569	General Industrial Machinery & Equipment, NEC	35	Industrial And Commercial Machinery And Computer Equipment
3570	Computer & of fice Equipment	35	Industrial And Commercial Machinery And Computer Equipment
3571	Electronic Computers	35	Industrial And Commercial Machinery And Computer Equipment
3572	Computer Storage Devices	35	Industrial And Commercial Machinery And Computer Equipment
3575	Computer Terminals	35	Industrial And Commercial Machinery And Computer Equipment
3576	Computer Communications Equipment	35	Industrial And Commercial Machinery And Computer Equipment
3577	Computer Peripheral Equipment, NEC	35	Industrial And Commercial Machinery And Computer Equipment
3578	Calculating & Accounting Machines (No Electronic Computers)	35	Industrial And Commercial Machinery And Computer Equipment
3579	Office Machines, NEC	35	Industrial And Commercial Machinery And Computer Equipment
3580	Refrigeration & Service Industry Machinery	35	Industrial And Commercial Machinery And Computer Equipment
3585	Air-Cond & Warm Air Heatg Equip & Comm & Indl Refrig Equip	35	Industrial And Commercial Machinery And Computer Equipment
3590	Misc Industrial & Commercial Machinery & Equipment	35	Industrial And Commercial Machinery And Computer Equipment
3600	Electronic & Other Electrical Equipment (No Computer Equip)	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3612	Power, Distribution & Specialty Transformers	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3613	Switchgear & Switchboard Apparatus	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3620	Electrical Industrial Apparatus	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3621	Motors & Generators	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3630	Household Appliances	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3634	Electric Housewares & Fans	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3640	Electric Lighting & Wiring Equipment	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3651	Household Audio & Video Equipment	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3652	Phonograph Records & Prerecorded Audio Tapes & Disks	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3661	Telephone & Telegraph Apparatus	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3663	Radio & Tv Broadcasting & Communications Equipment	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3669	Communications Equipment, NEC	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3670	Electronic Components & Accessories	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3672	Printed Circuit Boards	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3674	Semiconductors & Related Devices	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3677	Electronic Coils, Transformers & Other Inductors	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3678	Electronic Connectors	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3679	Electronic Components, NEC	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3690	Miscellaneous Electrical Machinery, Equipment & Supplies	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3695	Magnetic & Optical Recording Media	36	Electronic And Other Electrical Equipment And Components, Except Computer Equipment
3711	Motor Vehicles & Passenger Car Bodies	37	Transportation Equipment
3713	Truck & Bus Bodies	37	Transportation Equipment
3714	Motor Vehicle Parts & Accessories	37	Transportation Equipment
3715	Truck Trailers	37	Transportation Equipment
3716	Motor Homes	37	Transportation Equipment
3720	Aircraft & Parts	37	Transportation Equipment
3721	Aircraft	37	Transportation Equipment
3724	Aircraft Engines & Engine Parts	37	Transportation Equipment
3728	Aircraft Parts & Auxiliary Equipment, NEC	37	Transportation Equipment
3730	Ship & Boat Building & Repairing	37	Transportation Equipment
3743	Railroad Equipment	37	Transportation Equipment
3751	Motorcycles, Bicycles & Parts	37	Transportation Equipment
3760	Guided Missiles & Space Vehicles & Parts	37	Transportation Equipment
3790	Miscellaneous Transportation Equipment	37	Transportation Equipment
3812	Search, Detection, Navagation, Guidance, Aeronautical Sys	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3821	Laboratory Apparatus & Furniture	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3822	Auto Controls For Regulating Residential & Comml Environments	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3823	Industrial Instruments For Measurement, Display, and Control	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3824	Totalizing Fluid Meters & Counting Devices	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3825	Instruments For Meas & Testing of Electricity & Elec Signals	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3826	Laboratory Analytical Instruments	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3827	Optical Instruments & Lenses	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks

3829	Measuring & Controlling Devices, NEC	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3841	Surgical & Medical Instruments & Apparatus	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3842	Orthopedic, Prosthetic & Surgical Appliances & Supplies	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3843	Dental Equipment & Supplies	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3844	X-Ray Apparatus & Tubes & Related Irradiation Apparatus	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3845	Electromedical & Electrotherapeutic Apparatus	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3851	Ophthalmic Goods	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3861	Photographic Equipment & Supplies	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3873	Watches, Clocks, Clockwork Operated Devices/Parts	38	Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks
3910	Jewelry, Silverware & Plated Ware	39	Miscellaneous Manufacturing Industries
3911	Jewelry, Precious Metal	39	Miscellaneous Manufacturing Industries
3931	Musical Instruments	39	Miscellaneous Manufacturing Industries
3942	Dolls & Stuffed Toys	39	Miscellaneous Manufacturing Industries
3944	Games, Toys & Children's Vehicles (No Dolls & Bicycles)	39	Miscellaneous Manufacturing Industries
3949	Sporting & Athletic Goods, NEC	39	Miscellaneous Manufacturing Industries
3950	Pens, Pencils & Other Artists' Materials	39	Miscellaneous Manufacturing Industries
3960	Costume Jewelry & Novelties	39	Miscellaneous Manufacturing Industries
3990	Miscellaneous Manufacturing Industries	39	Miscellaneous Manufacturing Industries
4011	Railroads, Line-Haul Operating	40	Railroad Transportation
4013	Railroad Switching & Terminal Establishments	40	Railroad Transportation
4100	Local & Suburban Transit & Interurban Hwy Passenger Trans	41	Local And Suburban Transit And Interurban Highway Passenger Transportation
4210	Trucking & Courier Services (No Air)	42	Motor Freight Transportation And Warehousing
4213	Trucking (No Local)	42	Motor Freight Transportation And Warehousing
4220	Public Warehousing & Storage	42	Motor Freight Transportation And Warehousing
4231	Terminal Maintenance Facilities For Motor Freight Transport	42	Motor Freight Transportation And Warehousing
4400	Water Transportation	44	Water Transportation
4412	Deep Sea Foreign Transportation of Freight	44	Water Transportation
4512	Air Transportation, Scheduled	45	Transportation By Air
4513	Air Courier Services	45	Transportation By Air
4522	Air Transportation, Nonscheduled	45	Transportation By Air
4581	Airports, Flying Fields & Airport Terminal Services	45	Transportation By Air
4610	Pipe Lines (No Natural Gas)	46	Pipelines, Except Natural Gas
4700	Transportation Services	47	Transportation Services
4731	Arrangement of Transportation of Freight & Cargo	47	Transportation Services
4812	Radiotelephone Communications	48	Communications
4813	Telephone Communications (No Radiotelephone)	48	Communications
4822	Telegraph & Other Message Communications	48	Communications
4832	Radio Broadcasting Stations	48	Communications
4833	Television Broadcasting Stations	48	Communications
4841	Cable & Other Pay Television Services	48	Communications
4899	Communications Services, NEC	48	Communications
4900	Electric, Gas & Sanitary Services	49	Electric, Gas, And Sanitary Services
4911	Electric Services	49	Electric, Gas, And Sanitary Services
4922	Natural Gas Transmission	49	Electric, Gas, And Sanitary Services
4923	Natural Gas Transmisison & Distribution	49	Electric, Gas, And Sanitary Services
4924	Natural Gas Distribution	49	Electric, Gas, And Sanitary Services
4931	Electric & Other Services Combined	49	Electric, Gas, And Sanitary Services
4932	Gas & Other Services Combined	49	Electric, Gas, And Sanitary Services
4941	Water Supply	49	Electric, Gas, And Sanitary Services
4950	Sanitary Services	49	Electric, Gas, And Sanitary Services
4953	Refuse Systems	49	Electric, Gas, And Sanitary Services
4955	Hazardous Waste Management	49	Electric, Gas, And Sanitary Services
4961	Steam & Air-Conditioning Supply	49	Electric, Gas, And Sanitary Services
4991	Cogeneration Services & Small Power Producers	49	Electric, Gas, And Sanitary Services
5000	Wholesale-Durable Goods	50	Wholesale Trade-durable Goods
5010	Wholesale-Motor Vehicles & Motor Vehicle Parts & Supplies	50	Wholesale Trade-durable Goods
5013	Wholesale-Motor Vehicle Supplies & New Parts	50	Wholesale Trade-durable Goods
5020	Wholesale-Furniture & Home Furnishings	50	Wholesale Trade-durable Goods
5030	Wholesale-Lumber & Other Construction Materials	50	Wholesale Trade-durable Goods
5031	Wholesale-Lumber, Plywood, Millwork & Wood Panels	50	Wholesale Trade-durable Goods
5040	Wholesale-Professional & Commercial Equipment & Supplies	50	Wholesale Trade-durable Goods
5045	Wholesale-Computers & Peripheral Equipment & Software	50	Wholesale Trade-durable Goods
5047	Wholesale-Medical, Dental & Hospital Equipment & Supplies	50	Wholesale Trade-durable Goods
5050	Wholesale-Metals & Minerals (No Petroleum)	50	Wholesale Trade-durable Goods
5051	Wholesale-Metals Service Centers & of fices	50	Wholesale Trade-durable Goods
5063	Wholesale-Electrical Apparatus & Equipment, Wiring Supplies	50	Wholesale Trade-durable Goods
5064	Wholesale-Electrical Appliances, Tv & Radio Sets	50	Wholesale Trade-durable Goods
5065	Wholesale-Electronic Parts & Equipment, NEC	50	Wholesale Trade-durable Goods
5070	Wholesale-Hardware & Plumbing & Heating Equipment & Supplies	50	Wholesale Trade-durable Goods
5072	Wholesale-Hardware	50	Wholesale Trade-durable Goods
5080	Wholesale-Machinery, Equipment & Supplies	50	Wholesale Trade-durable Goods
5082	Wholesale-Construction & Mining (No Petro) Machinery & Equip	50	Wholesale Trade-durable Goods
5084	Wholesale-Industrial Machinery & Equipment	50	Wholesale Trade-durable Goods
5090	Wholesale-Misc Durable Goods	50	Wholesale Trade-durable Goods
5094	Wholesale-Jewelry, Watches, Precious Stones & Metals	50	Wholesale Trade-durable Goods

5099	Wholesale-Durable Goods, NEC	50	Wholesale Trade-durable Goods
5110	Wholesale-Paper & Paper Products	51	Wholesale Trade-non-durable Goods
5122	Wholesale-Drugs, Proprietaries & Druggists' Sundries	51	Wholesale Trade-non-durable Goods
5130	Wholesale-Apparel, Piece Goods & Notions	51	Wholesale Trade-non-durable Goods
5140	Wholesale-Groceries & Related Products	51	Wholesale Trade-non-durable Goods
5141	Wholesale-Groceries, General Line	51	Wholesale Trade-non-durable Goods
5150	Wholesale-Farm Product Raw Materials	51	Wholesale Trade-non-durable Goods
5160	Wholesale-Chemicals & Allied Products	51	Wholesale Trade-non-durable Goods
5171	Wholesale-Petroleum Bulk Stations & Terminals	51	Wholesale Trade-non-durable Goods
5172	Wholesale-Petroleum & Petroleum Products (No Bulk Stations)	51	Wholesale Trade-non-durable Goods
5180	Wholesale-Beer, Wine & Distilled Alcoholic Beverages	51	Wholesale Trade-non-durable Goods
5190	Wholesale-Miscellaneous Nondurable Goods	51	Wholesale Trade-non-durable Goods
5200	Retail-Building Materials, Hardware, Garden Supply	52	Building Materials, Hardware, Garden Supply, And Mobile Home Dealers
5211	Retail-Lumber & Other Building Materials Dealers	52	Building Materials, Hardware, Garden Supply, And Mobile Home Dealers
5271	Retail-Mobile Home Dealers	52	Building Materials, Hardware, Garden Supply, And Mobile Home Dealers
5311	Retail-Department Stores	53	General Merchandise Stores
5331	Retail-Variety Stores	53	General Merchandise Stores
5399	Retail-Misc General Merchandise Stores	53	General Merchandise Stores
5400	Retail-Food Stores	54	Food Stores
5411	Retail-Grocery Stores	54	Food Stores
5412	Retail-Convenience Stores	54	Food Stores
5500	Retail-Auto Dealers & Gasoline Stations	55	Automotive Dealers And Gasoline Service Stations
5531	Retail-Auto & Home Supply Stores	55	Automotive Dealers And Gasoline Service Stations
5600	Retail-Apparel & Accessory Stores	56	Apparel And Accessory Stores
5621	Retail-Women's Clothing Stores	56	Apparel And Accessory Stores
5651	Retail-Family Clothing Stores	56	Apparel And Accessory Stores
5661	Retail-Shoe Stores	56	Apparel And Accessory Stores
5700	Retail-Home Furniture, Furnishings & Equipment Stores	57	Home Furniture, Furnishings, And Equipment Stores
5712	Retail-Furniture Stores	57	Home Furniture, Furnishings, And Equipment Stores
5731	Retail-Radio, Tv & Consumer Electronics Stores	57	Home Furniture, Furnishings, And Equipment Stores
5734	Retail-Computer & Computer Software Stores	57	Home Furniture, Furnishings, And Equipment Stores
5735	Retail-Record & Prerecorded Tape Stores	57	Home Furniture, Furnishings, And Equipment Stores
5810	Retail-Eating & Drinking Places	58	Eating And Drinking Places
5812	Retail-Eating Places	58	Eating And Drinking Places
5900	Retail-Miscellaneous Retail	59	Miscellaneous Retail
5912	Retail-Drug Stores and Proprietary Stores	59	Miscellaneous Retail
5940	Retail-Miscellaneous Shopping Goods Stores	59	Miscellaneous Retail
5944	Retail-Jewelry Stores	59	Miscellaneous Retail
5945	Retail-Hobby, Toy & Game Shops	59	Miscellaneous Retail
5960	Retail-Nonstore Retailers	59	Miscellaneous Retail
5961	Retail-Catalog & Mail-Order Houses	59	Miscellaneous Retail
5990	Retail-Retail Stores, NEC	59	Miscellaneous Retail
6021	National Commercial Banks	60	Depository Institutions
6022	State Commercial Banks	60	Depository Institutions
6029	Commercial Banks, NEC	60	Depository Institutions
6035	Savings Institution, Federally Chartered	60	Depository Institutions
6036	Savings Institutions, Not Federally Chartered	60	Depository Institutions
6099	Functions Related To Depository Banking, NEC	60	Depository Institutions
6111	Federal & Federally-Sponsored Credit Agencies	61	Non-depository Credit Institutions
6141	Personal Credit Institutions	61	Non-depository Credit Institutions
6153	Short-Term Business Credit Institutions	61	Non-depository Credit Institutions
6159	Miscellaneous Business Credit Institution	61	Non-depository Credit Institutions
6162	Mortgage Bankers & Loan Correspondents	61	Non-depository Credit Institutions
6163	Loan Brokers	61	Non-depository Credit Institutions
6172	Finance Lessors	61	Non-depository Credit Institutions
6189	Asset-Backed Securities	61	Non-depository Credit Institutions
6199	Finance Services	61	Non-depository Credit Institutions
6200	Security & Commodity Brokers, Dealers, Exchanges & Services	62	Security And Commodity Brokers, Dealers, Exchanges, And Services
6211	Security Brokers, Dealers & Flotation Companies	62	Security And Commodity Brokers, Dealers, Exchanges, And Services
6221	Commodity Contracts Brokers & Dealers	62	Security And Commodity Brokers, Dealers, Exchanges, And Services
6282	Investment Advice	62	Security And Commodity Brokers, Dealers, Exchanges, And Services
6311	Life Insurance	63	Insurance Carriers
6321	Accident & Health Insurance	63	Insurance Carriers
6324	Hospital & Medical Service Plans	63	Insurance Carriers
6331	Fire, Marine & Casualty Insurance	63	Insurance Carriers
6351	Surety Insurance	63	Insurance Carriers
6361	Title Insurance	63	Insurance Carriers
6399	Insurance Carriers, NEC	63	Insurance Carriers
6411	Insurance Agents, Brokers & Service	64	Insurance Agents, Brokers, And Service
6500	Real Estate	65	Real Estate
6510	Real Estate Operators (No Developers) & Lessors	65	Real Estate
6512	Operators of Nonresidential Buildings	65	Real Estate
6513	Operators of Apartment Buildings	65	Real Estate
6519	Lessors of Real Property, NEC	65	Real Estate
6531	Real Estate Agents & Managers (For Others)	65	Real Estate
6532	Real Estate Dealers (For Their Own Account)	65	Real Estate
6552	Land Subdividers & Developers (No Cemeteries)	65	Real Estate
6770	Blank Checks	67	Holding And Other Investment Offices
6792	Oil Royalty Traders	67	Holding And Other Investment Offices
6794	Patent Owners & Lessors	67	Holding And Other Investment Offices
6795	Mineral Royalty Traders	67	Holding And Other Investment Offices
6798	Real Estate Investment Trusts	67	Holding And Other Investment Offices
6799	Investors, NEC	67	Holding And Other Investment Offices
7000	Hotels, Rooming Houses, Camps & Other Lodging Places	70	Hotels, Rooming Houses, Camps, And Other Lodging Places
7011	Hotels & Motels	70	Hotels, Rooming Houses, Camps, And Other Lodging Places
7200	Services-Personal Services	72	Personal Services
7310	Services-Advertising	73	Business Services
7311	Services-Advertising Agencies	73	Business Services
7320	Services-Consumer Credit Reporting, Collection Agencies	73	Business Services

7330	Services-Mailing, Reproduction, Commercial Art & Photography	73	Business Services
7331	Services-Direct Mail Advertising Services	73	Business Services
7340	Services-To Dwellings & Other Buildings	73	Business Services
7350	Services-Miscellaneous Equipment Rental & Leasing	73	Business Services
7359	Services-Equipment Rental & Leasing, NEC	73	Business Services
7361	Services-Employment Agencies	73	Business Services
7363	Services-Help Supply Services	73	Business Services
7370	Services-Computer Programming, Data Processing, Etc.	73	Business Services
7371	Services-Computer Programming Services	73	Business Services
7372	Services-Prepackaged Software	73	Business Services
7373	Services-Computer Integrated Systems Design	73	Business Services
7374	Services-Computer Processing & Data Preparation	73	Business Services
7377	Services-Computer Rental & Leasing	73	Business Services
7380	Services-Miscellaneous Business Services	73	Business Services
7381	Services-Detective, Guard & Armored Car Services	73	Business Services
7384	Services-Photofinishing Laboratories	73	Business Services
7385	Services-Telephone Interconnect Systems	73	Business Services
7389	Services-Business Services, NEC	73	Business Services
7500	Services-Automotive Repair, Services & Parking	75	Automotive Repair, Services, And Parking
7510	Services-Auto Rental & Leasing (No Drivers)	75	Automotive Repair, Services, And Parking
7600	Services-Miscellaneous Repair Services	76	Miscellaneous Repair Services
7812	Services-Motion Picture & Video Tape Production	78	Motion Pictures
7819	Services-Allied To Motion Picture Production	78	Motion Pictures
7822	Services-Motion Picture & Video Tape Distribution	78	Motion Pictures
7829	Services-Allied To Motion Picture Distribution	78	Motion Pictures
7830	Services-Motion Picture Theaters	78	Motion Pictures
7841	Services-Video Tape Rental	78	Motion Pictures
7900	Services-Amusement & Recreation Services	79	Amusement And Recreation Services
7948	Services-Racing, Including Track Operation	79	Amusement And Recreation Services
7990	Services-Miscellaneous Amusement & Recreation	79	Amusement And Recreation Services
7997	Services-Membership Sports & Recreation Clubs	79	Amusement And Recreation Services
8000	Services-Health Services	80	Health Services
8011	Services-Offices & Clinics of Doctors of Medicine	80	Health Services
8050	Services-Nursing & Personal Care Facilities	80	Health Services
8051	Services-Skilled Nursing Care Facilities	80	Health Services
8060	Services-Hospitals	80	Health Services
8062	Services-General Medical & Surgical Hospitals, NEC	80	Health Services
8071	Services-Medical Laboratories	80	Health Services
8082	Services-Home Health Care Services	80	Health Services
8090	Services-Misc Health & Allied Services, NEC	80	Health Services
8093	Services-Specialty Outpatient Facilities, NEC	80	Health Services
8111	Services-Legal Services	81	Legal Services
8200	Services-Educational Services	82	Educational Services
8300	Services-Social Services	83	Social Services
8351	Services-Child Day Care Services	83	Social Services
8600	Services-Membership or ganizations	86	Membership Organizations
8700	Services-Engineering, Accounting, Research, Management	87	Engineering, Accounting, Research, Management, And Related Services
8711	Services-Engineering Services	87	Engineering, Accounting, Research, Management, And Related Services
8731	Services-Commercial Physical & Biological Research	87	Engineering, Accounting, Research, Management, And Related Services
8734	Services-Testing Laboratories	87	Engineering, Accounting, Research, Management, And Related Services
8741	Services-Management Services	87	Engineering, Accounting, Research, Management, And Related Services
8742	Services-Management Consulting Services	87	Engineering, Accounting, Research, Management, And Related Services
8744	Services-Facilities Support Management Services	87	Engineering, Accounting, Research, Management, And Related Services
8880	American Depositary Receipts	88	Private Households
8888	Foreign Governments	88	Private Households
8900	Services-Services, NEC	89	Miscellaneous Services
9721	International Affairs	97	National Security And International Affairs
9995	Non-Operating Establishments	99	Nonclassifiable Establishments

Note: 1.SIC descriptions are taken from http://www.sec.gov/info/edgar/siccodes.htm
2.Group descriptions are from http://www.osha.gov/pls/imis/sic_manual.html