EXPLAINING RETURNS TO ACQUIRERS OF VENTURE CAPITAL BACKED INFORMATION TECHNOLOGY FIRMS: BARGAINING OR THE REAL OPTION HYPOTHESIS.

by

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Abstract

The purpose of this thesis is to determine whether the presence of venture capital has an effect on the announcement returns of a US acquirer of a US private information technology (IT) firm, and to determine whether this effect can be explained by either of two hypotheses taken from the literature.

Venture capitalists have extensive experience in the IT sector, having placed over 50% of their funds into IT firms, which have accounted for approximately 75% of their revenue. Furthermore, venture capitalists sell almost twice as many IT firms to acquirers as they take public in IPOs. While the literature on venture capital involvement in IPOs is extensive, there is no published work on the role venture capitalists in acquisitions and little consideration given explicitly to the importance of the IT sector.

The bargaining hypothesis proposes that bargaining may influence the distribution of surplus value in an acquisition (the difference between the value of a firm as a stand-alone entity and its value in the hands of an acquirer). It states that venture capitalists will bargain effectively on behalf of their investments so that the portion of the surplus accruing to the acquirer, which is reflected in their announcement returns, will be reduced.

The real option hypothesis proposes that venture capital backed firms are more R&D intensive and less mature at acquisition than other entrepreneurial firms, having created but not commercialized their technologies, such that they closer represent real options. In a multiple bidder context, as valuations of real options suffer from an increased information asymmetry, the winner's curse should be amplified with a venture backed target causing an acquirer's investors to believe that their firm has overpaid. This too would act to reduce announcement returns.

Using an event study methodology to examine acquisitions from the period 1980 to 2004, this research finds that announcement returns for acquisitions of venture backed IT firms are reduced. The effect of venture capitalists' reputations, and the finding that venture capital backed firms may be less R&D intensive, lends more support to the bargaining hypothesis as an explanation of this result.

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Dedication

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CHAPTER I Introduction

1.1 Introduction

For many researchers and practitioners venture capital is synonymous with the equity financing of entrepreneurial information technology (IT) firms. Over the past decade more than 50% of the venture capital investment in the US has been placed in IT firms, and these firms represent almost 75% of the total value of all venture capital investments at the time of an acquisition or initial public offering. The term 'venture capital' was coined to describe equity investment into semiconductor and computer firms. Many household names from the IT sector were financed, in part at least, by venture capitalists. These include Intel, Microsoft, Apple, Dell, 3com, Google, Yahoo and eBay, to name but a few. However, venture capitalists now also invest in biotechnology, business services, consumer products, energy, industrial equipment, and even retail ventures. Furthermore, the majority of entrepreneurial firms in the IT sector do not receive venture capital.

It is therefore important to consider whether venture capital provides something different to IT firms compared with firms from other sectors, and whether venture capital is interchangeable with other forms of finance, particularly for IT firms. Related to these topics is the question of whether venture capitalists are homogenous, or whether experience and reputation brings increased benefits to the financed firms. This thesis takes a step forward in assessing the involvement of venture capitalists in the firms that they finance, and their relationship with the IT sector, by considering the stock market reactions to announcements of acquisitions of entrepreneurial targets.

There is a large literature on the role of venture capitalists in firms that experience an initial public offering (IPO). Well known examples include Barry, Muscarella, Peavy & Vetsuypens (1990), Megginson & Weiss (1991), Lerner (1994), Jain & Kini (1995 & 2000), Gompers (1996), Gompers & Lerner (1997), Giudici & Paleari (2000), Bradley, Jordan, Roten & Yi (2001), Bouresli, Davidson, & Abdulsalam (2002), Wang, Wang & Lu (2003) and Li & Masulis (2004). While IPOs are important for venture capitalists and their investors, they are comparatively rare. Over the last ten years approximately twice

as many venture capital backed firms have been acquired as have experienced an IPO, and although the transaction values of acquisitions are generally smaller than the market capitalizations of firms that achieve a public listing, US venture capitalists appear to earn the majority of their income from acquisitions (c.f. an industry report by Hellmann, Egan & Brander (2005)). However, to the best of my knowledge and at the time of writing, the literature on the role of venture capitalists in firms that experience an acquisition consists of two unpublished papers (Gompers & Xuan (2005) and Brander & Egan (2005)) and this thesis.

Using an event study methodology I consider the short-term returns surrounding announcements of acquisitions of both IT and non-IT privately held firms from 1980 to 2004. I attempt to explain the similarities and differences in the announcement returns of venture capital backed and other entrepreneurial targets using two theories of venture capital involvement.

The bargaining hypothesis argues that venture capitalists play a value-added role in their firms when they are negotiating an acquisition. I suggest that venture capitalists, who earn much of their income from acquisitions, will bargain with potential acquirers and obtain favorable terms. Hence, the announcements of acquisitions of venture capital backed firms would result in decreased abnormal announcement returns for the acquirer, as their investors should anticipate that their firm will receive less of any surplus value created in the acquisition. Given that venture capitalists have long track records, and often substantial technical experience, in the IT sector, they should exhibit a particular bargaining ability when negotiating the acquisition of an IT firm. Thus I postulate that the sector of venture capital backed firms may play an important role in explaining the returns to acquisition announcements.

Under the real option hypothesis, venture capitalists select firms that are more R&D intensive and will be less mature at acquisition. An implication of this hypothesis is that the purchase of a venture backed firms would not be, typically, for market share or other immediate benefit, but rather the purchase of technology which will allow, given further expenditure and opportune circumstance, a future benefit. Because of the greater uncertainty in the valuation of such an enterprise, the real option hypothesis states that the winner's curse will be more pronounced and the investors of an acquirer will be more

likely to expect that their firm has over paid for its target. This hypothesis therefore also predicts that abnormal announcement returns for acquisitions of venture backed firms will be reduced with respect to announcement returns of acquisitions of other firms.

My major finding is that there is an announcement return effect attributable to the presence of venture capital; in acquisitions of firms from outside of the IT sector, the presence of venture capital actually increases the announcement returns accruing to the acquirer, whereas with acquisitions of IT firms the presence of venture capital acts to reduce the acquirer's announcement returns. This effect is robust to the inclusion of numerous exogenous and control variables, thus I find that venture capitalists do appear to play a role in the acquisitions of both their IT and non-IT firms.

To the best of my knowledge, this is the first contribution to the literature that places primary importance on the sector of the firm when considering the effects of venture capital. Essentially I propose that venture capital investments outside of the IT sector may behave very differently from expected, and that many findings in the literature may apply only to IT firms as these are usually dominant in any sample. The distinct behavior of IT firms is apparent through out the entire period of consideration, and so can not be solely attributed to a capital market myopia effect (see Salhman & Stevenson (1985)) for the Internet firm boom period of the late 1990's.

Within the IT sector it would appear that venture capital is not interchangeable with other forms of finance. In addition to the return effect, I found that venture capital backed firms achieved higher transaction values and were more likely to be bought by a larger acquirer in the same industry, with a low leverage and a larger number of competitors, for stock, in non-boom periods. They are also more likely to be immature and to come from California or Massachusetts.

In an examination of the pre-acquisition operational characteristics of the firms I found not only that IT firms are slightly different from other firms, but also that venture backed IT firms are less mature than their non-venture backed counterparts. Thus I can not reject the possibility that venture backed IT firms closer resemble real options, and I can not reject the real option hypothesis simply because it failed to make appropriate return predictions for the non-IT sector. Nor can I reject the bargaining hypothesis for its failure to predict returns for non-IT firms; without the benefit of their sectorial experience

and track record, venture capitalists may not be able to bargain effectively, and other factors may come into play.

For venture backed IT firms I attempt to determine which of the two competing hypotheses is more feasible. A measure of venture capitalists' reputation was a successful predictor of returns for the venture backed IT firms sub-sample during the boom period. This supports the recent literature (e.g. Sorensen (2004), Kaplan & Schoar (2005), and others) which demonstrated that venture capitalists are heterogeneous with respect to their portfolio firms. While this provided strong support for the bargaining hypothesis, which proposed a priori that bargaining ability would be related to experience, it is also possible that more experienced venture capitalists select IT firms which better resemble real options.

However, I was able to determine that, despite their relative immaturity, venture capital backed firms typically spend less on research and development. This is in direct contraction to a key proposition of the real option hypothesis, which argued that venture backed firms had lower sales, assets and employees, and were less profitable, precisely because they had been conducting research and development that they have sold to an acquirer for later realization. Unfortunately this result, while very highly statistically significant, was found using the very small set of firms that reported R&D expenditure, which may suffer from some self-reporting bias or otherwise be non-representative of all IT acquisition targets.

I found that for IT firms, the period, the payment method, several characteristics of the acquirer (total assets, leverage and number of competitors), the transaction value, the strategic fit between the target and the acquirer, and the location of the target are all strong predictors of the presence of venture capital. All of these variables, except the total assets of the acquirer and the location of the target, are also exogenous to the presence of venture capital. I show that the return effect due to the presence of venture capital is largely robust to their inclusion in a multivariate setting.

The remainder of this thesis is organized as follows: Chapter 2 provides a literature review that examines four research themes. These are returns to investors in venture capital exits, returns to firms involved in mergers and acquisitions, the role of venture capitalists in the firms that they finance, and the financing of innovation in

information technology firms. This review provided numerous exogenous and control variables, pertinent to studies of acquisitions, that were included in the subsequent analysis, and placed the two hypotheses in the context of the literature on venture capital participation theories.

Chapter 3 provides a detailed explanation of each hypothesis along with their predictions. It also provides a description of the event study methodology, with a discussion of the many issues inherent in conducting event studies, detail of the procedures used to determine whether a variable is exogenous or endogenous to the presence of venture capital, and a description of the data assembly required to create the sample that underlies the analysis and results.

Chapter 4 provides the analysis and results. To determine which one the two competing hypotheses is more feasible, I organize the presentation of this chapter such that it begins with an examination of the pre-operational characteristics of the firms and concludes with an analysis of the effects of the reputation of the venture capitalists and the R&D expenditure of the targets prior to acquisition. This chapter also contains sections devoted to the importance of IT firms, the implications of the payment method, and the effect of competition among potential acquirers. Chapter 5 provides the concluding remarks, and introduces a third hypothesis from the literature which may also explain the results found.

CHAPTER II Literature Review

2.1 Literature Review

This thesis builds upon four major research themes, each with its own established literature. These are: i) returns to investors in venture capital exits, ii) returns to mergers and acquisitions, iii) the role of venture capitalists in the firms that they finance, iv) the financing of innovation, especially in information technology. Each is explored in turn. In addition I make use of an event study methodology, which has its own literature that is reviewed separately in the hypotheses, methodology and data chapter.

2.2 Returns to investors in venture capital exits

The literature has shown that returns to venture backed firms post exit differ from those of other entrepreneurial firms, both because of their prior involvement and because of their specific roles at this crucial time in a firm's history. Megginson & Weiss (1991) found that the presence of venture capital increases the fraction of the proceeds accruing to an entrepreneurial firm at IPO. This paper hypothesized that venture capitalists can "certify that the offering price of the issue reflects all available and relevant inside information". Their work is therefore similar to that of DeAngelo & DeAngelo (1985) and Beatty & Ritter (1986), who considered this problem for investment bankers and auditors, and builds on the topic of IPO certification in general, as examined in Booth & Smith (1986). Barry, Muscarella, Peavy & Vetsuypens (1991) provide a comparable perspective on returns to venture-backed IPOs, and Li & Masulis (2004) showed more pronounced certification effects when underwriters are themselves venture capitalists.

'Reputation' may explain how venture capitalists gain better returns for their firms. Venture capitalists may use their reputations to secure the best underwriters for their ventures, who in turn may use their reputations to certify the offerings and secure superior returns. Megginson & Weiss examined the correlation between the presence and quality of venture capitalists and the quality of underwriters and auditors, and the

percentage of institutional holdings, as well as controlling for these effects. VC backed firms had significantly higher quality underwriters and auditors, as measured by market share or the number of IPOs brought to issue. The reputation of underwriters and its positive impact on initial public offerings is explored in Carter & Manaster (1990). However, this paper also found a certification effect attributable to the venture capitalists alone.

Venture capitalists need to build reputations and may not use them solely to the benefit of their firms. In Megginson & Weiss less than 1% of venture capitalists liquidated all of their position at IPO (or after a lock-period following the IPO), and most retained more than half of their holdings, providing them with credible reputations. However, Gompers (1996) found that younger venture capital funds attempt to establish reputations through premature IPOs that stifle a firm's value. Furthermore Bascha & Walz (2001) found that venture capitalists use their reputations to gain preferential terms in the deal structure, allowing them access to a greater share of any success at IPO. Other notable papers addressing the topic of venture capitalist reputations include Sahlman (1990) and Schertler (2002).

The reputation of a venture capitalist is of particular consideration to this thesis because I expect that bargaining ability will be related to experience. Measures of reputation, as found in Sahlman (1990), Sorensen (2004) and Kaplan & Schoar (forthcoming), consider the prior experience of venture capitalists in terms of the number of firms that they have financed, exited and held board seats in, sometimes within specific industries, as well as their past fund raising records. The recent literature has demonstrated that venture capitalists are heterogeneous with respect to their portfolio companies; that is financing from one venture capitalist is not necessarily interchangeable with financing another. Sorensen (2004) found that entrepreneurial firms are will to pay a premium, in terms of the pre-money valuation of their firms, to secure investment from highly experienced venture capitalists.

The continued involvement of venture capitalists also appears to influence the post-IPO performance of a firm; studies of the long term stock performance of venture capital backed firms have shown that they outperform comparable enterprises. Both Brav & Gompers (1997) and Gompers & Learner (1997) examined this phenomenon in

considerable detail. Brav & Gompers used five year buy-and-hold returns to show that the underperformance of venture backed firms was significantly reduced for both equal and value-weighted portfolios, but drastically so for equal-weighted ones, even after correcting for size and book-to-market ratio differences. The paper also tested underperformance against the three factor Fama-French model asset pricing model with comparable results. This research was built on Ritter (1991), who documented the general underperformance of IPO firms relative to the market.

However, when venture capitalists divest their holdings from a firm the stock returns may suffer. Bradley, Jordan, Yi, & Roten (2001) examined the abnormal returns associated with expiration of a lock-up period for IPO firms. This is the first opportunity for private investors to liquidate their holdings. They found that all firms experience negative abnormal returns, but for VC backed firms these losses were particularly, and significantly differently, larger.

The involvement of venture capitalists prior to exit, or a venture capital selection effect, may result in post IPO quality differences between them and other newly public firms. This is a separate consideration from the value that venture capitalists may add at exist or afterwards, and is closely related to the real option hypothesis. Jain & Kini (1995) found that venture backed firms have a superior operating performance after an IPO. Using accounting measures of performance, rather than stock returns, this paper considered the sales, assets, book to market ratio and price to earnings ratio of newly public firms. It found a significant positive correlation with the operating performance of the firm for both the presence of venture capital and for proxies for venture capitalist monitoring.

Wang, Wang & Lu (2003) examined the Singapore market and confirmed the findings of both Jain & Kini and Brav & Gompers, as well as adding that IPOs supported by older venture capital firms perform significantly better, lending support to a reputation hypothesis. Likewise, Jain & Kini (2000) showed that the presence of venture capital improves the survival likelihood of IPO firms using a Cox hazard methodology. Bouresli, Davidson & Abdulsalam (2002) showed that venture capital backed firms have a more independent governance structure both pre and post IPO, with insiders controlling less board positions, and CEOs owning a reduced holding.

While there are some recent contributions to the literature addressing returns to venture capital investment in general - examples include Jones & Rhodes-Kropf (2002), Ljungqvist & Richardson (2003), and Kaplan & Schoar (2005) - these have predominately taken a venture capital fund, not a portfolio firm, perspective. Cumming & Macintosh (2003) is unique in that it considered both IPOs and M&As as exit vehicles. This paper provided a comparison between US and Canadian markets, as well as much insightful discussion of the role of venture capitalists in resolving information asymmetries at exit. However it did not explicitly address returns.

My literature review was able to locate only a single discussion paper, by Gompers & Xuan (2004), which directly addressed the topic of this thesis. It considered returns to acquisitions of venture backed targets and is explored in detail below.

2.3 Returns to firms involved in mergers and acquisitions

There is a substantial literature on the factors affecting returns to acquisitions, from which I assemble a list of the most important exogenous and control variables for inclusion in my analysis. I begin with the early merger literature.

To set the scene I note that Asquith & Kim (1982) found that in the anticipation of a merger between two public firms, the target's stock and bond holders experienced significant positive returns, while the acquirer's did not. Asquith, Bruner, Mullins (1983) found that the relative size of the target was the primary determinant of the magnitude of the target's resulting gain. Other research on the effect on the target includes Huang & Walkling (1987), who found that abnormal returns for the target are associated with payment method, offer type and the degree of resistance. However, Bradley, Desai & Kim (1988) found that a tender offer (i.e. the formal announcement of intention to merge or acquire) can create synergistic stock gains; the lower the competition among bidders the higher the proportion of the gains accruing to the acquirer. But while the determinants of gains in mergers remain important for acquisitions their effects can be somewhat different in this context.

Definitions of a 'merger' and an 'acquisition' are overlapping in the literature, with many researches failing to distinguish between the two types of event. I make the

following distinction: in a merger both original parties continue operation within a single legal entity without one's identity being dominant over the others. In an acquisition one entity is fully absorbed into the other, losing its original identity in the process. This distinction relies on a subjective judgment regarding "dominance" and loss or persistence of "identity", but it does capture an important distinction. In this thesis the events under consideration are clearly acquisitions rather than mergers.

Maloney, McCormick & Mitchell (1993) considered both mergers and acquisitions and found that "the higher the leverage of the acquirer (or bidder), the greater the announcement-period acquirer returns". Loderer & Martin (1990) considered only acquisitions and found that size of the acquirer remained a very important determinant of returns. The paper used a very large sample (5,172 acquisitions) to show that acquisition announcements do benefit the shareholders of the acquirer after correcting for firm size, but that this benefit decreases over time. However, they also found that "in the aggregate, acquisitions tend to decrease shareholder wealth" because large firms pay too much. Moeller, Schlingemann & Stulz (2004 & 2005) showed that firm size and the year of the acquisition are both very important determinants of returns, as well as confirming overall results of poor medium and long term acquirer return performance and providing an excellent review of analysis on acquisitions conducted in the last 20 years.

Morck, Shleifer & Vishny (1990) found three reasons why abnormal returns to the acquirer surrounding an acquisition announcement might be lower or negative. These were that the acquisition was conglomerate, that the target was rapidly growing and that there was a poor prior performance by the acquirer. Kusewitt (1985), Chaterjee (1986), and Hopkins (1987) found intuitive results in their exploration of the effects of strategic fit, synergy and acquirer market position respectively.

The two most important determinants of acquirer returns in the literature – the method of payment and whether the target is public or private – were both explored in Chang (1998). Chang found that acquisitions for cash produced no abnormal returns for the acquirer while acquisitions for stock did, and that this return was significantly positive for acquisitions of private firms but significant negative for acquisitions of public firms. The paper summarized three potential hypotheses: i) the perfect competition

hypothesis, under which there should be no abnormal returns, ii) the monitoring hypothesis, under which an increase in outside block-holders increases monitoring and so returns, and management entrenchment (as in Morck, Shleifer & Vishny) decreases monitoring and so returns, and iii) the asymmetric information hypothesis, that assumes the greater the information asymmetry, the more negative the return.

Chang stated that in acquisitions of private companies "the target shareholders have an incentive to assess the bidding firm's offer carefully because they will end up holding a substantial amount of the bidding firm's stock". This argument has its theoretical basis in Hansen (1987), who also provided the complementary explanation that an acquirer would prefer to offer stock than cash when it has less information about a target firm's value. Ultimately Chang's findings supported both the monitoring and asymmetric information hypotheses.

Fuller, Netter & Stegemoller (2002), in a paper specifically designed to provide objective perspective on the issue of returns interpretation, agreed with Chang. Acquisitions of public companies for stock produce short-run negative abnormal returns, while acquisitions of private companies for stock produce short-run positive returns. Cash transactions do not produce returns. They also found that long-run abnormal returns are generally negative, no matter the method of payment or the public status of the target firm. André, Kooli, & L'Her (2004) examined long run performance of acquiring firms in Canada, with comparably distressing findings.

Gompers & Xuan (2004) found that the presence of venture capital in the target caused decreased short-term returns for the acquirer, but superior long-term performance, both in terms of stock returns and accounting ratios. While the paper does address the primary topic of this thesis, it covers only the boom period of 1990-2001 and, for short-term returns, considers only the payment method, the strategic fit and the relative size of the acquisition as exogenous explanatory variables. Their conclusion is that either venture capitalist are effective bargainers or that venture capital backed acquisitions have greater information asymmetry because they are acquisitions of 'real options', which have an inherent greater uncertainty concerning their future payoffs, and so suffer from an exaggerated form of the winner's curse. They reason that either hypothesis should act to reduce returns, and suggest that returns may be negative under the real option hypothesis.

Both hypotheses are explored in detail in the next chapter and considered throughout this thesis. However, readers should note that the real option hypothesis is contrary to much of the literature (e.g. Megginson & Weiss), which considers venture capitalists as information asymmetry reduction agents and argues that reduced asymmetries should result in decreased abnormal returns (e.g. Myers & Mujluf (1984)).

Several papers have considered returns to acquisitions without examining the performance of the acquirer. Examples include Ruback (1983), who used abnormal returns to show that the market for acquisitions was competitive, and Soon & Walkling (2000), who examined how an acquisition affects the returns of rival firms.

In conclusion, from the relative sizes of the reported effects, the following factors, in approximate order of declining importance, are crucial to understanding acquisitions: Event type (i.e. merger or acquisition), payment method, public status of the target (i.e. public or private), the year of the acquisition, size considerations (total assets, leverage and the relative transaction value), the leverage of the acquirer, the strategic fit and the competitiveness of the bidding. Jurisdictional differences have been addressed at the 'countries of origin' level for mergers but not considered for acquisitions, and only Gompers & Xuan have touched on the influential presence of venture capitalists. No single paper found in this review has attempted to incorporate more than four out of eleven of these factors. This thesis examines nine of them, in the context of acquisitions of private firms.

2.4 The role of venture capitalists in the firms that they finance

Aside from gaining better returns for their firms at IPO (Megginson & Weiss), or for their firm's acquirers at acquisition (Gompers & Xuan), venture capitalists may bring other benefits to the firms that they finance. A paper by Gorman & Salhman (1989) entitled "What do Venture Capitalists Do?" provides a basic overview of the role of venture capitalists. This includes selecting investments, monitoring the firm either directly by serving on the board or indirectly through liaisons with the CEO and CFO, assisting in fund raising (of course), providing strategic analysis, and management recruiting.

The primary goal of venture capitalists is to maximize their return on investment in private equity for their, predominantly institutional, investors. The literature has considered three main ways in which they might accomplish this goal, and some aspects of each of them are implicit in Gorman & Salhman.

The first area of research has explored the problems of asymmetric and imperfect information inherent in the provision of financing to new ventures. The theoretical basis of this research is mostly frequently cited as Akerlof (1970), Pauly (1974) and Rothschild & Stiglitz (1976). Chan (1983) considered venture capitalists as informed intermediaries in a market with imperfect information. Institutional investors place money with venture capitalists, rather than investing directly in private equity themselves, because the venture capitalists are better able to assess risk at the outset, and will then monitor the progress of their firms terminating the financing of underachievers.

Gompers (1995) found that venture capitalists "concentrate investments in early stage and high-technology companies where informational asymmetries are highest" and that they monitor more frequently as agency costs increase. Likewise, Lerner (1995) found that venture capitalists do intensively monitor their firms, particularly when the need for oversight is greater. Amit, Brander & Zott (1998) provided a detailed examination of both adverse selection and moral hazard in venture capital investment. They empirically demonstrate that their "information-based approach is consistent with the data on Canadian venture capital investment", and state that "venture capitalists exist because they are better at this function than unspecialized investors".

The monitoring hypothesis can equally be applied to IPOs (Megginson & Weiss) or acquisitions (Chang). Rather than reducing information asymmetries for institutional investors, the venture capitalist's role at exit may be to reduce the asymmetry, and hence abnormal returns, for either the market or the acquirer (or both). The role of reputation has been explored extensively in information economics, particularly in repeated games. While an examination of this area is beyond the topic of this thesis, readers should note that reputation may provide a mechanism to ensure that venture capitalists to accurately certify their firms.

The second area concerns the 'selection' hypothesis. Tyebjee & Bruno (1984) state that venture capital deals are "an orderly process of five sequential steps"; the first

three of these steps concern deal selection (the remaining two are deal structuring and post-investment activities). MacMillan, Siegel & Narashima (1985) used an industry-wide survey to identify six different categories of risk that venture capitalists consider when selecting a venture. Likewise MacMillan, Zemann & Narashima (1986) found that venture capitalists primarily selected their investments based on an assessment of 'competition risk' and 'product risk'.

Thus under this hypothesis a venture capitalists' primary expertise is the evaluation and selection of potential investments. At exit this would translate, all other things being equal, to venture backed firms being of superior quality when compared with their non-venture backed counterparts, but not necessarily into higher or lower returns for the acquirer. The real option hypothesis supposes that differences in acquisition announcement returns are attributable to a selection effect.

The third area of research concerns what many authors refer to as the "value-added" hypothesis. Tyebjee & Bruno & McIntyre (1983) found that all entrepreneurial ventures must develop different types of marketing expertise at different points in their lifecycle in order to advance. Venture capitalists, with their sectorial experience and networks, may bring these kinds of benefits to their firms.

MacMillan, Kulow & Khoylian (1988) found that value-added involvement is common place in venture-backed firms. Ehrlich, De Noble, Moore & Weaver (1994) found that venture capitalists have significantly higher levels of involvement with their firms than other private investors, and that they added the most value by providing help in selecting management. Hellmann & Puri (2002) found that, in addition to monitoring, venture capitalists play active roles in "professionalizing" their portfolio firms. This paper focused predominantly on human resources dimensions; venture backed firms were more likely to recruit an outside CEO, appoint a VP of sales earlier in the firms development, implement stock-option plans, and so forth.

The bargaining hypothesis at the core of this thesis can be considered a value-added venture capitalist role. Venture backed entrepreneurs have access to professional negotiators who seek to increase the share of the proceeds accruing to their firm at the time of an acquisition. Furthermore, Sapienza (1992) asked "When do venture capitalists add value?", and found that it was when their firms were highly innovative and their fund

was performing well. Thus a strong performing fund is suggestive of an increased reputation and perhaps increased bargaining abilities.

A recent trend in the literature has been to compare and contrast these hypotheses, and attempt to determine which is more dominant. Brander, Amit & Antweiler (2002) compared the selection and value-added hypotheses in the context of syndication in Canada. Their analysis showed that syndicated investments earned higher returns, indicating that the value-added hypothesis is more likely. Finally, Fairchild (2004) considers both moral hazard (between managers and VCs) and the value-added capabilities of venture capitalists, as well as reputation, in a 'manager-to-venture capitalist' bargaining context from a theoretical perspective. He found that "welfare is maximized when the venture capitalist has high value-adding capabilities, the market for reputation is informationally efficient, and the manager has bargaining power".

2.5 The financing of innovation in information technology firms

Small businesses, particularly those involved in information technology innovation, are financed differently from other firms. Giudici & Paleari (2000) found that small (European) technology-based firms relied primarily on personal investment and then on short-term bank debt to finance their companies, and that this acts as a barrier to the creation of new technologies. Van Auken (2001) found that small technology based firms were most familiar with traditional sources of capital like bank debt, and that they were least familiar with capital "commonly used to fund growth" like venture capital and other forms of outside equity investment. Mark (1999) found that the use of grants in innovative small firms provided both validation of a technology and leverage to access further funds. Van Auken (1996) found that "bootstrap" financing methods (i.e. obtaining funds from non-conventional sources like credit cards, the delaying of tax payments, etc) were reckoned more important by small technology oriented firms than their non-technology counterparts.

Despite the research just described, most academics agree that technology firms are better suited to equity investment. Oakley (1984) found that high-growth and technology oriented small firms were more likely to receive equity investment than their

stable, or declining, low technology counterparts. Aghion & Bond (2004) found that firms which report higher levels of R&D are more likely to raise funds by issuing equity than by raising debt. Hogan & Hutson (2005) found that (Irish) software companies, while still preferring internal to external funds, had a preference for equity investment over debt.

To many researchers investment in high-technology start-ups is synonymous with venture capital. Shepardson (1985) points out that whilst 'new' technologies have a greater inherent associated risk, and the costs of development are often greater than anticipated, the resulting returns are much higher than expected. This naturally attracts a specialized type of investor capable of diversifying this risk. Timmons & Bygrave (1986) found that firms seek out venture capitalists, and other classes of equity investor, for reasons other than the capital. This was confirmed in Sorensen (2004). Furthermore they found that value-added contributions are crucial to a small firm for it to innovate and grow.

Announcing an innovative undertaking often yields positive stock returns for public firms. Kelm, Narayanan & Pinches (1995) found that announcement of any of three different stages of R&D (initiation, continuation and new-product introduction) provided significant positive abnormal returns. In certain high-technology industries, particularly biotechnology, announcements of project initiation produced the greatest stock response of all. Similarly, Jaffe (1986) found that R&D outputs, such as patents, were positively correlated with both profit and market value for R&D intensive firms.

This is contrary to the findings for acquisitions, even though many acquisitions, perhaps particularly of venture backed firms under the real option hypothesis, may be explicitly purchases of R&D. Hitt, Hoskisson, Ireland & Harrison (1991) found that (internal) investment in R&D was negatively correlated with acquisitions. The paper found that acquisitions "curtail the championing process", interfering with the ability of organizational insiders to promote new products and processes. Thus purchasing R&D through an acquisition may be a 'lose-lose' proposition for established firms, at least in terms of their stock return.

Large firms may have several advantages when it comes to financing of innovation. Pettit & Singer (1985) found that small firms suffer from increased

information asymmetries with their investors. This would tend to increase their cost of capital. Cassar (2003) confirmed these findings and expanded upon them. Lefley (1997) shows how even large firms have adopted a 'per project' venture capital type approach to innovation financing. This was also echoed in Porter (1980). Large firms are able to diversify risk across many projects in much the same way as venture capitalists diversify risk across their portfolio. An excellent overview of the differences between small and large firm finance, and of the financial growth cycle, was provided by Berger & Udell (1998).

However, small firms may be better suited to innovative undertakings, and this might provide larger public firms with an incentive to acquire them. Knight (1989) found considerable differences between independent entrepreneurs and corporate innovators. Most importantly he found that independents largely created new products, whereas corporate innovators predominantly created new process that would be used within their firms.

The techno-economic paradigm, which predicts a shift from innovation by entrepreneurs to innovation by R&D laboratories of large companies, was explored in a book by Sundbo (1999). This was contrasted with the 'entrepreneur paradigm', that most authors consider currently dominant. Maidique (1980) supported the entrepreneur paradigm by using case studies to examine the changing role of the entrepreneur as firm size grows. He found that entrepreneurs were crucial to "radical technological innovation" at all points in a firm's history, but that as business grows "the entrepreneurial network become fragmented... critical roles are decoupled and a conservative bias is introduced into subsequent innovations". Dubini (1989) also put the entrepreneur first, finding that firms had the greatest success when there was the best possible 'fit' between the entrepreneurs and their product and market. Gompers, Lerner & Scharfstein (2005) found that a previous relationship with venture capital meant that a large firm was more likely to spawn new ventures, but still expected that the greatest entrepreneurial undertakings would be made by small firms. Overall the research appears to indicate that acquiring small, privately held, firms may be the best way to secure productive R&D that is ready for commercialization.

Finally, Hyytinen & Pajarinen (2005) found that ICT firms are unique amongst small innovative firms. The paper hypothesizes that, whilst market forces are similar, network effects are dramatically different for ICT firms. This difference is reflected in the leverage ratios; ICT firms are significantly more dependant on equity investment than comparable firms. This may be reflected in the fact that in excess of 50% of the US's venture capital investment goes to ICT firms.

2.6 Summary of the literature findings

In this literature review I have determined that venture capitalists select firms and/or play a pivotal role in the exit process, which may have an effect on the abnormal returns accruing to the acquirer. I identified a large number of factors that have proven effects on returns to acquisitions, and ranked them in order of importance. I did this so that I might have a relatively complete set of exogenous control variable for the presence of venture capital, and might also rank its importance in determining returns.

I have noted that there are three major themes to research on venture capital participation, and indicated that the bargaining hypothesis implies that venture capitalist take a value-added role whereas the real option hypothesis would be a venture capital selection effect. In addition I found that while R&D announcements generate positive stock returns for acquirers, acquisitions generally do not. However, it would appear that small firms may be more adept at innovation and this might provide large firms with an incentive to acquire them. Finally I explored the small literature on the differences between IT firms and other firms, establishing a case for a sector specific return effect.

CHAPTER III Hypotheses, methodology and data

3.1 Hypotheses, methodology and data

In this chapter I present the two hypotheses under consideration, the event study methodology that was used to test the hypotheses, and the sources and processes needed to assemble to the sample data. In addition I outline the general methodology that I will use to determine whether variables found in the literature review are exogenous or endogenous to the presence of venture capital.

3.2 The bargaining hypothesis

I consider an entrepreneurial venture, whether venture capital backed or not, to be a potential acquisition target. The theoretical framework is as follows: As a stand-alone enterprise the firm has a valuation of v^0, and each potential acquirer values the firm with valuations $v^1 \ldots v^n$ respectively. For each potential acquirer 'i' we can define the surplus resulting from the acquisition as $s^i = v^i - v^0$. I assume that this surplus is positive, as there is nothing to force the owners (or venture capitalists) of a privately held target to sell their firm to an acquirer. The valuation of the target should lie somewhere between the valuation of the firm as a standalone entity and the valuation of the firm by a potential acquirer.

The owners of the firm and the managers of the acquirer bargain over the acquisition price. I denote the share of the surplus going to the owners of the firm as α. There are several factors affecting bargaining. One of these is private information known only to the valuing firm. If the target firm and potential acquirers all have well known valuations, one would expect less surplus than if the valuations were poorly known. In addition, bargaining power might be related to skill and experience; venture capitalists are more likely to be experienced bargainers as they may have sold their firms to other acquirers in the past. My hypothesis is simply that α will be higher when the target firm is represented by venture capitalists.

I expect that investors will react to the expected surplus $(1-\alpha)s^i$ accruing to the acquiring firm. If the target is anticipated to receive the entire surplus, such that $(1-\alpha)s^i$ is zero, then there should be no abnormal return associated with the announcement. More generally one might expect that the abnormal returns will be decreasing with respect to the bargaining success of the target, and so with the presence of venture capital. Only if investors believe that their firm has overpaid for its target or the combination of the two firms is otherwise overvalued, should there be a negative abnormal return.

Thus the bargaining hypothesis states that announcements of acquisitions of venture capital backed firms operating in sectors where venture capitalists have experience will, all other things being equal, produce lower abnormal returns than announcements of acquisitions of other entrepreneurial ventures in these sectors.

3.3 The real option hypothesis

Entrepreneurial ventures may differ in terms of their operational characteristics and accordingly may be purchased, and so differently valued, for different post-acquisition purposes by their acquirers. In the instance of an acquisition of a relatively established enterprise for its assets, market share and cash flows, a net present value calculation may capture its value sufficiently. However, if the acquisition is a strategic investment designed to develop capabilities, and or foster flexibility, for the future, such that the acquiring firm may later choose to make expenditures and realize operational benefits, then real option valuation techniques may be more appropriate.

An option is a right to buy or sell a specific quantity of an asset at a predetermined price on or before a specified date. Options that grant the right to buy an asset are named 'call options' and options that grant the right to sell an asset are named 'put options'. The price at which the option can be exercised is referred to as the 'strike price' and an option has an 'expiration date'. A real option has all of the characteristics of an option but involves the right to buy or sell a real asset, rather than a financial asset.

As an example of a real option, I consider the lease of an oil field. The strike price of this real option is the exploration, development and extraction cost inherent in

realizing the value of the oil field (i.e. obtaining the oil from it), and the expiration date is the date by which this must be performed. The firm that purchased the lease may hold the right to the oil field until such a time as the oil market merits the expenditure necessary to extract the oil, at which point they could do so and realize the value of the option. If market conditions do not merit the expenditure before the expiration date of the option, then the option is forfeit.

Real option pricing models are most frequently applied to land and resource assets (e.g. Quigg 1993), but the valuation of an acquisition of a venture capital backed firm may share many of the same characteristics. If venture capital backed firms systematically develop intellectual property but are acquired prior to the commercialization of their technology, then their acquirers could hold this asset until market conditions, or other desirable factors, indicate that they should undertake further expenditure to realize the benefits.

Dixit & Pindyck (1994) separated real options from other financial options by requiring, among other things, that the underlying asset not be traded and that the option not be proprietary. Thus, real option analysis often has a game-theoretical component, as while only one firm may hold the asset, other firms may influence the exercise of the option or benefit from it. Both of these factors may be present in the acquisition of venture capital backed firm. Once purchased a firm is difficult to divest; particularly so if it is not revenue generating as a standalone entity. Also, venture capitalists claim to specialize in market making and disruptive technologies, which may have a dramatic impact on the competitive environment and be particularly sensitive to the success of concurrent undertakings.

Gompers & Xuan (2005) assert that acquisitions of venture capital backed firms are more like purchases of real options than acquisitions of other entrepreneurial ventures, and provide three relevant testable propositions for a 'real option hypothesis'. First, horizontal acquisitions should be more prevalent for venture backed firms; an acquirer in the same industry should be better able to estimate the value of a real option and to manage the acquired personnel. While one could argue that they are also better able to estimate the value of a target that is not a real-option, real options usually exhibit greater variance in their valuation, as they are associated with higher uncertainty.

However, the same prediction could be made using the bargaining hypothesis; venture capitalists may use their sectorial experience and networks to find potential acquirers for their firms.

Second, in the case of an acquisition of a venture capital backed firm, an acquirer must hold the asset underlying the real option by securing not only the rights to the intellectual property but also the entrepreneurial team capable of developing it (for them or their competition). Thus one might expect that acquisitions of venture capital backed firms are more likely to be acquisitions for stock, which would align the incentives of the managers of the target with those of the acquirer. The bargaining hypothesis does not make a clear prediction of the payment method. While, intuitively, one may expect that venture capitalists would prefer cash for their firms, stock is a liquid commodity that can be divested to limited partners in a similar fashion.

Third, as has already been mentioned, real option valuations are prone to greater uncertainty. They inherently seek to estimate the future benefits after new circumstances allow the firm to undertake further expenditure and then profitably realize the option. As such they may be prone to an exaggerated form of the winner's curse. The winner's curse is a phenomenon found in auctions where the bidding parties have incomplete information. Essentially, each bidder bids their valuation, so the winner of a 'highest-bid' auction must have paid the more than the mean valuation. The curse becomes more pronounced when there are either a large number of bidders or when the valuations are more uncertain.

This implies that abnormal returns associated with acquisitions of real options will be reduced with respect to acquisitions of other ventures. Investors may know that there was greater uncertainty in the valuation of the firm and may expect that the firm, suffering from the winner's curse, has over paid as a result. It is not apparent that venture capital investments in some industries should behave differently or are exempt from this; rather we would expect that all venture capital backed firms closer approximate a real option than other entrepreneurial firms. Thus, while both the real option hypothesis and the bargaining hypothesis agree that abnormal returns to acquirers of venture backed firms will be reduced, the bargaining hypothesis states that this should hold only, or to a higher degree, for sectors in which the venture capitalists have extensive experience.

3.4 The event study methodology

This thesis makes use of an event study methodology where each acquisition is a single observation and its announcement causes a shock to the returns of the acquiring firm. I treat the acquisitions as a sample, as if each observation had been generated by some underlying data creation process. This allows the application of sampling theory to provide statistical statements concerning the significance of any findings. The returns are the dependant variable, which I attempt to explain through a binary explanatory variable that indicates the presence of venture capital, as well as other explanatory and control variables.

MacKinlay (1997) provides a detailed paper on the application of event studies in economics and finance, which was used a based for the methodology. The event study has proved very popular and there is a very large number of applications, and much examination of the methodology in the literature. Despite this there is little consensus. The results reported in this thesis were therefore tested using an alternative methodology as well as alternative implementation choices (such as using different lengths for the estimation window), and appear sufficiently robust that such choices do not affect the substantive conclusions.

A key methodological consideration in conducting an event study is how to isolate the abnormal returns. This thesis uses the most popular method: the market model. However other models are also frequently applied and the results were checked for robustness using the 'subtraction model' advocated by Jorion, Lu, and Shi (2005). The subtraction model is extremely simple. An abnormal return is calculated by subtracting the market return from the firm's return on a day by day basis. In the market model the isolation of abnormal returns is somewhat more sophisticated.

Through-out this thesis, a 'return' is taken to be a single day 'buy and hold' return as defined in equation 1. Essentially the price today (adjusting for splits) plus any dividend, divided by the price yesterday, all minus one. Thus a return of 0.1 is a ten percent increase in price (assuming no dividend) from yesterday.

Equation 1:
$$r_t = \left(\frac{p_t f_t + d_t}{p_{(t-1)}} \right) - 1$$

In the market model we calculate how 'abnormal' a return is by considering both the past history of variation, and the variation with respect to the market. Using the raw return as the dependent variable, we seek to explain it with the market return, as shown in equation 2. Note that $E(\varepsilon_{it}=0)$ and $\text{var}(\varepsilon_{it})=\sigma_{\varepsilon_i}^2$. For the market return I use the AMEX, NASDAQ, NYSE index provided by the Center for Research on Security Prices (CRSP), though the results are relatively robust to this choice. This calculation is performed over an 'estimation window'; that is an uninterrupted sequence of days stopping shortly before the 'event window', which is a comparatively short sequence of days surrounding the announcement (the shock causing event). We then calculate an abnormal return using the predicted values obtained from equation 2, as in equation 3. The variance of this abnormal return is given in equation 4

Equation 2: $$R_{it}=\alpha_i+\beta R_{mt}+\varepsilon_{it}$$

Equation 3: $$AR_{i\tau}=R_{i\tau}-\hat{\alpha}-\hat{\beta}_i R_{m\tau}$$

Equation 4: $$\sigma^2(AR_{i\tau})=\sigma_{\varepsilon_i}^2+\frac{1}{L_1}\left[1+\frac{(R_{mt}-\hat{\mu}_m)^2}{\hat{\sigma}_m^2}\right]$$

For suitably large estimation windows (L_1) the variance of the abnormal returns closely approximates $\sigma^2(AR_{i\tau})=\sigma_{\varepsilon_i}^2$. For this reason most researchers advocate at least a 90 day estimation window and for the reported results I generally used a 250 day window. Under the null hypothesis the abnormal returns are distributed as $AR_{i\tau}\sim N(0,\sigma^2(AR_{i\tau}))$. This allows us to calculate z-scores and so significance for the abnormal returns that occur within the event window. Following convention I refer to the announcement day as 'Day 0', the preceding day as 'Day -1', and so forth.

Cumulative abnormal returns are calculated over a various time periods (i.e. some portion of the event window). This is done by summing abnormal returns over time, as in equation 5. A mean CAR for that period can then be calculated by taking the average across securities as in equation 6. Note that equivalently one can sum across securities and average over time.

Equation5: $$CAR_i(\tau_1,\tau_2)=\sum_{\tau=\tau_1}^{\tau_2} AR_{it}$$

Equation 6: $$\overline{CAR}(\tau_1,\tau_2)=\frac{1}{N}\sum_{i=1}^{N} CAR_i(\tau_1,\tau_2)$$

This mean CAR is distributed about zero and has a variance equal to the sum of the abnormal return variances, divided by the number of securities squared. This is shown in equation 7 below. In the analysis and results section CARs are considered for a variety of event windows, but most frequently for the symmetric three day window surrounding the announcement. It is important to consider the day before the announcement as there may be some leakage of information prior to the event. Leakage many days before the announcement is still subject to much uncertainty and is therefore less important. In addition, either because of announcements late in the trading day or delays in investors being informed, the day after the announcement should also be considered.

Equation 7: $$\text{var}(\overline{CAR}(\tau_1,\tau_2))=\frac{1}{N^2}\sum_{i=1}^{N}\sigma_i^2(\tau_1,\tau_2)$$

Perhaps the greatest criticism of event studies is that the model specification is often somewhat arbitrary. In conjunction with other factors, like short estimation windows, small samples and possible confounding events, reported results are often not robust. Conrad & Kaul (1993) and Coutts, Mills, & Roberts (1994) both suggest that the model used to predict abnormal return is itself an auxiliary hypothesis. When this model is under-specified then tests of the primary hypothesis become unreliable. In this analysis care was taken to ensure that the model was sufficiently complete and the robustness checks performed appear to confirm this.

While my primary interest is in the effect of the explanatory variable, the presence of venture capital, on cumulative abnormal returns, I also wish to test other possible explanatory variables and control variables. Thus, in addition to the standard univariate tests used in all event studies, this thesis makes use of multivariate (ordinary-least squares) regressions, that are robust to the effects of heteroskedacity, to explore the effects of the payment method, the operational characteristics of the acquiring firm, the

characteristics of the acquisition, and other important variables uncovered in the literature review.

3.5 Endogenous and exogenous variables

The purpose of using a multiple regression framework is to include other control and treatment variables which might, in conjunction with the presence of venture capital, explain the abnormal returns. However, it is also possible that many of these variables might be endogenous to the presence of venture capital. That is, they may be a continuant in predicting the presence of venture capital rather than (or perhaps in addition to) being a factor that predicts the abnormal returns in conjunction with the presence of venture capital. For example, other authors have noted the importance of the acquirer's leverage in predicting abnormal returns. It is possible that leverage will predict returns in conjunction with venture capital, or that venture capitalists actively seek out cash-rich potential acquirers and so that the acquirer's leverage will itself predict the presence of venture capital, or both.

Including leverage in a multiple regression framework is therefore subject to some interpretation problems. If the observed effect due to the presence of venture capital is unaffected by the inclusion of leverage, which is itself a predictor of returns, then the venture capital effect can be said to be robust to this inclusion and leverage may be an exogenous emitted variable. However, if the exogenous variable is correlated with the presence of venture capital then failing to include it would introduce a bias and overstate the magnitude of the effect. On the other hand, if the observed effect due to the presence of venture capital is reduced by the inclusion of leverage and it can be found to be a predictor of venture capital then leverage may be an endogenous variable. To establish whether a variable is endogenous to the presence of venture capital, this thesis uses a probit model analysis. The choice of model is somewhat arbitrary as I have no prior expectation concerning the distribution of the error term, so the results are checked using a Logit model analysis as well.

The probit model is a binary regression using the probit function that can be derived from a simple latent variable model as follows. Firstly, as in equation 8, one

specifies a latent variable model. Here, v* is a normalized variable that increases the likelihood of venture capital backing, z' is a vector of potential endogenous factors, β is a vector of associated coefficients, and ε is the random error. Then, specific to the probit model, one makes the assumption that the error conditional on z' is normally distributed about zero. This assumption is shown in equation 9. Now one constructs a binary variable V (which can be considered the result of an underlying stochastic process) such that it takes the value one if v* is greater than zero, and zero otherwise (see equation 10). I use my binary variable indicating the presence of venture capital to represent V. This allows one to make testable statements (see equation 11) concerning the vector of potential endogenous variables based on the cumulative normal distribution function.

Equation 8: $v^* = \beta z' + \varepsilon$

Equation 9: $\varepsilon \mid z' \sim N(0,1)$

Equation 10: $V \equiv 1(v^* > 0)$

Equation 11: $\Pr(V = 1 \mid Z = z) = \Phi(z'\beta)$

Essentially, the probit model estimates the coefficients in the vector β, and the significance levels of these coefficients indicate whether the variables in question are significant predictors of the presence of venture capital. It does this by considering the probability that the error outweighs -βz' (or βz' as the distribution is symmetric), which is given by the cumulative normal distribution function. This can be summarized as follows: $\Pr(V = 1 \mid z) = \Pr(\beta z' + \varepsilon > 0) = \Pr(\varepsilon > -\beta z') = \Phi(\beta z')$. The logit model is very similar, except that it uses a different distribution assumption (shown in equation 12).

Equation 12: $$\Pr(V = 1 \mid Z = z) = \frac{e^{z'\beta}}{1 + e^{z'\beta}}$$

In the analysis section each control or explanatory variable is tested in three ways: i) with a univariate regression to test whether it alone can predict abnormal returns; ii) in a multivariate regression with the presence of venture capital, testing it as a potential exogenous variable; and iii) in a probit model analysis to determine whether it is an endogenous predictor of the presence of venture capital. At the end of the analysis and results section multivariate regressions and multivariate Probit models are tested with the combinations of factors that may provide interesting results. Probit model analysis, like

OLS, is susceptible to the effects of heteroskedacity. The analysis was therefore run with the 'robust' option in STATA, which uses the 'Huber-White Sandwich' method to correct for heteroskedacity if any is present.

3.6 Data description

The dataset underlying this thesis was assembled from four primary data sources: Thomson SDC (Securities Data Corporation) Platinum mergers and acquisitions, Thomson VentureXpert portfolio companies, CRSP (the Center for Research in Security Prices) daily prices, and COMPUSTAT balance sheet and income statement extracts. The last two of these data sources are available to researchers through WRDS (Wharton Research Data Services at wrds.wharton.upenn.edu). The datasets drawn from these data sources were integrated using either CUSIP matching (named after the Committee on Uniform Security Identification Procedures) or careful company name matching. The procedure for assembling the datasets from each of these data sources and both matching methods are detailed in this section.

In addition the thesis makes use of a proprietary classification based on the NAICs (North American Industry Classification) industry coding system to identify ICT (Information & Communications Technology) firms. No distinction between IT and ICT is intended and the terms will be used interchangeably. Using the NAIC category name and description, all six digit NAIC codes that describe ICT companies where taken from the complete set of 2002 US NAIC codes (available from www.census.gov/epcd/naics02). The full list of NAIC codes used in the classification, along with the number of acquisitions ultimately included from each code, is provided in appendix 1.

My classification is largely consistent with the few available published definitions. The NAIC system classifies industries using a six digit hierarchical number, and so definitions of aggregate grouping, such as for ICT, are often made on the basis of three or four digit mappings. The ICT sector is particularly difficult to isolate using three or four digit groups, and I regard my comprehensive six digit classification as one of the major contributions of this research.

One available six digit mapping is published by the BCTIA (British Columbia Technology Industry Association). My classification contains all of the BCTIA's classification and allows some additions, specifically in the retail and wholesale sectors. As this classification will be used to define vertical (i.e. supply chain) relationships this is appropriate. Many ICT companies now provide products or services at all levels of the supply chain (i.e. component development, manufacturing, wholesale and retail). Dell Computers is a frequently cited example. Furthermore, wholesalers and retailers of computer related products are particularly heavy users of B2B and B2C commerce. My classification is also largely consistent with Industry Canada's mixed four and five digit classification, the four digit high-tech classification by the Bureau of Labor Statistics, and the six digit high-tech classification provided by the American Engineering Association.

From the Thomson SDC Platinum mergers and acquisitions database I requested information on the acquirer, acquiree and the acquisition transaction for all acquisitions of private US firms by public US firms, listed on the NYSE, NASDAQ and AMEX exchanges, from 1980 to 2004 inclusive. Note that the data source began recording acquisitions in 1979 but there were very few records for that year. This produced 32,784 records, of which 32,781 had NAIC codes for both the acquiree and acquirer. Four of these codes (22111A, 52599A, 52599B, 52599C) were proprietary to Thomson; these were translated to 221110, 525990, 525990 and 525990 respectively.

Of the 32,781 acquisitions records, 6,425 concerned ICT companies. I placed a series of constraints on this dataset that reduced the number records. Firstly I considered only the initial acquisition of a private firm. Some firms in the dataset were acquired and "spun-off', only to be later acquired by another entity. As the intention is to compare venture capital backed firms against comparable entrepreneurial ventures, the first acquisition is appropriate. I then required that the acquirer acquire a controlling interest in the target (i.e. more than 50%) or that this percentage be not disclosed, and that the acquirer was a public company at the time of the acquisition (rather than becoming one later). The results presented in the analysis and results chapter are not materially different if the undisclosed acquisitions are included or excluded. Furthermore, I considered it inappropriate to have multiple acquisitions announced on the same day by the same acquirer. After imposing this final constraint requiring that each announcement day (for a

specific acquirer) contain news of only a single announcement, the dataset contained 4,824 acquisitions of ICT firms (and of a total of 22,963 acquisitions of firms in any sector).

The Thomson SDC mergers and acquisitions database provides six digit CUSIP Issuer Numbers for its public companies. A CUSIP is a nine digit number. The first six digits uniquely identify the issuer (i.e. they are the Issuer Number), the next two identify the issue and the final digit is a frequently neglected check digit calculated according to an algorithm. Detailed information on CUSIPs is available from the CUSIP service bureau (www.cusip.com). The SDC CUSIP Issuer Numbers were standardized to six digits by pre-pending zeros where necessary. CRSP requires eight digit CUSIPs to retrieve price histories.

To further complicate matters, eight digit CUSIPs change over time (as new issues come into effect) and approximately 10% of SDC CUSIPs were found to be incorrect. A complete set of all traded eight digit CUSIPs, together with other company identifying information and the date the issues commenced and finished trading, were downloaded from CRSP. These were then matched on the basis of their first six digits and the acquisition announcement date to identify the correct eight digit CUSIP for each acquisition. This was successful in the vast majority of cases, and readers are cautioned that other methods will likely fail. In about 10% of cases a match was made using a combination of the exchange, the ticker symbol and the acquisition date, and then confirmed using company names. Ultimately I was able to identify valid eight digit CUSIPs for 4,562 ICT acquisitions (out of 21,542 acquisitions in total).

Thomson SDC mergers and acquisitions also provided some accounting information for the privately held target firms prior to acquisition in a very limited number of cases. Data on assets, sales, employees, R&D expenditure and other variables, was taken when it was available. The primary purpose of this data was to compare the pre-acquisition operating performance of venture capital backed firms with other entrepreneurial ventures to examine, in accordance with the real option hypothesis, whether one group was significantly more immature, faster growing or research focused than the other. The statistical analysis of this data is presented in the analysis and results chapter but a high degree of idiosyncratic variation and low power essentially prevented,

a priori, any meaningful results. Collection of this data may well shed light on many unresolved questions in the literature but was beyond the scope of this thesis.

CRSP provides the single day buy and hold returns and a composite NYSE-NASDAQ-AMEX index specifically for event studies; these were used and are recommended. However, individual prices, dividends and adjustment factors were also retrieved and the single day buy and hold returns were validated using equation 1 above. Researchers using the raw variables are cautioned that the inclusion of the price adjustment factors is crucial, that prices may contain error codes and that the absolute value of the price should be used as negative prices indicate estimated averages. For each firm the complete price history was retrieved and duplicated for each acquisition, then for each acquisition the price history was re-sequenced from day zero (in both directions) to remove weekends and non-trading days. Finally, a 250 day estimation window from day -280 to day -31 was extracted, as was 61 days beginning on day -30 for use in event windows.

I required the acquirer to have a sequential set of at least 50 trading days ending at day -31 in order to be included in the dataset, but the vast majority (88%) had complete 250 estimation windows. This is essentially a full year of trading and easily meets the requirement set out in equation 4 (above) for the variance to approximate $\sigma^2(AR_{i\tau}) = \sigma^2_{\varepsilon_i}$. This estimation window data was then processed in STATA. A single record was identified by both the CUSIP and the acquisition announcement date together. For each record I regressed the single day buy and hold returns against the corresponding value weighted NYSE-NASDAQ-AMEX composite return. I recorded the predicted alpha and beta parameters for use in market model (c.f. equations 2 & 3), as well as the root mean squared error of the model for use in testing the significance of our abnormal returns (c.f. equations 4 & 7). The CRSP price data and these regressions provided parameters for 4,391 ICT acquisitions (and 20,773 acquisitions in total).

I then incorporated event window returns into the data set. For a complete, sequential, uninterrupted 61 day event window I had prices (i.e. returns and other information) for 4,351 ICT acquisitions (out of 20,619 acquisitions). It was important to exclude firms with interruptions in their event windows as a discontinuity could indicate a suspension of trading that would directly influence the announcement effect. From this

61 day window I extracted 21, 11, 7 and 3 day symmetric windows (around the announcement day) for analysis. Results for the 7 and 3 day windows are reported in the analysis section but the 21 and 11 day windows were also examined in detail.

From the Thomson VenturExpert 'portfolio companies' database I retrieved information on all private firms that received venture capital from 1st January 1980 to the 1st January 2004. The information included the company name and state, as well as all relevant details of their financing histories. In total information on 25,990 firms was retrieved. Given that it typically takes a firm some time to be acquired after its last round of financing, there will be a small period at the beginning of the 1980s where venture capital backed firms are underrepresented. However, I checked that this does not materially affect the results of my analysis in any way.

In the US companies incorporate with a state registrar. I developed and used proprietary name matching software to identify matches between firms listed in the 'portfolio companies' dataset and firms in my acquisitions dataset. I required that the state listed in both datasets be the same for each match and all matches were checked by hand, with reference to founding dates (from SDC), dates of first investment (from VentureXpert), and other information, to ensure that there were no false positives. A total of 871 out of 4,351 ICT acquisitions were determined to have been venture capital backed at some point prior to their acquisition announcement. Thomson VentureXpert has recent begun providing information on mergers and acquisitions of venture capital backed firms. The matches were checked against this list and other researchers should note that the VentureXpert coverage, which relies on self-reporting by venture capitalists, is relatively poor.

Finally I retrieved balance sheet and income statement information for all of the acquirers in the dataset, where it was available, from COMPUSTAT. COMPUSTAT accepts six digit CUSIPs as an identifier; these were constructed by taking the first six digits of the eight digit CUSIPs that were used to retrieve price information from CRSP. As both data sources are available through WRDS it was expected that they would have a high degree of concordance in the recording of their CUSIPs. Almost all firms (4,344 out of 4,351 ICT acquirers) had accounting information available for the year of the acquisition.

CHAPTER IV Analysis and results

4.1 Analysis and results

This analysis and results chapter is comprised of seven sections. The first section uses the operational characteristics of the target prior to acquisition to provide a preliminary analysis of the real-option hypothesis. The second section examines the effect of the presence of venture capitalists in returns to acquisitions of both IT and non-IT firms; this demonstrates that considering the sector of the firm is of crucial importance to an analysis of acquisitions of venture backed firms. The third section examines the influence of the payment method, as this is often reckoned the most important variable in predicting abnormal returns accruing to acquirers. The fourth section considers the notion of competition among potential acquirers to find support for both hypotheses. The fifth section examines six other influences on returns and determines whether each is exogenous or endogenous to the presence of venture capital in an acquisition of an IT firm. The sixth and seventh sections provide multivariate probit and logit models and multivariate regressions to examine the combined effects of these variables on and with the presence of venture capital for acquisitions of IT firms. It also considers the amount of venture capital invested. A final section uses measures of reputation within the venture capital backed sub-sample to provide further support for the bargaining hypothesis.

4.2 Analyzing the real-option and bargaining hypotheses

This thesis examines the short-term stock performance of acquisitions of venture backed firms with acquisitions of their non-venture backed counter parts. It considers two main competing hypotheses for why returns to acquisitions of venture backed targets should differ from those of other entrepreneurial ventures. Gompers & Xuan (2004) put forward a 'real-option' hypothesis. This hypothesis essentially stated that venture capital backed firms make larger investments into R&D but are less mature at acquisition. Thus their purchase represents an investment in future potential (that carries greater inherent

risks) rather than in established product lines and market shares. An alternative hypothesis, put forward in Brander & Egan (2005), is that venture capitalists may bargain on behalf of their firms with potential acquirers. This is in line with the literature on venture capitalists as value-added investors.

Both the real-option hypothesis and the bargaining hypothesis imply that short-term returns to acquirers should be reduced when venture capitalists are present in the target. The real-option hypothesis should hold equally for acquisitions of both IT and non-IT firms, unless there is some systematic difference in the pre-acquisition operational characteristics of the two groups. The bargaining hypothesis should provide stronger results for firms where venture capitalists have the greatest experience and reputation, such as those in the IT sector. To establish a case for the real-option hypothesis it is therefore necessary to examine the operational characteristics of the target firms prior to acquisition.

Under the real-option hypothesis venture backed firms should have lower input and outputs prior to acquisition. Tables 4.1 and 4.2 show the mean values of inputs and outputs and t-tests their difference. Specifically the total assets and no. of employees are taken as measures of the firm's inputs, and the total sales and total R&D expenditure are taken as measures of the firm's outputs. In addition net income is reported as it provides the best available measure of profitability. This examination of the target's operational characteristics is done for both the last twelve months of operation prior to the acquisition and one year previously.

Table 4.1: Operating performance of the target (last twelve months)

	Not VC backed		VC backed		Difference		
Variables	N	μ	N	μ	(μ1-μ2)	S.Error	t-statistic
Sales	4375	134.49	336	56.69	77.8	68.59	1.13
Net Income	1665	13.22	195	-4.49	17.71	8.43	2.10 **
R&D	32	5.53	25	3.88	1.65	4	0.41
Total Assets	2227	326.98	197	52.54	274.44	182	1.51
No. of Employees	275	149.45	65	154.28	-4.83	25.96	-0.19

***, **, * = significant at the .01 level, .05 level, and .10 level respectively (value in millions US$).

Table 4.2: Operating performance of the target (one year previous)

Variables	Not VC backed		VC backed		Difference		
	N	μ	N	μ	(μ1-μ2)	S.Error	t-statistic
Sales	2719	39.04	261	29.87	9.17	4.51	2.04 **
Net Income	1519	2.32	189	-4.91	7.23	1.21	5.98 ***
R&D	35	5.14	29	3.51	1.63	3.65	0.45
Assets	1534	60.42	189	22.65	37.77	4.86	7.77 ***

***, **, * = significant at the .01 level, .05 level, and .10 level respectively (value in millions US$).

Table 4.1 shows that for the last twelve months of operation prior to acquisition, with the exception of net income, there are no significant differences between venture backed firms and their non-venture backed counterparts. However, table 4.2 shows that everything except R&D expenditure is significantly different for the prior period. Sales, net income, R&D expenditure, and total assets are all higher for non-venture backed firms for the twelve months prior to acquisition, but the large variance in performance on these measures across firms, and the low availability of data for these measures, makes all of these differences insignificant.

Overall, the results do lend some support to the real-option hypothesis, with two surprising exceptions. Firstly, the total number of employees, which is only available for the last twelve months, is slightly larger for venture backed firms. Secondly, venture backed firms appear to spend less on research and development. However, the data availability is extremely poor for these variables, idiosyncratic variation is high, and the differences are thoroughly insignificant. Perhaps the greatest support for the real-option hypothesis comes from examining the net income of the firms. Venture backed firms are, on average, loss making for the two years prior to the acquisition, where as non-venture backed firms are firmly profitable. This suggests that an acquisition of a venture backed firm may be more for its future potential. Venture backed firms were also significantly smaller in terms of assets for the -24 to -12 month period prior to the acquisition.

Table 4.3 shows the operational characteristics of firms in the IT sector. With reference to the results for all firms (as presented in table 4.1) it is apparent that IT firms are somewhat different. For venture backed firms these differences are very small, except

for total assets where IT firms are about half the typical size. For non venture backed firms the sales, total assets and R&D expenditure are all between double and triple the typical size.

Table 4.3: Operating performance of IT firms (last twelve months)

Variables	Not VC backed		VC backed		Difference		
	N	μ	N	μ	(μ1-μ2)	S.Error	t-statistic
Sales	649	460.29	185	59.09	401.2	437.77	0.92
Net Income	265	-1.34	121	-6.12	4.78	2.74	1.75 *
R&D	16	10.22	15	2.87	7.35	7.76	0.95
Total Assets	270	1500.8	122	19.49	1481.31	1481.42	1
No. of Employees	100	109.02	44	111.09	-2.07	21.98	-0.09

***, **, * = significant at the .01 level, .05 level, and .10 level respectively (value in millions US$).

One might therefore expect that for IT firms the real-option hypothesis would produce a slightly stronger effect, and thus it is not possible to state that the real option effect should be equal across all sectors. However, even for IT firms there is still no significant difference attributable to the presence of venture capital for any variable except net income. Hence this analysis can provide no statistical support from the operational characteristics of the target firms prior to acquisition for the real-option hypothesis.

Morck, Shleifer & Vishny (1990) found that poorer returns were attributable in part to a rapidly growing target. From a comparison of tables 4.1 and 4.2 it is evident that both venture backed and non-venture backed firms are growing rapidly. Table 4.4 (below) shows that there is no significant difference in the rate of growth between these two groups, although sales (for example) had increased by an average of approximately 42% more for venture backed firms in their last year as privately held enterprises.

Table 4.4: Growth of the target (in % from one year previous)

Variables	Not VC backed		VC backed		Difference		
	N	μ	N	μ	(μ1-μ2)	S.Error	t-statistic
Sales	2620	2.87	254	44.32	-41.45	28.57	-1.45
Net Income	1383	2.43	179	8.31	-5.88	9.31	-0.63
R&D	32	4.01	25	5.4	-1.39	5.02	-0.28
Total Assets	1522	6.86	188	5.75	1.11	4.26	0.26

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

4.3 The presence of venture capital and abnormal returns

I begin by examining the seven day CARs of all (20,619) firms in the sample, to determine whether the presence of venture capital has an effect across all sectors. The diagrams of these CARs are shown in figures 4.1 and 4.2. The announcement day is denoted day 0 and preceding days are assigned negative numbers. There appears to be a small reduction in the day 1 to day 3 CARs when venture capital is present in the target, but the announcement effect on day 0 is almost identical.

Figure 4.1: Acquisitions of Non-VC firms

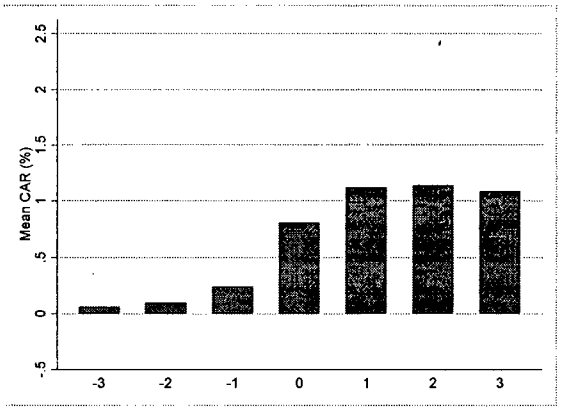
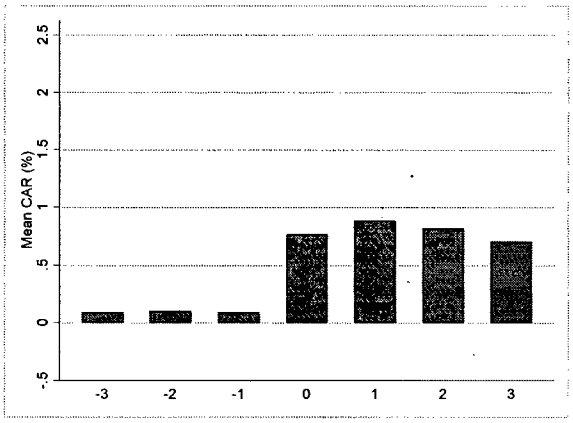


Figure 4.2: Acquisitions of VC backed firms



The results in figures 4.1 and 4.2 were purely descriptive. Table 4.5 examines the significance of the abnormal returns on a cumulative basis, starting three days before the announcement and continuing forward to the third day afterwards. The results are presented for all acquisitions, acquisitions of non venture capital backed targets and acquisitions venture capital backed targets. Irrespective of whether or not the firm is venture capital backed, the cumulative abnormal returns, starting from day -3, are positive and statistically significant from the day of the announcement to the end of the window. For all acquisitions and non-venture backed acquisitions, CARs are also statistically significant prior to the announcement, which is indicative of information leakage and the high power of my sample size.

Table 4.5: Significance of CARs from Day -3, venture backed and not.

Acquisitions Sample	All Acquisitions	Non-Venture Backed	Venture Backed
CAR from Day -3	N = 20,619 (z-score)	n = 19,158 (z-score)	n = 1461 (z-score)
Day -3	0.06 (2.4)**	0.06 (2.3)**	0.09 (0.8)
Day -2	0.09 (2.7)***	0.09 (2.6)***	0.10 (0.7)
Day -1	0.23 (5.3)***	0.24 (5.4)***	0.09 (0.5)
Day -0	0.80 (16.4)***	0.81 (16.0)***	0.76 (3.6)***
Day -1	1.10 (20.0)***	1.12 (19.8)***	0.88 (3.8)***
Day -2	1.12 (18.5)***	1.14 (18.4)***	0.81 (3.2)***
Day -3	1.06 (16.2)***	1.08 (16.2)***	0.70 (2.5)**

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

The significance of CARs can also be shown by evaluating the significance of specific windows, rather than individual days starting from three days before the event. Obvious window choices include the announcement day, the announcement day and the following day, and three and seven day windows symmetric about the announcement day. The significance of each of these windows, for the same three samples, is shown in table 4.6. From this point on I will use this format to present results, and focus on the three day symmetric window in all regressions.

Table 4.6: Significance of CARs for four windows, venture backed and not.

Acquisitions Sample	All Acquisitions	Non-Venture Backed	Venture Backed
Event Window	N = 20,619 (z-score)	n = 19,158 (z-score)	n = 1461 (z-score)
Announce Day	0.58 (23.5)***	0.57 (22.6)***	0.67 (6.4)***
2 Day Window	0.87 (25.1)***	0.88 (24.7)***	0.79 (5.4)***
3 Day Window	1.01 (23.6)***	1.02 (23.4)***	0.78 (4.3)***
7 Day Window	1.06 (16.2)***	1.08 (16.2)***	0.70 (2.5)**

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

For each window considered, cumulative abnormal returns are positive and significant, irrespective of the presence or absence of venture capital. Furthermore, as shown in table 4.7, there is no significant difference between the returns to venture backed firms and the returns to their non-venture backed counterparts for any choice of window.

Table 4.7: Difference in mean CAR for venture backed and not

	Non-venture backed (N=19,158)		Venture backed (N=1,461)		Difference		
Event Window	μ	S.Error	μ	S.Error	(μ1-μ2)	S.Error	t-statistic
Announce Day	0.57	2.47	0.67	2.46	-0.1	0.16	-0.62
2 Day Window	0.88	2.78	0.79	2.88	0.09	0.22	0.39
3 Day Window	1.02	2.97	0.78	3.05	0.24	0.25	0.95
7 Day Window	1.08	3.37	0.7	3.48	0.38	0.33	1.16

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

This is in stark contrast to the findings of Gompers & Xuan. One possible explanation for this discrepancy is the difference in sample periods. Gompers & Xuan examined returns to acquisitions that took place between 1990 and 2001. Returns this period are somewhat difference and are shown in a comparable t-test in table 4.8.

Table 4.8: Difference in mean CAR for venture backed and not (1990-2001)

	Non-venture backed (N=14,439)		Venture backed (N=944)		Difference		
Event Window	μ	S.Error	μ	S.Error	(μ1-μ2)	S.Error	t-statistic
Announce Day	0.64	2.48	0.68	2.44	-0.04	0.2	-0.2
2 Day Window	0.98	2.83	0.87	2.94	0.11	0.29	0.37 *
3 Day Window	1.15	3.04	0.81	3.14	0.34	0.33	1.02
7 Day Window	1.19	3.48	0.89	3.65	0.3	0.44	0.68

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

For this period there is a significant difference between acquisitions of venture capital backed and non venture capital backed firms, at the 0.1 level, for the two day window (the event day and the following day). Furthermore, all CARs are approximately 0.1% to 0.2% higher, reflecting the higher expectations of the boom period. However, these are far from the results reported by Gompers & Xuan, who stated that they too used the Thomson SDC mergers and acquisitions and CRSP data. They found a significant positive three day return (of 0.6%, similar to my 0.8%) but stated (page 17, paragraph 3) that this was "significantly smaller than the 1.58% CAR for non venture backed acquisitions", whereas I find that the return is not significantly smaller that the 1.15% CAR for all acquisitions from 1990 to 2001. I showed in the last chapter that their methodology is almost identical; they used Brown & Warner (1985) as a procedural guide for their event study. Their sample for this period is somewhat different with 8,690 non venture backed acquisitions (compared with my 14,439) and 1,120 venture backed acquisitions (compared with my 944); while it is possible that they suffer from some selection bias (I use all available acquisitions data), ultimately the cause of the CAR result discrepancy is unknown. Some further disparities are examined in the payment method section below.

T-testing the difference in means is an appropriate method of comparison as venture capital backed firms and non venture capital backed firms are two naturally distinct groups. However, I also present the results of an OLS regression (below) where

the dependent variable is the three day CAR, and the explanatory variable is the presence of venture capital. This approach is used throughout this thesis and is appropriate when one wishes to consider the influence of other exogenous explanatory variables or control variables. In addition, it allows the use of an alternative venture capital variable that reflects the total known amount of venture capital invested.

This distribution of the amount venture capital invested for those firms where venture capitalists provided financing is provided in table 4.9 below. The mean venture capital investment is approximately $21m, and the median $10m, for these acquired firms. This is relatively little when we consider that for venture backed firms the average acquisition price is $110m (median $37m), and the average acquirer has assets of $7.9b (median $565m). As the distribution of the amount of venture capital, like almost every variable in the subsequent analysis, is skewed, the log of the amount of venture capital will be used in the regressions.

Table 4.9: Distribution of venture capital invested (in US$k) for VC backed firms

	p10	p25	p50	p75	p90	N	mean	skewness
VC Invested (US$k)	898	3,099	9,857	25,286	56,000	1,461	21,475	8.0 ***

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Table 4.10 presents the results of the OLS regressions. As was evident from the three day CAR t-test, the presence of venture capital is not a significant predictor of abnormal returns for all firms. Neither is the amount of venture capital invested, which has a near identical t-score. However, the examination of acquisitions of IT firms, in the next section, provides very different results.

Table 4.10: Explaining CAR3 with the presence of venture capital

Variable	Presence of venture capital (binary) N=20619	Log. Total investment ($) N=20619
Beta (t-score)	-0.24 (-0.96)	-0.03 (-1.03)
Constant (t-score)	1.02 (16.07***)	1.02 (16.14***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively (value in millions US$).

4.4 The importance of examining IT firms

Hyytinen & Pajarinen (2004), among others, assert that IT firms are different from other firms. For Hyytinen & Pajarinen this difference is attributed to network effects specific to the IT industry. Venture capitalists have extensive experience in the IT sector; over 50% of their invested dollars are placed in IT firms and over 75% of their firms' exit value is from IT firms. Furthermore the IT industry's network effects may assist venture capitalists in their bargaining.

The bargaining hypothesis states that returns to acquirers should be reduced when venture capital is present in the target. However, without extensive sectorial experience venture capitalists may not be able to bargain as effectively. Thus in non-IT sectors I expect this reduction in returns to be less or perhaps even non-existent. Likewise, I have found that there may be some systematic differences in the pre-acquisition operational characteristics of IT firms in comparison to other firms. Thus the real option hypothesis may hold to a stronger degree for IT firms. Essentially, a venture capitalist's investment in an IT firm may behave more like a real option than their other investments.

The seven day CARs diagrams of purchases of venture backed and non venture backed IT firms and non-IT firms are shown in figures 4.3 through 4.6. Non venture backed firms produce positive abnormal returns, with returns to acquisitions of IT firms almost a ½ of a percent higher from the announcement day forward to day 3.

Figure 4.3: Non-VC backed IT firm

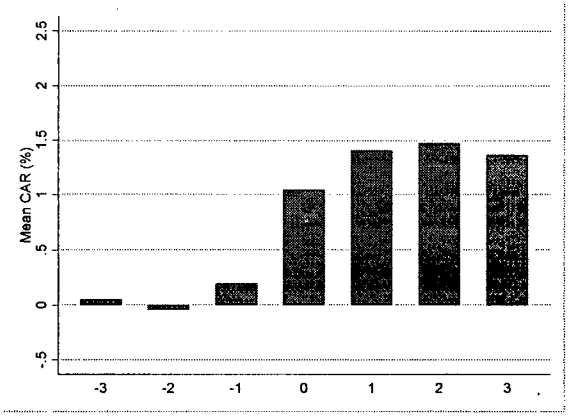


Figure 4.4: Non-VC backed Non-IT firm

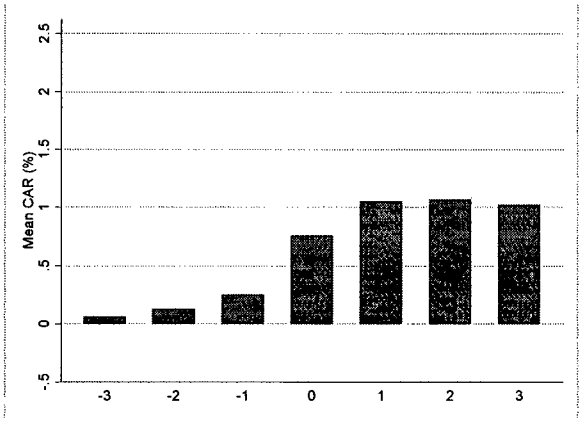


Figure 4.5: Venture backed IT firm

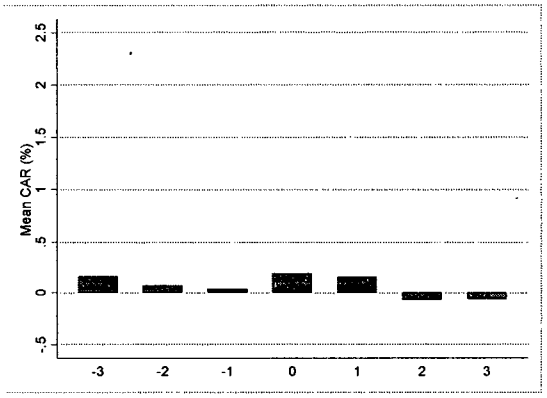
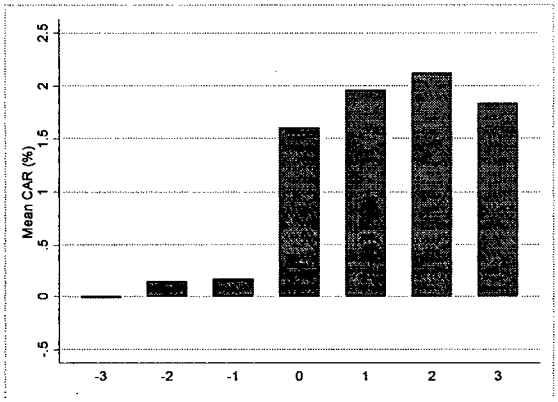


Figure 4.6: Venture backed non-IT firm



For venture backed IT firms the effect is clean and obvious. The CAR never exceeds ¼ of a percent and is essentially a flat line on this scale. A surprise finding is the CAR associated with the purchase of a venture backed firm outside of the IT sector. The announcement day produces an average 1.5% return which rises to 2% by the following day. Thus the presence of venture capital actually increases the acquirers CAR for acquisitions of non-IT firms. I will later show that this effect is almost entirely attributable to purchases for stock where the CAR from day -3 reaches about 4% by the second day after the announcement. This represents a hypothesis failure.

Without further information, neither the real option hypothesis nor the bargaining hypothesis can explain this phenomenon. Under the bargaining hypothesis I would have to conjecture either that venture capitalist are extremely poor negotiators when they don't have any industry experience, so bad in fact that a firm is better off without them, or that without experience they can't negotiate effectively and other factors come into play. I would favor the later. Under the real option hypothesis I would have to conjecture that either only IT firms approximate real options and that the systematic differences must be considerable (which I am unable to statistically support), or the winner's curse problem only applies to IT firms; perhaps because there are very few bidders for non-IT firms. This second option is briefly explored later.

Table 4.11 examines the statistical significance of the presence of venture capital on returns to acquisitions for IT and non-IT firms for the four windows of interest. For every window returns to acquisitions of venture backed IT firms are not significant and

returns to all other acquisitions are positive, significant and economically meaningful. For the three day window an effect in the 1% to 2% range is found, with the largest return accruing to acquisitions of venture backed non-IT firms and the smallest to their non venture backed counterparts. In fact, for non-IT firms the returns are approximately double the size when venture capital is present.

Table 4.11: Significance of CARs, venture backed & not, and IT & not

	IT Non venture (N=3,480)	Non-IT Non venture (N=15,678)	IT Venture backed (N=871)	Non-IT Venture backed (N=590)
Announce Day	0.85 (10.8)***	0.51 (20.1)***	0.16 (1.1)	1.44 (9.8)***
2 Day Window	1.21 (10.9)***	0.81 (22.4)***	0.12 (0.6)	1.79 (8.6)***
3 Day Window	1.45 (10.6)***	0.93 (21.1)***	0.08 (0.3)	1.82 (7.2)***
7 Day Window	1.36 (6.5)***	1.02 (15.2)***	-0.06 (-0.2)	1.84 (4.7)***

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Table 4.12 provides t-tests for the difference in means associated with the presence of venture capital. For acquisitions of both IT firms and non-IT firms there is a significant difference at the 0.01 and 0.05 level respectively. For IT firms the presence of venture capital reduces returns (such that they are not significantly different from zero), and for non-IT firms it increases them.

Table 4.12: Difference in mean [-1,+1] CAR for venture backed and not

	Not VC backed		VC backed		Difference		
	N	μ	N	μ	(μ1-μ2)	S.Error	t-statistic
IT firms	3,480	1.45	871	0.08	1.37	0.41	3.35 ***
Non-IT firms	15,678	0.93	590	1.82	-0.89	0.36	-2.43 **

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Finally, table 4.13 (below) presents results of the univariate OLS regressions, using the log of the total venture capital investment, for both IT firms and non-IT firms. The t-scores are again almost identical to those achieved using the binary measure of the presence of venture capital. For much of the subsequent analysis I will therefore use only

the presence of venture capital as an explanatory variable, however, I will return to the examination of the investment amount in a multivariate setting at the conclusion of this chapter.

Table 4.13: Explaining CAR3 with the presence of venture capital for IT firms

Variable	IT firms N=4,351 (t-score)	Non-IT firms N=16,268 (t-score)
Log. Total investment ($)	-0.15 (-3.35***)	0.10 (2.41**)
Constant	1.45 (5.91***)	0.93 (16.86***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively (value in millions US$).

Two important findings have been made so far. Firstly, IT firms are clearly different, in their interaction with venture capital at least, from other firms. That the IT sector has accounted for the majority of venture capital investment makes this distinction all the more important for future research. Secondly, an IT cluster effect prevents us from determining that venture capital is a predictor of returns for all acquisitions. With the presence of venture capital the acquisitions of IT firms experience a decreased return and the acquisitions of non-IT firms experience an increased one. Over all acquisitions these two clusters cancel each other out leaving no significant effect.

4.5 The implications of payment method

Chang (1998), Fuller, Netter & Stegemoller (2002), Huang & Walkling (1987) and others, all place the greatest importance on payment method in explaining returns. For several reasons, each explored in the literature review, acquisitions for stock should produce greater cumulative abnormal returns than acquisitions for cash, and, in fact, most authors hypothesized and found that acquisitions for cash produced no significant abnormal returns. This thesis, along with Gompers & Xuan (2005) and Brander & Egan (2005), places the greatest importance on the presence of venture capital (and the sector of the firm) in explaining returns. However, there are several reasons why the payment method may be of particular importance in conjunction with the presence of venture

capital; these are explored below, but first I examine the payment effect independent of other considerations.

The Thomson SDC mergers and acquisitions data contains an indicator for the method of payment: Cash, stock, a mix of cash and stock, and 'other'. In a reduced number of cases, there was information on the exact amount of cash and the value of stock that was used in the transaction. In the case of a stock-cash mixed payment, table 4.14 shows that there is an approximately equal proportion of cash and stock making up the total.

Table 4.14: Mean values of cash and stock within quartiles of the total payment

Percentile of Total	p0 - p25	p25 - p50	p50 - p75	p75 – p100
Mean value of mix	2.38	8.77	23.23	143.38
Mean value of cash	1.14	4.30	11.61	45.72
Mean value of stock	1.23	4.46	11.61	55.07

(values in million of US$)

Four diagrams of the seven day cumulative abnormal returns, from three days before the announcement to three days afterwards, are provided in figures 4.7 through 4.10, one for each payment method. At first glance, stock acquisitions produce larger abnormal returns than cash or payment through other methods, and a mix of stock and cash performs much like stock (one possible explanation of this is that the presence of stock, irrespective of the quantity, sends the same signal to investors). This is broadly consistent with the literature. A common hypothesis is that if an acquirer were uncertain about a transaction's value, due to increased information asymmetry, they would rather pay in stock. However, both Chang (1998) and Fuller, Netter & Stegemoller (2002), argued that there should be no abnormal return for acquisitions of privately held firms for cash alone.

Figure 4.7: Cash Only

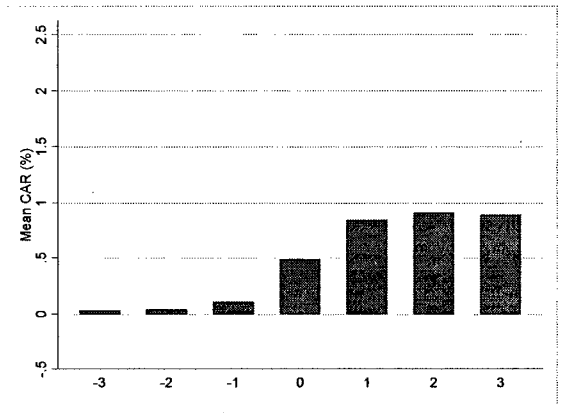


Figure 4.8: Stock Only

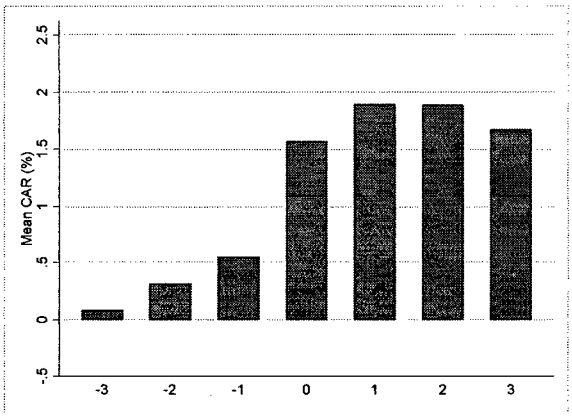


Figure 4.9: Both Cash & Stock

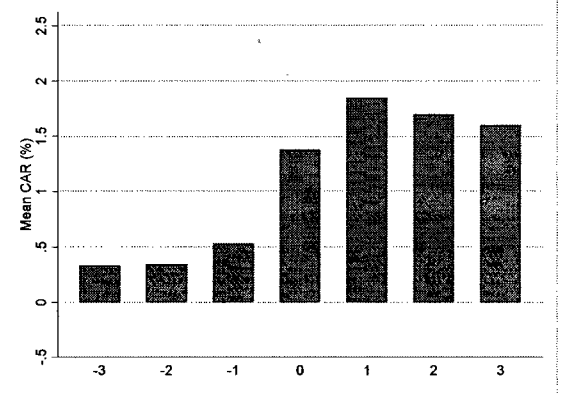
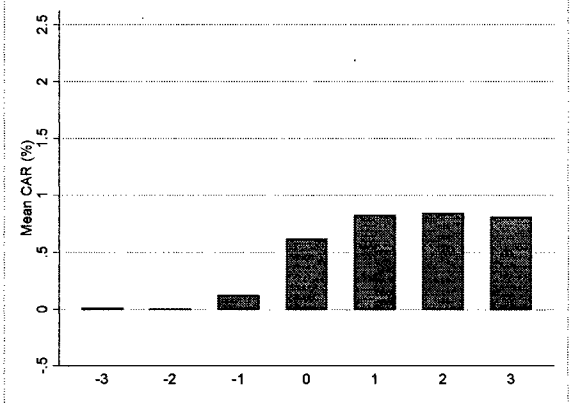


Figure 4.10: Other Payment Method



For my event windows, no matter the payment method, the return is positive and significant, even for cash alone. This is shown in table 4.15 below. A total of 9200 acquisitions are marked as having a payment method 'other'. No further description was available, and although this category appears to behave like cash, it and the cash-stock mix category are excluded from much of the subsequent analysis. I constructed two variables 'binshares' and 'purecash' for later use. Purecash is 1 for cash only, and 0 for all other payment methods, and binshares is 1 when there are shares present, whether alone or in a mixed payment, and 0 otherwise.

Table 4.15: Significance of CARs for the different payment methods

Payment Method Event Window	Cash (z-score) n = 5805	Stock (z-score) n = 3055	Mix (z-score) n = 2357	Other (z-score) n = 9200
Announce Day	0.38 (10.2)***	1.02 (13.6)***	0.85 (9.5)***	0.49 (13.6)***
2 Day Window	0.74 (14.0)***	1.35 (12.7)***	1.31 (10.3)***	0.70 (13.6)***
3 Day Window	0.81 (12.5)***	1.58 (12.1)***	1.50 (9.7)***	0.82 (13.0)***
7 Day Window	0.89 (9.0)***	1.68 (8.5)***	1.60 (6.7)***	0.81 (8.4)***

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

I can provide no explanation for why my cash returns are positive; this finding is contrary to the literature. However, table 4iii shows that there is a significant difference between acquisitions for cash and acquisitions for stock. Paying in cash reduces the three day CAR by an average of almost 0.8% compared with paying in stock.

Table 4.16: Difference in mean CAR for stock versus cash

	Cash (N=5805)		Stock (N=3055)		Difference		
Event window	M	S.Error	μ	S.Error	(μ1-μ2)	S.Error	t-statistic
Announce Day	0.38	2.35	1.02	3.17	-0.64	0.2	-3.27 ***
2 Day Window	0.74	2.65	1.35	3.51	-0.61	0.24	-2.53 **
3 Day Window	0.81	2.75	1.58	3.73	-0.78	0.27	-2.87 ***
7 Day Window	0.89	3.03	1.68	4.03	-0.79	0.32	-2.50 **

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

The second component of the real option hypothesis, as it was originally presented by Gompers & Xuan, is that acquisitions of venture backed firms should be more likely to be paid for in stock than other ventures. This is because it is important for the acquirer to tie in the managers of the target as they are may be integral to the later realization of the real option. Furthermore, as previously stated, most researchers agree that acquirers prefer to pay in stock when the information asymmetry is larger. The bargaining hypothesis makes no clear prediction for the preferred payment method; limited partners may be equally willing to accept publicly traded stock as cash. From table 4.17 it is apparent that venture backed firms are almost twice as likely to be paid for

in stock alone and more likely to have stock present in the payment. However, cash or a mix containing cash seems to be the preferred payment method for all acquisitions.

Table 4.17: Percentage occurrence of cash and stock for venture backed and not

	Cash Only	Stock Only	Cash Present	Stock Present
Venture Backed	28.82%	24.30%	40.45%	38.93%
Non venture backed	28.10%	14.09%	39.52%	25.51%

The results for the boom period are slightly different, with a higher proportion of venture backed acquisitions being paid for in stock alone. However, I can not support the finding from Gompers & Xuan that 57.63% of venture backed firms were purchased for stock alone, nor that 26.47% of non venture backed firms were paid for in the same manner. I put these figures at 31.46% and 15.34% respectively (see table 4.18).

Table 4.18: Percentage occurrence of cash and stock for venture backed and not (Gompers & Xuan period: 1990-2001)

	Cash Only	Stock Only	Cash Present	Stock Present
Venture Backed	22.35%	31.46%	33.37%	41.48%
Non venture backed	24.23%	15.34%	36.25%	27.36%

Table 4.19 shows the significance of CARs, for each window of interest, accounting for both the payment method and the presence of venture capital for the period 1980 to 2004. It shows two important findings. Firstly, whether the transaction is paid in cash or in stock, and whether the target firm is venture capital backed or not, the acquisition will still generate significant positive abnormal returns for short windows. Though the presence of venture capital does reduce the significance level of the CARs, the IT clustering effect (discussed further below) is still dominant in terms of explanatory capabilities. Secondly, irrespective of venture capital backing, cash produces a lower CAR than stock; this is as one might expect from the literature and inline with the notion that payment is made in stock when there is a greater uncertainty over the valuation.

Table 4.19: Significance of CARs for cash and stock, venture backed and not

Event window	Cash Only Non VC (N=5384)	Stock Only Non VC (N=2700)	Cash Only VC (N=421)	Stock Only VC (N=355)
Announce Day	0.39 (10.1)***	1.01 (12.8)***	0.27 (1.8)*	1.13 (4.5)***
2 Day Window	0.76 (14.0)***	1.42 (12.8)***	0.42 (2.0)**	0.82 (2.3)**
3 Day Window	0.83 (12.4)***	1.69 (12.5)***	0.57 (2.1)**	0.72 (1.7)*
7 Day Window	0.93 (9.1)***	1.80 (8.7)***	0.39 (1.0)	0.79 (1.2)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

In a final criticism of the findings of Gompers & Xuan, I note that they reported a three day CAR of -0.58% (t=-1.60, N=531) for acquisitions of venture backed firms for stock, and that their venture backed acquisitions for cash produced comparatively greater returns (1.73%, t=4.32, N=202). If an acquirer's investors believed that the combination of the acquisition price and the valuation of the firm preceding the announcement exceeded the sum of the expected value of the two firms in combination, then we might anticipate obtaining a negative abnormal return. In essence negative returns can be associated with the belief that the acquirer has over paid for the target; this is a direct prediction of the winner's curse and so the real-option hypothesis. My finding that the abnormal return is always either not significantly different from zero or is positive, even when the target is venture capital backed and the acquisition price is paid in cash alone, undermines this argument.

There would appear to be a relationship between the presence of venture capital, the payment method and whether or not the target was in the IT sector. Table 4.20 below presents the correlations among these variables. Adjusting the error rate for multiple comparisons using the standard bonferroni adjustment, there is a significant correlation between being venture capital backed and being an IT firm, between being venture capital backed and receiving a payment that contains stock, and between being an IT firm and receiving a payment that contains stock. I have previously noted that non-IT firms have usually higher returns when they are venture capital backed. The finding that IT firms are more likely to receive a payment that contains stock provides further

difficulties; this implies that non-IT firms are more likely to be paid for in cash and I have demonstrated that acquisitions with this payment method are likely to produce reduced returns.

Table 4.20: Correlation between venture capital, IT targets and payment in cash

	Venture capital backed	Target in IT sector	Payment contains stock
Venture capital backed	1.000	-	-
Target in IT sector	0.2607***	1.000	-
Payment contains stock	0.0608***	0.1243***	1.000

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Tables 4.21 and 4.22 show the CARs for IT and non-IT in combination with the presence and absence of venture capital, for both cash alone and stock alone as payment methods. There are two immediate findings. Firstly, venture backed IT firms with either payment method produce no significant cumulative abnormal returns. This supports both primary hypotheses. Secondly, returns to venture capital backed non-IT firms are positive, strongly significant, and very economically meaningful. The total return across both payment methods is on the order of 3%, with the strongest effect coming from acquisitions for stock. In fact, returns to acquisitions of venture backed non-IT firms for stock are dramatically larger than any from any other type of acquisition.

One should not expect venture capitalists to bargain less effectively when the payment is to be made in stock, as they would not benefit from any short-term increase in returns. The offer share price and quantity is usually set at the announcement and venture capitalists would benefit from positive announcement returns if these were to persist until they could liquidate their holdings (i.e. venture capitalists might not have an incentive to bargain for any surplus if this were true). However, in unreported tests of longer windows, I confirmed the findings of Fuller, Netter & Stegemoller (2002) and others; these returns generally do not persist beyond seven days and are negative over the time periods necessary for the acquisition to take place and for the venture capitalists to liquidate their positions.

Table 4.21: Significance of CARs for cash only, venture backed & not, and IT & not

	IT Non VC (N=717)	Non-IT Non VC (N=4667)	IT VC (N=228)	Non-IT VC (N=193)
Announce Day	0.86 (5.9)***	0.32 (8.3)***	-0.12 (-0.5)	0.73 (3.7)***
2 Day Window	1.52 (7.4)***	0.65 (12.0)***	-0.15 (-0.5)	1.10 (4.0)***
3 Day Window	1.74 (8.1)***	0.69 (10.5)***	0.03 (0.1)	1.21 (3.6)***
7 Day Window	1.91 (4.9)***	0.78 (7.7)***	-0.04 (-0.1)	0.90 (1.7)*

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Table 4.22: Significance of CARs for stock only, venture backed & not, and IT & not

	IT Non VC (N=747)	Non-IT Non VC (N=1953)	IT VC (N=250)	Non-IT VC (N=105)
Announce Day	1.74 (9.1)***	0.73 (9.1)***	0.15 (0.5)	3.45 (7.8)***
2 Day Window	2.39 (8.9)***	1.04 (9.2)***	-0.28 (-0.6)	3.43 (5.5)***
3 Day Window	2.61 (7.9)***	1.34 (9.7)***	-0.40 (-0.8)	3.41 (4.4)***
7 Day Window	2.56 (5.1)***	1.51 (7.1)***	-0.49 (-0.6)	3.84 (3.3)***

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Table 4.23 provides t-tests for the groups above. The venture capital backed group of non-IT firms is significantly different from its non venture capital backed counterpart at the 0.05 level. However, within each payment method the significance of this difference disappears, probably due to the reduction is power.

Table 4.23: Difference in mean [-1,+1] CAR for venture backed and not

	Not VC backed		VC backed		Difference		
	N	μ	N	μ	(μ1-μ2)	S.Error	t-statistic
IT : All acquisitions	3,480	1.45	871	0.08	1.37	0.41	3.35 ***
IT : Cash only	717	1.74	228	0.03	1.71	0.74	2.30 **
IT : Stock only	747	2.61	250	-0.4	3.02	1.15	2.61 ***
Non-IT : All acquisitions	15,678	0.93	590	1.82	-0.89	0.36	-2.43 **
Non-IT : Cash only	4,667	0.69	193	1.21	-0.52	0.55	-0.94
Non-IT : Stock only	1,953	1.34	105	3.41	-2.06	1.31	-1.58

***, **, * = significant at the .01 level, .05 level, and .10 level respectively (value in millions US$).

To conclude the consideration of the payment and its relationship with both the presence of venture capital and the IT sector, I perform an OLS regression and probit analysis as before. These are conducted using both the purecash and the binshares variables as measures of the payment method, and are presented in tables 4.24 and 4.25, and tables 4.26 and 4.27, respectively.

Without considering IT, the presence of venture capital is not a significant predictor of returns. But within either IT firms or non IT firms, the presence of venture capital is a significant predictor and is robust to the inclusion of a payment method variable. Only for non-IT firms is the payment method itself a predictor of returns, both alone and in conjunction with the presence of venture capital. Furthermore, for these firms, venture capital predicts positive returns, even after controlling for the payment method.

For the probit analyses, I find that the choice of payment method variable is important. Payment in cash alone is only a predictor of the presence of venture capital in IT firms. The presence of stock in the payment, however, is a predictor of the presence of venture capital for all firms, IT firms and non-IT firms. Its reduced significance for IT firms (to the 0.05 level) is likely attributable to the reduction in power.

Table 4.24: Regression to explain CAR3 with pure cash as a payment method

Variable	All Acquisitions N=20619 (t-score)		Acquisitions: IT firms N=4351 (t-score)		Acquisitions: non-IT firms N= 16,268 (t-score)	
Pure cash	-0.28 (-2.21**)	-0.28 (-2.21**)	0.19 (0.38)	0.26 (0.52)	-0.36 (-3.40***)	-0.37 (-3.44***)
Venture capital	-	-0.24 (-0.95)	-	-1.38 (-3.36***)	-	0.90 (2.46**)
Constant	-0.28 (-2.21**)	1.10 (14.15***)	1.13 (4.83***)	1.40 (5.29***)	1.07 (15.23***)	1.04 (14.74***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Table 4.25: Probit examining pure cash's role in the presence of venture capital

Variable	All Acquisitions N=20619 (z-score)	IT firms N=4351 (z-score)	Non-IT firms N= 16,268 (z-score)
Pure cash	1.70 (0.58)	18.02 (3.53***)	6.05 (1.53)
Constant	-147.43 (-94.51***)	-88.24 (-35.56***)	-181.45 (-81.32***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Table 4.26: Regression to explain CAR3 with the presence of stock in the deal

Variable	All Acquisitions N=20619 (t-score)		Acquisitions of IT firms N=4351 (t-score)		Acquisitions: non-IT firms N= 16,268 (t-score)	
Stock present	0.73 (4.25***)	0.74 (4.31***)	0.65 (1.34)	0.69 (1.41)	0.74 (5.06***)	0.73 (5.00***)
Venture capital	-	-0.32 (-1.26)	-	-1.39 (-3.39***)		0.84 (2.30**)
Constant	0.81 (13.47***)	0.83 (13.36***)	0.94 (4.59***)	1.20 (5.18***)	0.79 (13.46***)	0.76 (12.81***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Table 4.27: Probit examining the presence of stock's role in the presence of VC

Variable	All Acquisitions N=20619 (t-score)	IT firms N=4351 (t-score)	Non-IT firms N= 16,268 (z-score)
Stock present	24.31 (8.56***)	9.19 (2.06**)	15.99 (3.88***)
Constant	-154.19 (-96.14***)	-87.56 (-31.78***)	-183.75 (-84.58***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

4.6 Competition among acquirers

Bradley, Desai & Kim (1988), Kusewitt (1985), Chaterjee (1986), and Hopkins (1987) all found that competition among potential acquirers was an important predictor of the short-term returns. I do not have data available for the number of parties interested in acquiring a specific target, so instead I construct a measure of the number of public firms with the same six digit NAIC code as the acquirer at the time of the announcement of the acquisition, to act as proxy for it.

The effect of this measure on the effect of the presence of venture capital in IT firms should allow me to find support for both of my two competing hypotheses. Under the bargaining hypothesis one would expect venture capitalists to have greater success when there are more available acquirers to choose from; this is a recognized factor in negotiation and many textbooks have noted the extraordinary increase in bargaining power that comes from having a strong 'best alternative to a negotiated agreement'. Thus more competition among potential acquirers implies better bargaining capabilities and so reduced returns.

The effect on returns associated with the real option hypothesis is derived from the effects of the winner's curse. Essentially the winner's curse is more pronounced when there are many bidders. With few bidders, or only one bidder, the curse does not apply; there is no reason to expect that acquirers will have overpaid for their targets and returns should not be reduced. But with more bidders the variation in valuations under uncertainty is more pronounced, the winner's curse stronger, and the returns to the acquirer are more reduced. Similarly, one could conjecture that smaller markets are more nascent and thus would favor buying market share, and that in markets with a large number of firms there is a greater incentive to look to the future for competitive advantage. This would provide the same effect; more competitive markets will be associated with acquisitions of real options and so reduced returns.

Table 4.28 below shows the distribution of the number of competitors for all of the types of acquisition considered so far. The markets of acquirers are highly competitive; at the time of an announcement there is a mean of 158 and a median of 38 public firms in the same NAIC as an acquirer. Venture backed acquisitions appear to

occur in markets with more public firms with the same NAIC code. For all sectors this difference is slight but for the IT firms the difference more systematic and noticeable. As the number of competitors is significantly skewed the log of this number is used in the subsequent analysis.

Table 4.28: Distribution of number of competitors (for full 6 digit NAIC), for various types of acquisition

	p10	p25	p50	p75	p90	N	μ	skewness
All Acquirers	5	11	38	150	434	19302	157.9	2.3 ***
Of venture backed	9	12	72	209	376	1430	156.3	2.4 ***
Of non-venture	4	11	35	141	434	17872	158.1	2.3 ***
Of IT	11	11	56	177	376	4243	145.5	2.6 ***
Of non-IT	4	11	34	110	444	15059	161.4	2.2 ***
Of venture backed IT	11	11	89	254	376	865	171.1	2.3 ***
Of non-venture IT	11	11	52	177	376	3378	138.9	2.6 ***
Of venture non-IT	5	16	49	177	434	565	133.6	2.6 ***
Of non-venture non-IT	4	11	33	110	685	14494	162.5	2.1 ***

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Table 4.29 shows the effects of regressing the log of the number of competitors on the three day CARs for all acquisitions, IT acquisitions and non IT acquisitions. This measure is not, on its own, a significant predictor of returns for any group. This will be the last time I consider the puzzling returns for non-IT firms. Readers should recall that I have previously demonstrated that the presence of venture capital is a predictor of returns for both IT firms and non-IT firms, and that the effect was in opposite directions for these two groups; For IT firms the venture capital effect was negative, and for non-IT firms it was positive.

The results below show that for IT firms the venture capital effect is robust to the inclusion of a measure of competition and still causes a reduction of approximately 1.4% to the three day CAR. However, for non-IT firms the venture capital effect is completely altered. Although it is not significant in conjunction with the competition measure, the presence of venture capital now reduces returns by about ¼ of 1%.

Table 4.29: Regression to explain CAR3 with the number of competitors

Variable	All Acquisitions N=19,025 (t-score)		Acquisitions: IT firms N=4,307 (t-score)		Acquisitions: Non-IT firms N=14,718 (t-score)	
Log of no. competitors	0.00 (0.06)	-0.25 (-0.95)	0.15 (1.23)	0.18 (1.42)	-0.05 (-1.47)	0.01 (0.17)
Venture capital	-	0.01 (0.17)	-	-1.42 (-3.40***)	-	-0.25 (-0.95)
Constant	1.02 (8.13***)	1.03 (8.18***)	0.57 (1.15)	0.75 (1.51)	1.14 (9.58***)	1.03 (8.18***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Under either of the two hypotheses, one would expect the influence of competition to be largely endogenous to the presence of venture capital. Table 4.30 confirms this, showing that the measure of competition is a constituent of the measure of the presence of venture capital, even for non-IT firms.

Table 4.30: Probit examining competitors' role in the presence of venture capital

Variable	All Acquisitions N=19,025 (z-score)	Acquisitions of IT firms N=4,307 (z-score)	Non-IT firms N=14,718 (z-score)
Log of competitors	11.83 (14.77***)	6.38 (4.17***)	6.58 (6.28***)
Constant	-187.92 (-56.62***)	-110.63 (-16.37***)	-200.66 (-48.73***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Concluding the discussion of the effect of venture capital on non-IT firms, I find that neither of the two primary hypotheses of this thesis is able to explain the resulting returns. I have demonstrated that this is not a payment effect; the venture capital effect is robust the inclusion of the payment method. However, only for non-IT firms does the payment method remain a predictor of returns when considered in conjunction with venture capital. In addition, while competition is not a predictor of returns for these non-IT firms, it is a component of venture capital. When competition is controlled for, venture capital creates a reduction in returns (albeit a smaller one) as it does with IT firms.

4.7 Other influences on abnormal returns

From the literature review I identified six other variables which have been observed to affect cumulative abnormal returns, and which also may contribute to the presence of venture capital. These are the size of the acquirer, its leverage at the time of the transaction, the transaction value or relative transaction value, the location of the target, the timing, and the strategic fit. Each is considered in turn.

Loderer & Martin (1990) found that larger acquirers tended to over pay for their acquisitions. Table 4.31 shows the distribution of the acquirers' total assets, the best available measure of its size, for a variety of acquisition types.

Table 4.31: Distribution of acquirer total assets, for various types of acquirer

	p10	p25	p50	p75	p90	N	μ	skewness
All Acquirers	38.1	112.1	416.1	1657.9	6492.6	19114	4467.7	25.4 ***
Of venture backed	49	142.1	565.5	2817.9	16522	1390	7922.8	25.4 ***
Of non-venture	37.3	109.5	404.4	1591.6	6003	17724	4196.7	23.1 ***
Of IT	33.6	85	297.6	1285.4	6967.1	4125	4841.8	29.9 ***
Of non-IT	40.6	123.3	452.3	1759	6419	14989	4364.7	21.3 ***
Of venture backed IT	65.3	159.4	632.8	3165.6	27277	833	9666.3	22.5 ***
Of non-venture IT	29.9	73.3	248.4	1045.7	4788.4	3292	3621	29.7 ***

***, **, * = significant at the .01 level, .05 level, and .10 level respectively (value in millions US$).

Acquirers of venture backed firms tend to be larger, approximately 1.5 times the size of acquirers of non-venture backed firms. Acquirers of IT firms tend to be smaller, about ¾ of the size of non-IT firms. Surprisingly then, acquirers of venture backed IT firms are the largest of all, about twice the size of non-venture backed IT firms, and 1.5 times the size of an average acquirer of venture backed firms. Table 4.32 shows that the size of the acquirer is a strong predictor of the three day CAR. As the total assets measure is significantly skewed its log was used for the analysis. The regression supports the claims of Loderer & Martin in that larger firms appear to pay a penalty in their cumulative abnormal returns for their purchase, indicating that they are perceived to have over-valued their acquisitions.

Table 4.32: Regression to explain CAR3 with total assets

Variable	All Acquisitions N=19,114 (t-score)		Acquisitions of IT firms N=4,125 (t-score)	
Log of total assets	-0.48(-11.18***)	-0.48(-11.16***)	-0.56 (-4.10***)	-0.53 (-3.93***)
Venture capital		-0.04 (-0.15)		-0.73 (-1.93*)
Constant	3.86 (12.54***)	3.86 (12.54***)	4.29 (4.44***)	4.28 (4.43***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Venture capitalist may actively seek large acquirers for their firms for this or for other reasons. The total assets measure effect was highly significant and similar in magnitude for all acquisitions and IT acquisitions. It made the presence of venture a non-significant predictor for all acquisitions and reduced the venture capital effect by half (though it remains significant at the 0.1 level) for IT firms. Table 4.33 shows that the total assets measure can be considered a constituent of the presence of venture capital for all firms as well as for IT firms. Its sign is positive indicating that venture capital is associated with larger acquirers.

Table 4.33: Probit examining total asset's role in the presence of venture capital

Variable	All Acquisitions N=19,114 (z-score)	Acquisitions of IT firms N=4,125 (z-score)
Log of total assets	5.59 (8.14***)	12.91 (12.19***)
Constant	-180.75 (-39.29***)	-163.00 (-23.26***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

A firm's leverage is defined as its total liabilities divided by its total assets. Thus if the has used debt to purchase all of its assets then it have 100% leverage. Venture backed firms are known to actively seek cash rich targets, that is targets with low leverage. Table 4.34 shows the distribution of leverage for various types of acquisition. Acquirers of venture backed firms do appear to be less leveraged than acquirers of non-venture backed firms. IT industry firms have lower total assets than non-IT firms but, as Oakley (2004) and others have reported, technology oriented firms tend to use less debt.

This would seem to hold here, as IT firms have about 2/3 of the leverage of their non-IT counterparts.

Table 4.34: Distribution of acquirer leverage (in percent), for various types of acquirer

	p10	p25	p50	p75	p90	N	M	skewness
All Acquirers	21	35.9	54.2	71.3	90.7	19076	54.5	1.5 ***
Of venture backed	14	24	38.4	56	71.1	1386	41.1	0.8 ***
Of non-venture	21.8	37.5	55.4	72.4	91	17690	55.5	1.6 ***
Of IT	15	23.3	38.3	56.7	74.3	4117	41.9	1.0 ***
Of non-IT	25.2	41.6	57.6	74.1	91.4	14959	57.9	1.8 ***
Of venture backed IT	13.7	22.1	34.4	50.6	67.8	830	38	1.1 ***
Of non-venture IT	15.2	23.6	39.6	58	76	3287	42.8	0.9 ***

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Maloney, McCormick & Mitchell (1993) found that highly leveraged firms experienced lower abnormal returns when they made an acquisition. This is not corroborated in table 4.35. Leverage does not appear to significantly influence returns, at least on its own. Table 4.36 confirms that venture capitalists do seek low leverage acquirers for their ventures. An acquirer's leverage is significantly negatively associated with the presence of venture capital for both all firms as well as for IT firms.

Table 4.35: Regression to explain CAR3 with leverage

Variable	All Acquisitions N=19,076 (t-score)		Acquisitions of IT firms N=4,117 (t-score)	
Log of leverage	-0.52 (-1.20)	-0.60 (-1.38)	2.03 (1.73*)	1.79 (1.54)
Venture capital	-	-0.33 (-1.30)	-	-1.20 (-3.04***)
Constant	1.15 (5.78***)	1.21 (5.97***)	0.30 (0.73)	0.62 (1.50)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Table 4.36: Probit examining leverage's role in the presence of venture capital

Variable	All Acquisitions N=19,076 (z-score)	Acquisitions of IT firms N=4,117 (z-score)
Log of leverage	-183.09 (-20.65***)	-74.76 (-5.31***)
Constant	-74.89 (-21.19***)	-59.03 (-11.60***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Asquith, Bruner, Mullins (1983) and others have reported that the relative size of the transaction is a strong predictor of the abnormal returns experienced by the acquirer. Relative transaction size is the value of the transaction divided by the total assets of the acquirer. One could also consider just the transaction value itself. In a multivariate setting placing relative transaction size (or leverage) with total assets will implicitly include total assets a second time. Table 4.37 considers the distribution of the relative transaction sizes for various types of acquisition.

Table 4.37: Distribution of relative transaction value (in percent), for various types of acquisition

	p10	p25	p50	p75	p90	N	μ	skewness
All Acquirers	0.4	1.5	5.3	14.5	32.2	9779	17.9	59.4 ***
For cash only	0.4	1.2	3.6	9.2	19.9	4288	10.6	43.5 ***
For stock only	0.3	1.2	5.4	18.8	51.4	2367	30.2	38.2 ***
Of venture backed	0.6	2.6	9.7	25.2	54	920	36.4	17.2 ***
Of non-venture	0.4	1.5	5	13.5	30.2	8859	16	70.7 ***
Of IT	0.7	2.6	8.5	19.9	44.9	2343	26.7	23.6 ***
Of non-IT	0.4	1.4	4.5	12.8	28.4	7436	15.2	67.4 ***
Of venture backed IT	0.5	2.3	9.5	24.6	55.5	565	40.5	15.3 ***
Of non-venture IT	0.8	2.7	8.3	18.7	41.9	1778	22.3	13.4 ***

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Acquisitions for stock appear to support higher relative transaction sizes than acquisitions for cash. This is particularly pronounced for the very high relative value transactions. Likewise venture backed firms and IT firms both have higher relative

transaction sizes than their non-venture backed and non-IT counterparts. Unsurprisingly then, acquisitions of venture backed IT firms are the largest of all in relative terms. It should be noted that for all acquisitions the median transaction size is about 5% (the mean is approximately 18%) of the acquirers' total assets. Thus these acquisitions are significant events for the acquirers and one would expect them to generate economically meaningful returns.

Tables 4.38 and 4.39 show the difference in explanatory power of relative transaction size and the transaction size itself. Relative transaction size is a significant predictor for all firms and for IT firms. For IT firms the venture capital effect is slightly amplified by the inclusion of relative transaction value, and for all firms it becomes significant at the 0.05 level. However, transaction size itself is generally not a significant predictor, although for IT firms it does produce an effect of -0.5% (significant at the 0.1 level) when considered alone. Overall the finding is that the larger the relative transaction size, the larger the resulting abnormal return. This is consistent with Asquith, Bruner & Mullins and is an intuitive result.

Table 4.38: Regression to explain CAR3 with the relative transaction value

Variable	All Acquisitions N=9,779 (t-score)		Acquisitions of IT firms N=2,343 (t-score)	
Log of relative value	0.73 (11.90***)	0.74 (12.13***)	0.56 (3.19***)	0.56 (3.18***)
Venture capital	-	-0.89 (-2.54**)	-	-1.81 (-3.08***)
Constant	3.60 (13.45***)	3.72 (13.77***)	2.84 (4.12***)	3.28 (4.49***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively (value in millions US$).

Table 4.39: Regression to explain CAR3 with the transaction value

Variable	All Acquisitions N=10,522 (t-score)		Acquisitions of IT firms N=2,464 (t-score)	
Log of trans. value	-0.10 (-1.12)	-0.09 (-0.98)	-0.52 (-1.74*)	-0.41 (-1.37)
Venture capital	-	-0.45 (-1.33)	-	-1.56 (-3.10***)
Constant	1.63 (5.47***)	1.64 (5.49***)	2.99 (2.77***)	3.04 (2.82***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively (value in millions US$).

Tables 4.40 and 4.41 show that both high relative transaction value and high transaction value itself are components of venture capital when we consider all firms, but that relative transaction value is not for IT firms and is instead insignificantly negative. This again suggests an IT specific effect.

Table 4.40: Probit examining relative transaction value's role in the presence of VC

Variable	All Acquisitions N=9,779 (t-score)	Acquisitions of IT firms N=2,343 (t-score)
Log of rel. trans. value	8.85 (7.33***)	-0.05 (-0.03)
Constant	-105.43 (-27.49***)	-70.39 (-12.78***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively (value in millions US$).

Table 4.41: Probit examining transaction value's role in the presence of VC

Variable	All Acquisitions N=10,522 (z-score)	Acquisitions of IT firms N=2,464 (z-score)
Log of trans. value	17.21 (14.14***)	24.32 (12.08***)
Constant	-185.50 (-43.17***)	-145.57 (-20.57***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively (value in millions US$).

Together I refer to total assets, leverage and relative transaction value as the size effects. They are considered further in a multivariate setting later. In addition to the size effects, the year of the acquisition, the location of the target and the strategic fit between the acquirer and the target are all potentially important explanatory variables. These are now considered in turn.

Moeller, Schlingemann & Stulz (2004 & 2005) and others have commented on the change in return patterns from one period to another. This is reportedly due to the changing state of the market, waves of technological innovation, waves of acquisitions, and other considerations. Furthermore, industry reports (e.g. Hellmann, Egan & Brander (2005)) have noted that venture backed acquisitions appear more prevalent, although have lower value, when the market for IPOs is poor. That is to say venture capitalists may be forced to seek acquisitions for their firms when other means of exit are unavailable,

and that venture backed acquisitions may follow a different rhythm from their non-venture backed counterparts. This is shown in tables 4.42 and 4.43.

Table 4.42: Breakdown of Acquisitions by Period

Period	Cash only N (%)	Stock only N (%)	Non-venture N (%)	Venture backed N (%)
1980 – 1984	849 (14.6%)	207 (6.8%)	1208 (6.3%)	48 (3.3%)
1985 – 1989	403 (6.9%)	238 (7.8%)	1393 (7.3%)	152 (10.4%)
1990 – 1994	909 (15.7%)	688 (22.5%)	3861 (20.2%)	204 (14.0%)
1995 – 1999	2285 (39.4%)	1454 (47.6%)	8617 (45.0%)	467 (32.0%)
2000 – 2004	1359 (23.4%)	468 (15.3%)	4079 (21.3%)	590 (40.4%)

In table 4.42 acquisitions of venture backed firms have steadily increased period by period from 1980 to 2004. For non-venture backed firms acquisitions jumped from 7% for the late 1980's to over 20% for the early 1990's, peaking with almost half of the acquisitions in the sample in the late 1990's.

Table 4.43: Breakdown of Acquisitions by Period

Period	Non-IT target N (%)	IT target N (%)	IT: Non-venture N (%)	IT: Venture backed N (%)
1980 – 1984	1132 (7.0%)	124 (2.8%)	100 (2.9%)	24 (2.8%)
1985 – 1989	1331 (8.2%)	214 (4.9%)	154 (4.4%)	60 (6.9%)
1990 – 1994	3503 (21.5%)	562 (12.9%)	467 (13.4%)	95 (10.9%)
1995 – 1999	7175 (44.1%)	1909 (43.9%)	1607 (46.2%)	302 (34.7%)
2000 – 2004	3127 (19.2%)	1542 (35.4%)	1152 (33.1%)	390 (44.8%)

The trend, shown in table 4.43, for venture backed and non-venture backed IT firms is very similar, although the distribution of acquisitions for the non-venture backed IT groups is more skewed towards the present. A possible explanation for this is the infancy of the IT sector; the entire of the 1980's accounts for less than 8% of IT acquisitions, compared with over 15% for non-IT acquisitions.

For non-venture backed firms the most acquisitions happened in the stock market boom of the late 1990's, but for venture backed firms acquisitions were more common in

the following recession of 2000-2004. I therefore construct a 'boom' variable that takes the value of 1 for the period 1995 to 1999, and 0 for all other periods. Table 4.44 shows that the boom variable is a strong predictor of returns for all acquisitions, and significant at the 0.05 level for acquisitions of IT firms.

Table 4.44: Regression to explain CAR3 with the period

Variable	All Acquisitions N=20,619 (t-score)		Acquisitions of IT firms N=4351 (t-score)	
Boom	0.59 (4.75***)	0.59 (4.69***)	0.97 (2.35**)	0.85 (2.06**)
Venture capital	-	-0.13 (-0.51)	-	-1.25 (-3.05***)
Constant	0.63 (6.46***)	0.64 (6.48***)	0.63 (2.12**)	0.94 (2.82***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

For IT firms the effect of the presence of venture capital is fairly robust to the inclusion of the boom variable. Its beta is reduced by about 0.15%, but the effect remains significant at the 0.01 level. The boom variable itself also experiences a 0.15% reduction in its beta as well. Table 4.45 shows that the boom variable can, as was expected, be considered a component of the presence of venture capital.

Table 4.45: Probit examining the period's role in the presence of venture capital

Variable	All Acquisitions N=20619 (z-score)	Acquisitions of IT firms N=4351 (z-score)
Boom	-38.55 (-14.43***)	-32.39 (-7.43***)
Constant	-124.94 (-64.18***)	-66.78 (-21.28***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Other authors have reported findings from just boom or pre-boom time periods, or have noted the importance of the 'bullishness' of the IPO market on the acquisitions market. Thus this boom variable will be considered again in conjunction with other variables, particularly the size variables, later. The consideration of such a long time period, essentially capturing the history of venture capital and information technology, is one of the major contributions of this research.

Morck, Shleifer & Vishny (1990), Gompers & Xuan (2005) and others have noted the importance of the strategic fit between the target and the acquirer on the resulting returns. Generally the findings were that non-conglomerate acquisitions out performed conglomerate acquisitions. As stated in the methodology section, I constructed a horizontal-vertical-conglomerate variable for each and every acquisition. An acquisition is defined as horizontal if the target and the acquirer have the same six digit NAIC code. It is defined as vertical if both the target and the acquirer are in the same industry, like IT for example, and the acquisition is not horizontal. And it is defined as conglomerate if the acquisition is neither horizontal nor vertical. The percentages of the different strategic fits for the various types of acquisition are shown in tables 4.46 and 4.47 below.

Table 4.46: Breakdown of Acquisitions by Strategic Fit (Payment method and VC)

Strategic Fit	Cash only N (%)	Stock only N (%)	Non-venture N (%)	Venture backed N (%)
Horizontal	2539 (43.7%)	1674 (54.8%)	9032 (47.1%)	671 (45.9%)
Vertical	900 (15.5%)	564 (18.5%)	3301 (17.2%)	365 (25.0%)
Conglomerate	2366 (40.8%)	817 (26.7%)	6825 (35.6%)	425 (29.1%)

Table 4.47: Breakdown of Acquisitions by Strategic Fit (IT firms and VC)

Strategic Fit	Non-IT target N (%)	IT target N (%)	IT: Non-venture N (%)	IT: Venture backed N (%)
Horizontal	7867 (48.4%)	1836 (42.2%)	1410 (40.5%)	426 (48.9%)
Vertical	2163 (13.3%)	1503 (34.5%)	1195 (34.3%)	308 (35.4%)
Conglomerate	6238 (38.3%)	1012 (23.3%)	875 (25.1%)	137 (15.7%)

For strategic fit there are obvious differences in the percentage allocation for every type of acquisition considered. Cash acquisitions are more likely to be conglomerate than stock acquisitions which are most often horizontal. Venture backed firms are more likely to be acquired in a vertical acquisition than their non-venture backed counterparts, which are more likely to be acquired by an unrelated firm. I have established that venture back acquisitions are more likely to be paid for in stock so this follows quite well. IT firms are more likely to be acquired in a vertical acquisition than

their non-IT counterparts, but considering venture backed IT firms does not amplify this effect. Rather venture backed IT firms are almost exactly as likely to be involved in a vertical acquisition as non-venture backed IT firms. The difference between these two groups is, instead, the propensity to be involved in a horizontal or conglomerate acquisition.

Venture backed IT firms are more likely to be by a firm in their supply chain and non-venture backed IT firms are more likely to be acquired by an unrelated enterprise. Inline with the bargaining hypothesis, one might expect that venture capitalists would use their networks of contacts and their past experience in the IT industry to find an acquirer that is itself an IT firm. Likewise, firms in the same industry may be more likely to be able to realize a real option. Thus the results in table 4.47 support both of my primary hypotheses.

To simplify the analysis the horizontal-vertical-conglomerate measure was reduced to a binary conglomerate measure. This does not distinguish between horizontal and vertical acquisitions, but performed much like the alternative binary measures that were tried but not reported. Given the percentage allocation above, the results of table 4.48 are not unexpected. For all acquisitions the conglomerate measure is a strong predictor of abnormal returns and is unchanged by the inclusion of a measure of the presence of venture capital. For IT firms, however, the conglomerate measure is not a significant predictor and the presence of venture capital is robust to its inclusion. I expect instead that the non-conglomerate nature of the acquisition is a component of the venture capital effect for IT firms.

Table 4.48: Regression to explain CAR3 with the strategic fit

Variable	All Acquisitions N=20619 (t-score)		Acquisitions of IT firms N=4351 (t-score)	
Conglomerate	0.43 (2.96***)	0.42 (2.94***)	1.08 (1.60)	0.97 (1.46)
Venture capital	-	-0.21 (-0.85)	-	-1.27 (-3.27***)
Constant	0.86 (13.32***)	0.87 (13.40***)	0.93 (4.95***)	1.21 (5.72***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Table 4.49 shows that the conglomerate effect is a significant negatively contributing component of the presence of venture capital for both all firms and for IT firms. Note that the effect is stronger (even given the reduced power) for IT firms.

Table 4.49: Probit examining strategic fit's role in the presence of venture capital

Variable	All Acquisitions N=20619 (z-score)	Acquisitions of IT firms N=4351 (z-score)
Conglomerate	-14.43 (-5.07***)	-32.86 (-5.97***)
Constant	-142.21 (-89.25***)	-77.28 (-31.91***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

The final variable considered is location. Other authors have considered the impact of the target's location on the returns of the acquirer, but this was for targets from different international jurisdictions. This, and Brander & Egan (2005), is the first research I am aware of that has considered the state of the acquirer. This is only relevant for two reasons. Firstly certain US states, specifically California and Massachusetts, account for a disproportionate amount of venture capital investment. In fact, these two states account for more than 60% of all venture investment. Secondly, the various states have differing proportions of IT firms. To some degree this is correlated with the presence of venture capital, however, it is also a separate consideration.

Tables 4.50 and 4.51 show the percentages of acquisitions for the five biggest venture capital investment states in the US, for the same set of acquisition types considered before.

Table 4.50: Breakdown of acquisitions by location

Location	Cash only N (%)	Stock only N (%)	Non-venture N (%)	Venture backed N (%)
California	995 (17.1%)	638 (20.9%)	2956 (15.4%)	589 (40.3%)
Florida	327 (5.6%)	176 (5.8%)	1140 (6.0%)	27 (1.8%)
Massachusetts	248 (4.3%)	152 (5.0%)	735 (3.8%)	206 (14.1%)
New York	343 (5.9%)	132 (4.3%)	1154 (6.0%)	51 (3.5%)
Texas	503 (8.7%)	205 (6.7%)	1568 (8.2%)	71 (4.9%)
Other	3389 (58.4%)	1752 (57.3%)	11605 (60.6%)	517 (35.4%)

Table 4.51: Breakdown of acquisitions by location

Location	Non-IT target N (%)	IT target N (%)	IT: Non-venture N (%)	IT: Venture backed N (%)
California	2212 (13.6%)	1333 (30.6%)	928 (26.7%)	405 (46.5%)
Florida	1010 (6.2%)	157 (3.6%)	141 (4.1%)	16 (1.8%)
Massachusetts	565 (3.5%)	376 (8.6%)	233 (6.7%)	143 (16.4%)
New York	937 (5.8%)	268 (6.2%)	240 (6.9%)	28 (3.2%)
Texas	1403 (8.6%)	236 (5.4%)	205 (5.9%)	31 (3.6%)
Other	10141 (62.3%)	1981 (45.5%)	1733 (49.8%)	248 (28.5%)

California's dominance in terms of venture capital backed firms is clear. Over 40% of venture backed acquisition targets come from California, but the state is an enormous innovation center regardless and 15% of non-venture backed firms come from there too. California also has a high proportion of IT firms. About a ¼ of non-venture backed IT firms and almost a ½ of venture backed IT firms come from there. A variety of variables were created and tested to reflect this location effect. Ultimately a binary variable representing whether or not the target came from California was used, as this is the prototypical venture capital and IT state, and as this variable performed best.

Table 4.52 shows that the location variable can not explain the 3 day CAR for the acquirer; this is not surprising. For IT firms the effect of the presence of venture capital is almost completely unaffected by the inclusion of the location variable.

Table 4.52: Regression to explain CAR3 with the location

Variable	All Acquisitions N=20619 (t-score)		Acquisitions of IT firms N=4351 (t-score)	
California	-0.06 (-0.35)	-0.03 (-0.19)	-0.08 (-0.19)	0.13 (0.29)
Venture capital	-	-0.23 (-0.92)	-	-1.39 (-3.45***)
Constant	1.02 (15.20***)	1.03 (15.09***)	1.20 (4.64***)	1.42 (5.00***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

However, given the abundance of venture capital in some states and its scarcity in others, one might expect that the location of the target is itself a component of the presence of venture capital. Table 4.53 shows that for both all acquisitions and for just IT acquisitions the location does contribute to the presence of venture capital.

Table 4.53: Probit examining location's role in the presence of venture capital

Variable	All Acquisitions N=20619 (z-score)	Acquisitions of IT firms N=4351 (z-score)
California	66.51 (22.34***)	50.43 (11.10***)
Constant	-163.45 (-101.76***)	-101.77 (-36.77***)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

From this point on I consider only acquisitions of IT firms. This research has demonstrated the presence of venture capital is not a predictor of returns for all firms because for non-IT firms it creates positive returns where as for IT firms it creates negative returns, and in aggregate these two effects neutralize each other. Furthermore, neither hypothesis is able to explain the positive returns created for non-IT firms, although this is perhaps less of problem for the bargaining hypothesis which had a priori sector specific expectations. I can not reject the real option hypothesis using the findings from non-IT firms as there may be systematic differences between IT and non IT firms in terms of their pre-acquisition operational characteristics, even though I was unable to statistically demonstrate them.

4.8 Explaining the presence of venture capital

For IT firms, this research has established that the method of payment, the number of competitors, acquirer's total assets and leverage, the transaction value, timing and strategic fit of the acquisition, and the location of the target all individually contribute to explaining the presence of venture capital. This section seeks to determine which combinations of these variables together provide the best explanation of the presence of venture capital.

Timing may affect the size measures and possibly the strategic fit. It is likely to be independent of location, as the location measure 'California' has not drastically changed its association with either venture capital or IT firms over the last 25 years; California has always been the dominant jurisdiction for both venture capital and IT, since either was invented. Furthermore, with the possible exception of minor jurisdictional cost variations for labor or capital, it is hard to see how location could interact with any of the size variables. Thus we might expect that location will be a predictor in any combination.

Of the two payment method measures, only the presence of stock was found to contribute to the presence of venture capital. However, I will use the 'purecash' variable in the following analysis, as I found in unreported tests that it performs marginally better in conjunction with other variables. In the reporting of the distributions I noted that the payment method appears to interact with the transaction value, the acquirer's leverage and the strategic fit; possibly it explains part of these variables. Likewise, it is reasonable to hypothesize that the number of competitors may be a (partial) determinant of the either the strategic fit or the transaction value, or both.

Table 4.54 presents five probit models, each with a different specification. Note that the logs of variables were used, as before, to correct for skewness. It was determined that the payment method did not undermine the influence of other variables, but that there was an interaction between the number of competitors and the transaction value.

Specification 1 presents the size variables with the payment method, the boom measure and the number of competitors. Only the number of competitors is insignificant. If we remove it, as in specification 2, all of the size measures, the payment method and the boom measure are strong predictors of the presence of venture capital. Specification 3

shows that removing the transaction value and replacing the number of competitors makes it a significant component too. Specification 4 shows that the measures not related to size, in combination with the boom effect and the payment method, are likewise strong predictors of the presence of venture capital. Specification 5 is the most complete specification possible with this variable set. It contains all previously determined components of venture capital for IT firm, except the competition measure.

Table 4.54: Probit to explain the presence of venture capital

Variables	Specification 1 N=2,324 (z-score)	Specification 2 N=2,340 (z-score)	Specification 3 N=4,078 (z-score)	Specification 4 N=4,307 (z-score)	Specification 5 N=2,340 (z-score)
Boom	-17.14 (-2.70***)	-17.65 (-2.82***)	-21.07 (-4.40***)	-29.01 (-6.38***)	-19.55 (-3.09***)
Pure cash	19.17 (2.74***)	19.53 (2.81***)	15.23 (2.79***)	14.21 (2.68***)	21.07 (3.00***)
Log total assets	8.50 (4.07***)	8.54 (4.13***)	14.29 (11.91***)	-	7.90 (3.79***)
Log leverage	-67.75 (-3.42***)	-69.47 (-3.51***)	-112.73 (-7.09***)	-	-41.85 (-2.05**)
Log trans. value	19.09 (7.35***)	19.15 (7.41***)	-	-	18.75 (7.21***)
Log no. competitors	1.44 (0.68)	-	3.80 (2.36**)	4.18 (2.67***)	-
Conglomerate	-	-	-	-30.39 (-5.31***)	-29.61 (-3.34***)
California	-	-	-	45.80 (9.88***)	37.34 (6.00***)
Constant	-160.68 (-10.84***)	-154.49 (-12.62***)	-142.61 (-13.20***)	-98.93 (-12.56***)	-167.29 (-13.22***)
Pseudo R-squared	0.0938	0.0934	0.0624	0.0491	0.1136

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Specification 5 provides a pseudo R-squared of 0.1136. This is a quite a strong result given the number of possible factors that are likely components of the presence of venture capital in an acquisition.

The signs of the contributing components are much as we would expect and are unchanged by any inter-component interaction. The boom reduces the likelihood of a venture capital backed acquisition. From industry reports, the literature and the reported distributions, it appears that venture capitalists may seek acquisitions when they are unable to secure initial public offerings for their firms. Payment in cash contributes

positively to the presence of venture capital. Even though I noted that venture capital backed firms are more often paid for in stock, I found that payment in cash alone was a predictor of the presence of venture capital and this is in accordance with the finding that venture capitalist actively seek cash rich acquirers, shown by the negative contribution of leverage.

Venture capital is also positive associated with a high transaction value and the target firm being located in California, and negatively associated with conglomerate acquisitions. Furthermore, a high number of competitors is positively associated with venture capital but only when we don't consider the transaction value that was obtained in the acquisition.

Table 4.55 repeats the analysis using a logit model. The results are essentially robust to the choice of model, with very similar coefficients. The pseudo R-squared for the logit is 0.0003 higher than that of the probit (using specification 5).

Table 4.55: Logit to explain the presence of venture capital

Variables	Specification 1 N=2,324 (z-score)	Specification 2 N=2,340 (z-score)	Specification 3 N=4,078 (z-score)	Specification 4 N=4,307 (z-score)	Specification 5 N=2,340 (z-score)
Boom	-25.25 (-2.30**)	-26.09 (-2.41**)	-34.32 (-4.08***)	-50.52 (-6.34***)	-29.28 (-2.67***)
Pure cash	34.29 (2.87***)	34.97 (2.95***)	27.25 (2.89***)	25.39 (2.78***)	39.21 (3.26***)
Log total assets	14.40 (4.00***)	14.49 (4.06***)	25.46 (12.00***)		13.16 (3.62***)
Log leverage	-123.47 (-3.60***)	-126.30 (-3.69***)	-206.99 (-7.37***)		-77.04 (-2.18**)
Log trans. value	33.92 (7.45***)	34.02 (7.52***)			33.73 (7.42***)
Log no. competitors	2.38 (0.65)		6.73 (2.40**)	7.04 (2.54**)	
Conglomerate				-55.06 (-5.25***)	-52.46 (-3.30***)
California				79.00 (9.89***)	62.86 (5.89***)
Constant	-275.18 (-10.72***)	-265.08 (-12.32***)	-244.68 (-12.83***)	-164.51 (-11.84***)	-287.67 (-12.77***)
Pseudo R-squared	0.0943	0.0940	0.0630	0.0490	0.1139

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

4.9 The impact of exogenous variables

From the single factor and bi-factor regressions in the previous sections, I can assemble four groups of variables. The first group containing the total assets of the acquirer, the relative transaction value and the boom effect includes measures that meet three criteria: i) they are predictors of returns for IT firms in themselves, ii) they remain predictors in conjunction with the presence of venture capital, and iii) the effect attributable to the presence of venture capital is robust to their inclusion. The second group containing leverage and the transaction value meets the (i) and (iii) criteria. The third group containing the payment method, strategic fit and the location of the firm only meets the (iii) criterion. The final group, which contains just the number of competitors at the time of the acquisitions, fails to meet any of the criteria; only this measure nullified the effect of the presence of venture capital.

The intention of this section is to include exogenous explanatory variables and control variables, in conjunction with the presence of venture capital, to explain the returns to acquisitions of IT firms. It seems unlikely that the number of competitors is either an exogenous explanatory variable or a control variable. Likewise, the strategic fit, the payment method and the location have all failed to explain returns themselves, and unless there is some synergistic interaction between them, or with the other variables, they will remain insignificant predictors. Furthermore, in the case of location, there is no immediate and sensible hypothesis apparent for why it should produce an effect, so it can be safely discarded.

The relative transaction value was a far stronger predictor of returns than the transaction value itself and so it should be used. However, I have noted that it contains a measure of the total assets of the acquiring firm and so I might expect that placing it together with total assets might undermine the efficacy of one or the other, or both.

Table 4.56 shows five variable specifications. Again, and as before, the logs of these variables were used to correct for skewness. The first considers the presence of venture capital, the boom effect, the leverage and the total assets. The second replaces the total assets with the relative transaction value. With the lower t-score for the relative transaction value, this decreases the R-squared of the model from 0.0128 to 0.0102.

However, given the influence on the venture capital variable, I consider it a superior specification. The third specification included both the total assets and the relative transaction value. As was feared, together the significance of either is lost. Specification 4 includes the number of competitors to the variables from specification 2. Surprisingly it is significant at the 0.1 level. The 5th and final specification replaces the competition measure with both a payment method measure and a measure of the strategic fit. Neither was successful in combination, and in unreported tests variations of both were also tried separately without success.

Table 4.56: Multivariate regression of the 3 day CAR for IT firms

	Specification 1 N=4,117 (t-score)	Specification 2 N=2,340 (t-score)	Specification 3 N=2,340 (t-score)	Specification 4 N=2,324 (t-score)	Specification 5 N=2,340 (t-score)
Venture capital	-0.48 (-1.27)	-1.51 (-2.70***)	-0.97 (-1.83*)	-1.57 (-2.73***)	-1.41 (-2.62***)
Boom	0.79 (2.29**)	1.19 (2.12**)	0.92 (1.83*)	1.39 (2.30**)	1.34 (2.22**)
Log of leverage	3.12 (2.29**)	4.29 (2.11**)	4.43 (2.14**)	4.24 (2.11**)	3.35 (1.83*)
Log of total assets	-0.56 (-3.82***)		-0.54 (-1.62)		
Log of relative trans. value		0.61 (3.27***)	0.26 (1.06)	0.63 (3.32***)	0.70 (3.65***)
Log of no. competitors				0.38 (1.88*)	
Pure cash					0.73 (1.18)
Conglomerate					1.84 (1.36)
Constant	2.90 (3.59***)	1.34 (1.80*)	3.42 (2.47**)	-0.27 (-0.22)	1.24 (1.66*)
R-squared	0.0114	0.0102	0.0128	0.0116	0.0127

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

For three of the five specifications the effect due to the presence of venture capital is robust to the inclusion of the other variables. Only the inclusion of the total assets measure reduces its effect in a meaningful way causing it to lose significance. This reduction is particular drastic (on the order of 1% or 2/3rd of the natural effect) when the relative transaction value is not included. Overall, specification 3 is slightly superior to

specification 5, with an R squared of 0.0128 compared with 0.0127, but specification 4 is the best in terms of capturing the most significant variables.

R-squared values reported in the event study literature are generally on the order of 0.01 to 0.1. Gompers & Xuan (2005), which is arguably the closest comparison paper, report values of 0.01 to 0.016, but other authors (e.g. Chang (1998) and Fuller, Netter & Stegemoller (2002)) have reported values closer to 0.05 in the analysis of acquisitions of private firms. The expected R-squared is low for event studies; as these models are not expected explain a large proportion of the variance. The returns to an individual acquisition are the product of a large number of factors idiosyncratic to the target, the acquirer and the acquisition. These include the quality of the firms, the competency of their managers, the strategic implications of the acquisition, the (expected) ease of integration of the target into the acquirer, and so forth. Furthermore there is a very large variation in returns in the normal course of events.

However, MacKinley (1997) states that cumulative abnormal returns on the order of 0.5% to 2% should be considered economically meaningful. Thus this analysis expected that, given a sufficiently large sample and careful implementation, the small systematic effects due to the factors under consideration would be apparent and economically meaningful. The finding that the presence of venture capital creates a robust 1.5% decrease to cumulative abnormal returns of announcements of acquisitions of IT firms, and that other factors produce effects on the order of 0.5% to 5%, is therefore a reasonably strong result.

Table 4.57 repeats the five variable specifications presented above, but using the log of the total amount of venture capital invested (in US$k) to replace the binary presence of venture capital variable. The results are essentially identical; using the amount of venture capital invested does not appear to add any new information.

Table 4.57: Multivariate regression of the 3 day CAR for IT firms

	Specification 1 N=4,117 (t-score)	Specification 2 N=2,340 (t-score)	Specification 3 N=2,340 (t-score)	Specification 4 N=2,324 (t-score)	Specification 5 N=2,340 (t-score)
Log of VC invested	-0.05 (-1.18)	-0.16 (-2.62***)	-0.10 (-1.65)	-0.16 (-2.66***)	-0.15 (-2.54**)
Boom	0.79 (2.28**)	1.18 (2.10**)	0.92 (1.82*)	1.38 (2.28**)	1.33 (2.20**)
Log of leverage	3.12 (2.29**)	4.31 (2.13**)	4.46 (2.15**)	4.26 (2.12**)	3.37 (1.84*)
Log of total assets	-0.56 (-3.80***)		-0.54 (-1.60)		
Log of relative trans. value		0.61 (3.27***)	0.26 (1.06)	0.63 (3.31***)	0.70 (3.65***)
Log of no. competitors				0.39 (1.89*)	
Pure cash					0.73 (1.19)
Conglomerate					1.85 (1.36)
Constant	2.88 (3.58***)	1.32 (1.79*)	3.39 (2.45**)	-0.29 (-0.24)	1.22 (1.65*)
R-squared	0.0113	0.0102	0.0127	0.0115	0.0126

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

4.10 The reputation of venture capitalists versus the attributes of their firms

In this final section I consider the sub-sample of venture capital backed IT firms and attempt to determine if a measure of the reputation of the venture capitalists involved or of the pre-acquisition accounting characteristic of the portfolio firm can predict returns. This should help determine which of the two competing hypotheses is more feasible. Table 4.58 below shows two measures of reputation. The first measure is the log of the number of portfolio firms financed by all venture capitalists involved in financing the specific firm. This reflects the ability of the venture capitalists to raise and place funds, and so their experience. The second measure is the ratio of the number of exits achieved by all venture capitalists that were involved in financing the firm to the total number of portfolio firms financed. This reflects the past success of the venture capitalists in achieving exits relative to the frequency of their investments.

I have previously provided some evidence to support the notion that venture capitalists may deliberately exit their portfolio firms through acquisitions when market downturns prevent initial public offerings. As such action is likely to undermine the effects of their reputations, I also test the second measure in both boom and non-boom periods, with the expectation that it will provide significant effects only during the boom.

Table 4.58: Reputation regressions of the 3 day CAR for venture backed IT firms

	Specification 1 All Periods N=871 (t-score)	Specification 2 All Periods N=871 (t-score)	Specification 3 Boom Period N=397 (t-score)	Specification 4 Non-boom Period N=474 (t-score)
Log of no. firms funded	-0.05 (-0.28)	-	-	-
Ratio of firms funded to exits	-	-0.71 (-1.00)	-1.65 (-1.69*)	0.15 (0.16)
Constant	0.42 (0.34)	1.67 (1.01)	4.46 (2.00**)	-0.87 (-0.38)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Only during the boom period is measure of reputation a significant predictor (at the 0.1 level) of announcement returns. In unreported tests I found that most measures of venture capitalists' reputations are very highly significant predictors of announcement returns for the sample of all IT firms and perform better than simple measures of the presence of venture capital; however they generally fail to find significance within the venture backed sub-sample, probably as a result of the reduced power. For all periods, or the boom period, venture capitalists reputations act to further reduce announcement returns. This lends support to the bargaining hypothesis; one would expect venture capitalists with strong reputations to be successful bargainers. It does not rule out the real option hypothesis; it is possible that venture capitalists with strong reputations select portfolio firms that better approximate real options. However, with this evidence the bargaining argument appears the stronger and more likely explanation.

Table 4.59 below shows regressions of the three day CAR for the sample of venture backed IT firms using two measures of the characteristics of the firm prior to acquisition. The data is only available in approximately 1/5 of the cases so the tests suffer from a lack of power and this sub sample may not be representative. The two measures are the sales and net income of the target firm, both taken for the last twelve months of operation prior to the acquisition, and they are tested for the entire period, the boom period of 1990 to 1999, and the non-boom period (1980 to 1989 and 2000 to 2004).

Table 4.59: Target characteristics and the 3 day CAR for venture backed IT firms

	Spec 1 All periods N=185 (t-score)	Spec 2 All periods N=121 (t-score)	Spec 3 Boom N=86 (t-score)	Spec 4 Boom N=63 (t-score)	Spec 5 Non-boom N=99 (t-score)	Spec 6 Non-boom N=58 (t-score)
Sales prior to acquisition	-0.00 (-1.64)	-	-0.01 (-2.10*)	-	0.05 (1.24)	-
Net income prior to acquisition	-	0.04 (1.31)	-	0.00 (0.32)	-	0.37 (2.68**)
Constant	0.75 (0.78)	2.78 (0.20)	2.27 (1.43)	3.04 (1.46)	-1.37 (-0.86)	0.34 (0.16)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Despite the reduced power both raw accounting measures almost find significance in all time periods, and sales in the boom and net income in the bust are significant at the 0.1 and 0.05 levels respectively. Readers should note that for most venture capital backed IT firms the net income is negative prior to acquisition. In fact only the 90th percentile of firms had a positive net income. Sales, while typically small, must be either zero or positive. The distributions for both variables for venture backed IT firms are shown in table 4.60 below.

Table 4.60: Distribution of sales and net income for venture backed IT firms

	p10	p25	p50	p75	p90	N	μ	skewness
Sales (US$m)	0.7	3	9	22.9	40	185	59.1	13.27 ***
Net income (US$m)	-20.6	-9.4	-3.7	-0.3	1.8	121	-6.1	4.75 ***

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

The results from table 4.59 should be interpreted as follows: i) during the boom period increasing the sales of a venture backed IT firm will decrease the announcement return of the acquirer (i.e. further the venture capital effect) but during the non-boom period this will increase the announcement return (i.e. undermine the venture capital effect). ii) during the boom period the net income of a venture backed IT firm has no effect on the announcement return of the acquirer, but during non-boom periods an increased loss with decrease the announcement return (i.e. further the venture capital effect).

Higher values of sales are indicative of more advanced commercialization. The net income of a firm alone is not a measure of commercialization. A firm could be loss making because it expends its resources on the development of a technology prior to achieving sales, or because it has developed its technology and is now expending its resources in an attempt to gain a market share.

I find that during boom periods the venture capital effect is furthered by increasing the sales of the target firm and is irrespective of any loss it may have incurred. Venture capital practitioners and entrepreneurs during this period both touted the mantra "achieve market share at all costs now and capitalize on this later"; my results uphold this sentiment. However, this is in stark contrast to the real option hypothesis, which proposes that venture capital backed firms should develop technology for later commercialization by their acquirers. I remind my readers that Gompers & Xuan, who put forward the real option hypothesis, exclusively studied the boom period.

During the non-boom periods the venture capital effect was furthered by having reduced sales and incurring a larger loss. Taken together these findings indicate that venture capital backed firms expended their resources on development and did not

achieve substantial commercialization prior to acquisition. Thus it is possible that for this period a venture capital backed firm more closely resembled a real option. Together these findings add to the recent literature (e.g. Gompers, Kovner, Lerner & Scharfstein (2005)) that considered how venture capitalists reacted to the boom period of the 1990's. They provide some empirical evidence to support the notion that venture capitalists may have altered their behavior in an attempt to exploit perceived 'first mover' advantages for their firms in the quickly growing IT market.

Related to this, is the finding that venture capital backed firms are comparatively less likely to experience an acquisition during the boom period (see table 4.42 & 4.43). Drawing on the work of Kahneman & Tversky, behavioral finance might offer a explanation for this finding. Lovallo & Kahneman (2003) found that both executives and entrepreneurs are particularly prone to cognitive biases. They stated that, particularly in the context of mergers and acquisitions, "executives can over-attribute their company's strong performance to their own actions and abilities rather than to the buoyant economy". While I was unable to locate any empirical research directly addressing the topic of cognitive bias in acquisitions during the boom period, this is likely due in part to the recentness of the phenomenon, and cognitive bias seems a probable contributing factor to the disproportionate number of acquisitions.

A cognitive bias is "an error in the way that the mind processes information", which may lead to over-optimism and a tendency for individuals to exaggerate their own talents. Two additional factors are often viewed as components as of cognitive-bias: Anchoring (basing an analysis on an over-optimistic starting point) and organizational pressures (attractive proposals are more likely to be financed). I propose that all of the agents involved in the acquisitions during the boom period may have been acting under the influence of a cognitive bias.

Firstly, managers of an acquirer may have over-estimated their ability to integrate a target into their firm and to make it more valuable, and this may have been encouraged by organizational pressures. Also, they may have anchored their offer prices on the acquisition values that were taking place, making their offers very attractive to rational managers of the targets who had more realistic information about the valuation of their own firms. Together with IPO seeking behavior by venture capitalists, who may have

been experiencing similar cognitive biases of their own, this would lead to a disproportionately high number of acquisitions of non-venture backed firms.

Secondly, if investors in public markets were over-valuing firms, due to a systematic cognitive bias, the other actors could have acted rationally to exploit this. Venture capitalists achieved the highest ever number of initial public offering for their firms during the boom. With over-enthusiastic markets, particularly for information technology firms, venture capitalists may have been able to secure initial public offerings (with strong valuations) for comparatively weaker firms that, in less optimistic periods, would have achieved an acquisition at best. Likewise, managers of non-venture capital backed targets may have realized that the market valuations of their firm exceeded their private valuations and so, acting rationally, could enhance the wealth of their shareholders by selling their firms. This line of reasoning is similar to that used in Rhodes-Kropf & Viswanathan (2003), who considered the correlation between (public firm) merger waves and market valuations.

From the acquiring firms' perspective, (as in Gilchrist, Himmelberg, & Huberman (2005), and Bruner (2005)), the optimistic market valuations of the boom period may have signaled to rational managers that they should exploit this passing sentiment. Myers & Majluf (1984) found that equity issuances tend to occur when stock valuations are high and Shleifer & Vishny (2001) recognized that acquisitions purchased with stock are equivalent to an equity issuance by the buyer. These factors together indicate that acquirers may have sought to acquire a disproportionate number of firms during the boom period, and coupled with the venture capitalists' preference for initial public offerings, may explain the high frequency of non-venture capital backed acquisitions.

I regard my examination of the boom effect as one of the major contributions of this research; however, I note that I am unable to provide conclusive evidence as to the causes of the apparent change in behavior of the venture capitalists, the acquirers and the managers of the targets. I thus suggest that this should be an interesting topic for future research. To complete this results section, I now return to an analysis of the pre-operational characteristics of the target firms.

Table 4.61: R&D expenditure and the 3 day CAR for IT firms

	Non-venture backed IT firms		Venture backed IT firms	
	N=16 (t-score)	N=18 (t-score)	N=15 (t-score)	N=17 (t-score)
R&D expenditure for last 12 months	-0.18 (-8.22***)		-0.30 (-0.42)	
R&D expenditure one year previous		-0.18 (-8.80***)		-0.50 (-0.74)
Constant	6.30 (2.62**)	5.94 (2.75**)	-0.59 (-0.17)	-0.69 (-0.24)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

Table 4.61, above, considers the effect of the R&D expenditure of the target on the cumulative abnormal returns of the acquirer. In a final presentation of evidence against the real option hypothesis I note that despite the paucity of data on R&D expenditure, it is a significant predictor of returns for non-venture backed IT firms but not for venture backed IT firms (using the value for either the last twelve months of operation prior to acquisition or for one year previously). Furthermore, a probit analysis confirms that R&D expenditure is a negatively associated component of the presence of venture capital for IT firms. These results are shown in tables 4.61 (above) and 4.62 (below).

Table 4.62: Probit examining R&Ds role in the presence of VC for IT firms

Variable	Last twelve months of operation N=31 (t-score)	One year previously N=35 (t-score)
R&D Expenditure	-1.62 (-2.06**)	-1.61 (-2.08**)
Constant	4.05 (0.17)	3.76 (0.17)

***, **, * = significant at the .01 level, .05 level, and .10 level respectively.

A primary premise of the real option hypothesis is that venture capital backed firms are more R&D intensive than their non-venture capital backed counterpart. The

finding that R&D expenditure is significantly negatively associated with the presence of venture capital for IT firms, even given that the very small sample may not be random and representative, lends support to exactly the opposite conclusion.

CHAPTER V Conclusion

5.1 Conclusion

This thesis has examined the short-term announcement returns associated with acquisitions of entrepreneurial US private firms by US public firms listed on the NYSE, Nasdaq and Amex markets, made between 1980 and 2004. It undertook this examination, using an event study methodology, with the express purpose of considering the impact of the presence of venture capital in the target firm on the acquirer's announcement returns. The recent literature (Gompers & Xuan (2005) and Brander & Egan (2005)) has provided two theories of venture capital participation – the real option hypothesis and the bargaining hypothesis - each of which had testable implications for the short term announcement returns; the primary objective of this research was to establish which of these theories is more feasible. While there is a considerable literature (see the literature review chapter) on the role of venture capitalists in the initial public offerings of their firms, the literature on venture capital backed acquisitions is, at the time of writing and to the best of my knowledge, limited to two unpublished papers and this thesis.

One might consider that acquisitions are more important that initial public offerings to venture capitalists for two reasons. Firstly a venture capital backed firm is more likely to be acquired that to experience an initial public offering. A recent industry report (Hellmann, Egan & Brander (2005)) showed that in the 1997 to 2004 time period, which includes the strongest IPO market in the history of venture capital, acquisitions out numbered IPOs approximately two to one for US venture capital backed firms. Secondly, while acquisition transaction values are typically lower than the market capitalizations achieved at IPO, the relative abundance of acquisitions means that (US) venture capitalists earn the majority of their income from such events.

Furthermore, the dynamics of an acquisition differ from those of an IPO, making this a different and interesting area of new research. The founders and managers of a firm experiencing an initial public offering retain (or perhaps regain) control of their firm and face new challenges in the pursuit of long term success. Whereas in an acquisition the

executives generally lose control over their firm's future and may stay with the acquirer only as long as contractually required or as long as their incentives are suitably aligned. Thus one might expect that an acquisition is more an exercise of venture capitalists control rights than an IPO, which is a mutually successful outcome for both the executives of the portfolio firm and the venture capitalists.

Initial public offerings rely on underwriters, auditors and other parties that each independently examine and certify the firm. Prior research (e.g. Megginson & Weiss (1991)) has found that venture capitalists participate both directly and indirectly in this process by certifying the firm themselves and by using their reputations to attract higher quality third parties. In an acquisition the venture capitalists generally act alone. They may approach potential acquirers, negotiate with them and sell their firm without the assistance of any third party or even the managers of the firm itself.

Thus this thesis is only an introduction to this topic area. While the hypotheses represent interesting and important research questions, perhaps more important is the generalization one can make from the findings. I am able to determine that the presence of venture capital has a very highly significant effect on the short term abnormal returns accruing to the acquirer for both IT firms and non-IT firms. I do not consider the long term performance of the acquirer, the interaction between the managers of the target firm and their venture capitalists before, during and after the event, the similarities and differences between firms that achieve an IPO and those that experience an acquisition, or any other important aspects of this new area. However, I have determined, in one limited context, that venture backed firms are different from other entrepreneurial ventures when considered as acquisition targets.

In this chapter I will explore the support for each of my two hypotheses and attempt to determine which is more feasible. I will then provide several other key findings and the theoretical implications of my research. In the process of the literature review I uncovered numerous important exogenous and control variables that have previously been found to influence announcement returns. I will examine my findings on each of these, providing my support for prior theories or possible causes for any inconsistencies. I will also state my contribution to the body of knowledge and explore my evidence to support the generalization that the presence of venture capital is an

important consideration in acquisitions. The chapter concludes with some limitations and directions for future research.

5.2 The research question

The primary research question considers whether the presence of venture capital in the target has an effect on the short term announcement returns of the acquirer, and whether this effect is better explained by either the bargaining or the real option hypothesis. These hypotheses are presented below before I restate my findings.

The bargaining hypothesis, put forward in Brander & Egan (2005), proposes that at the time of an acquisition venture capitalists play a value-added role in the firms that they have financed by negotiating with potential acquirers. This hypothesis predicts that abnormal announcement returns accruing to the acquirer will be reduced when the target is venture capital backed; it proposes that venture capitalists will successfully bargain for any surplus value created in the acquisition, reducing the surplus accruing to the acquirer, and that the acquirer's investors will react to this accordingly. Furthermore, the bargaining hypothesis argues that bargaining ability will be related to the experience of the venture capitalists, and so predicts that this bargaining effect will be stronger in the IT sector where venture capitalists have invested the majority of their funds and have considerable track records.

The real option hypothesis, put forward in Gompers & Xuan (2005), proposes that acquisitions of venture backed firms are more for future potential than acquisitions of other entrepreneurial targets; venture capitalists may select firms that are more R&D intensive and so less mature at acquisition. The implication is that venture capital backed firms are acquired for their technology, which given further expenditure and opportune circumstance, may be later realized by the acquirer. Therefore they closer approximate a real option and their valuation is subject to greater uncertainty. Because of this, in a multiple bidder context, the winner's curse will be more pronounced for venture backed firms, and the acquirer's investors will be more likely to believe that their firm has overpaid for its target. Thus announcement returns should be reduced, or possibly negative, when venture capitalists are present in the target.

The overall finding is that the presence of venture capital in the target does act to influence announcement returns for acquisitions of both IT and non-IT firms. For acquisitions of IT firms the presence of venture capital reduces abnormal announcement returns, but for acquisitions of non-IT firms it increases them. In aggregate, because the frequency of venture backed acquisitions (870 IT firms vs. 590 non-IT firms) and the magnitude of effects (-1.4% for IT firms vs. +0.9% for non-IT firms) are not too disproportionate for these two groups, the results cancel each other out, leaving no significant announcement return effect attributable to the presence of venture capital for the entire sample.

Neither hypothesis can explain the finding for non-IT firms, as neither hypothesis had predicted that the presence of venture capital would increase returns. However, this finding can not be used to reject the hypotheses. The bargaining hypothesis had a priori sector specific expectations for the IT sector; it is entirely possible that without extensive experience in the sector of their firm venture capitalists are unable to bargain effectively, and that other factors come into play. This result requires another theory regarding the role of venture capital in acquisitions as (in unreported tests) I found that the venture capital effect for non-IT firms is robust to the inclusion of my exogenous and control variables. However, no such theory is available from the literature and it is beyond the scope of this research to propose new theories.

For the real option hypothesis I can present two rationales of the result for non-IT firms. Firstly, in an analysis of the pre-operational characteristics of the target firms I found that IT firms appear more immature than non-IT firms, irrespective of the presence of venture capital, and that the difference in maturity between venture capital backed firms and other entrepreneurial ventures is more pronounced for IT firms. Accordingly it is possible that venture capital backed IT firms may closer represent real options than their non-IT counterparts, and so that the real option hypothesis may only hold for this group.

Secondly, I found in my analysis that acquirers of venture backed non-IT firms typically have fewer direct competitors than acquirers of venture backed IT firms. In the hypothesis, methodology and data chapter I stated that the number of bidders and the relative uncertainty in valuations are the two primary causes of the winner's curse. With a

reduced number of bidders the curse is weakened and investors will be less likely to believe that their firm has overpaid for its target. This would leave two explanations for the increased return: That it is a reflection of the increased uncertainty in the valuation of the target (as in Myers & Majluf (1984)) or that the real option effect is reduced and other factors come into play.

For IT firms, my finding that the presence of venture capital produces a 1.4% decrease in three day cumulative abnormal announcement return of the acquirer supports both hypotheses. In the literature review chapter I assembled a large list of factors that have previously been shown to be important predictors of the abnormal announcement returns in acquisitions. The effect due to the presence of venture capital is robust to the inclusion of all of these variables, except a measure of the size of the acquiring firm (total assets). The inclusion of the total assets of the acquiring firm reduced the effect of the presence of venture capital by about 0.5%, making it insignificant in one multivariate specification.

The literature (e.g. Loderer & Martin (1990) and Moeller, Schlingemann & Stulz (2004 & 2005)) has documented that larger firms tend to overpay for their targets, resulting in reduced abnormal return. Thus when the acquirer is large the real option effect, which also predicts that acquirers will overpay, may be a secondary consideration. Likewise I determined that the size of the acquirer was a predictor of the presence of venture capital. Thus venture capitalists may seek out large acquirers for their firms precisely because they are known to overpay and this may be an alternative to bargaining over any surplus value.

In order to determine which of the bargaining and real option hypotheses is more feasible I examined the effect of the reputation of the venture capitalists. My finding that measures of the reputation of venture capitalists act to reduce announcement returns for the sub sample of acquisitions where the target was a venture backed IT firm, lends comparatively more support to the bargaining hypothesis. This result appears to confirm a basic premise of the bargaining hypothesis; bargaining ability should be related to experience. However, it is also possible that more experienced venture capitalists select firms that better resemble real options, and so this finding can not be used to rule out the real option hypothesis.

Drawing on the observation that venture capitalists disproportionately seek acquisitions for their firms when IPO markets are poor, one might expect that the venture capitalists' bargaining ability would be strongly undermined by their need to exit an investment at all costs. I found that a measure of reputation was a significant predictor (at the 0.1 level) of announcement returns during the boom period but not during the other periods, which provides empirical evidence to support this new supposition.

For a very small number of IT target firms (31 out of 4,351) I had some data on the R&D expenditure for of the last twelve months of operation prior to acquisition, or the year preceding this (35 observations). For venture backed firms the R&D expenditure was not a predictor of abnormal returns, but for the non-venture backed firms R&D expenditure was a very highly significant predictor of abnormal returns (at the 0.01 level). Furthermore, in a probit analysis I was able to demonstrate that R&D expenditure is a highly significant (0.05 level) negatively contributing component of the presence of venture capital. These findings directly contradict a key proposition of the real option hypothesis: that venture capital backed firms are more R&D intensive than other entrepreneurial ventures. However, the sample is very small, the data likely suffers from self-reporting bias, and these firms may not be representative of all IT acquisition targets. Thus, while I report these results, the real option hypotheses can not be rejected on this basis.

I found venture backed firms are more likely to be paid for in either stock or a mix of cash and stock supporting the proposition that acquirers of a real option will need to provide incentives to tie in managers and developers capable of realizing the option. However, this does not undermine the bargaining hypothesis as it made no proposal regarding the payment method, and as limited partners may be equally willing to accept publicly traded stock (a liquid commodity that they already hold) to cash. I also found that venture backed firms command higher transaction values. This could be regarded as successful bargaining if it took into account the differences in firm quality, but I had insufficient measures of firm quality to attempt this. Finally, the finding that venture backed IT firms are more likely to be acquired by a firm within their sector provides equal support to both hypotheses. It is both easier for an IT acquirer to realize an IT real option, and for venture capitalists to locate and negotiate with an IT firm.

Overall, within IT firms, I find results that support both the bargaining and the real option hypotheses and no results that allow me to firmly reject either hypothesis. I would suggest that there is comparatively more support for the bargaining hypothesis, and my results are at least suggestive that one important value-added role of venture capitalists is to bargain with potential acquirers on behalf of their IT firms. I would add that my findings differ from those of Gompers & Xuan who found that acquisitions of venture capital backed firms for stock produced negative returns. Negative returns are much more strongly suggestive of the real option hypothesis. That my venture capital effect causes a reduction in announcement returns but leaves them either positive or not significantly different from zero, brings into question both the findings of Gompers & Xuan and the real option hypothesis that they proposed.

To conclude this section I note that there are two additional hypotheses that have not been considered. First, inline with the findings of the literature, venture capitalists may use their reputations to certify their firms to potential acquirers. This would reduce the information asymmetry inherent in a valuation and hence reduce the abnormal returns (as in Myers & Majluf (1984)). This is very similar to the certification hypothesis put forward for IPOs by Megginson & Weiss (1991), the monitoring hypothesis examined in acquisitions by Chang (1998), and the general 'venture capital as information asymmetry reduction agents' literature epitomized in Chan (1993), Gompers (1995), Lerner (1995), Amit, Brander & Zott (1998) and others.

Second, because of the information asymmetry that may exist between an acquirer and a target, it is possible that venture capitalists are engaging in adverse selection or at least that the acquirers investors believe that the venture capitalists have engaged in adverse selection. This would also act to reduce abnormal announcement returns. Adverse selection (see Akerlof (1970)) has been explored in several aspects of the venture capital literature (e.g. Cumming (2005), Kaplan & Strömberg (2003) and Amit, Brander & Zott (1998)), and to some degree in the context of IPOs by Xi & Masulis (2004). Generally no evidence of adverse selection by US venture capitalists is found, however, all of my evidence is as consistent with both of these alternative hypotheses as it is with the bargaining hypothesis.

5.3 Implications for theory

This research would typically be classified as contributing to the finance, strategy and entrepreneurship disciplines. There is now an extensive literature on both acquisitions and venture capital, and this research is directly relevant to both areas. However, I propose that it also contributes to the Management Information Systems research area.

The MIS discipline has struggled to define itself, in part because it is a young discipline facing an ever evolving topic matter. A recent prominent paper addressing this problem (Benbasat & Zmud (2003)) stated "after 30 years, insufficient progress has been made in establishing [MIS's] identity". However, a narrow view of MIS has emerged in the literature (e.g. Orlikowski & Iacono (2001) and Benbasat & Zmud (2003)) that considers only research focusing directly on the 'IT artifact' and its immediate nomological network as MIS.

An IT artifact is conceptualized as "the application of IT to enable or support some [business] task(s) embedded within a [business] structure(s) that itself is embedded within a [business] context(s)". Note that the word 'business' has been added for clarity and was not included by the original authors. Furthermore only research that considers the conceptualization, construction, implementation, evolution, usage or support of an IT artifact (or any other interplay between the artifact and its business context) is regarded as strictly relevant.

Hence, under the narrow view, MIS should consider only the business interaction of information technology with some business component inside of the firm. The only three finance oriented papers I could locate that were published in the mainstream MIS literature (Matlin (1979), Chatterjee, Richardson & Zmud (2001) and Dehning, Richardson & Zmud (2003)) all used event studies to examine the value created by announcements of internal IT-related events. However, many practitioners and academics do take a broader view of MIS.

Academic disciplines within business research are predominantly of two types: Those that focus on a methodology (such as finance or accounting), and those that focus on an industry (such as transportation and logistics or real estate). MIS is a discipline that

uses outside methodologies and applies them to the study of IT artifacts in a business context. Thus MIS should be considered an industry focused discipline. Under this broader view, an IT firm itself could be considered an IT artifact. As my research considers the financing and acquisition of start-up IT firms, which develop and commercialize information technology, it could then be said to consider directly the conceptualization, construction, implementation, evolution, and usage of an IT artifact.

In the remainder of this section I consider the contributions of this research to the literature on acquisitions and venture capital participation. I begin by considering three generalizations of my findings and their relationship with venture capital participation theories.

Firstly, I find a difference in effect attributable to the presence of venture capital on acquisition announcement returns for IT and non-IT firms. I have reported that the effect due to the presence of venture capital is robust to the inclusion of numerous exogenous and control variables for both groups, and that for IT firms it reduces announcement returns while for non-IT firms it increases them. Furthermore I have noted that acquisitions of IT firms are characterized by a horizontal or vertical strategic fits and by high competition for the acquirer, whereas acquisitions of non-IT firms are predominately acquired in conglomerate acquisitions and by acquirers who face comparatively lower competition. I now make the generalization that there are systematic differences in the effect of venture capital for these two groups and that these differences may not be limited to announcement returns, or even other acquisition characteristics.

Venture capitalists have long track records in IT and often little experience in other sectors. I believe that this is likely to have an impact on their other interactions with their portfolio firms, not just during an acquisition negotiation. This is the first venture capital research that I am aware of to place primary importance on the sector of the firm. As most samples of venture capital portfolio firms are dominated by IT firms (usually on the order of 2:1), many of the results in the literature may only apply to the IT sector. Controlling for industry effects using three digit SIC codes, as is most common, does not address this problem; three digit SIC groupings contain mixes of IT and non-IT firms.

Secondly, in the context of acquisitions, venture capital does not appear to be interchangeable with other forms of finance. If one accepts that the results are due to the

bargaining hypothesis or some certification effect, then venture capitalist add value to their firms as well as providing finance. This added value is at least partially dependent on the reputations of the venture capitalists. Informal equity investors like friends and family, and even angel investors, may add value but do not have reputations that an acquirer would recognize and so can not fulfill this role. Banks and other providers of commercial finance do have reputations but generally do not provide added value services.

However, if I had found that the real option hypothesis was the best explanation of the announcement return effect, then perhaps venture capital could have been considered interchangeable with other forms of finance. The real option hypothesis proposes that venture capitalists will select investments that closer approximate real options. If a firm that meets the same criterion were to receive financing from another source, it would not cease to resemble a real option. Rather I would have to state that no other identifiable group of financiers chooses to invest in real options en masse.

Thirdly, the reputation of venture capitalists was shown to further reduce announcement returns of venture capital backed IT firms during the boom period. Thus I conclude that venture capitalists, as a type of financier, are not homogeneous. As I have stated, the recent literature (e.g. Sorensen (2004)) has provided examples of the heterogeneous nature of venture capitalists in other contexts. However, in making a generalization concerning heterogeneity, I would assert that the period of consideration may be of importance.

When market factors prevent superior venture capitalists from gaining superior returns through added value, other factors (like allocations of control rights) may come into play or one venture capitalist may be largely indistinguishable from another. I have provided some evidence to support the notion that venture capitalists may actively seek acquisitions when the market for IPOs is poor. Approximately 40% of venture backed acquisitions in my sample occurred after the dot-com crash, compared with just 21% of non-venture backed acquisitions. This may be to the detriment of, or irrespective of, their reputations.

This research has confirmed or questioned numerous findings from the literature on factors that influence returns to announcements of acquisitions for all firms, IT firms

and non-IT firms. It has also ranked the effects of these factors, as well as the effect of the presence of venture capital, in terms of their magnitudes in the context of acquisitions of private US IT firms by public US firms. The remainder of this sector is devoted to a statement of these findings, and a brief consideration of the different effect of venture capital for non-IT firms.

Overall I find that, providing one considers the sector of the target firm, the presence of venture capital is the most important determinant of announcement returns. For IT firms the presence of venture capital reduces the acquirer's announcement returns by 1.4% and for non-IT firms it increases them by approximately 0.9%.

Asquith, Bruner, Mullins (1983) found that the relative size of the target was the most important determinant of returns to the acquirer in the context of public firm with public firm mergers. I find that it produces a 0.73% announcement return effect for IT firms that is robust to the inclusion of all other variables except for the total assets of the acquirer. It is intuitively obvious that the relative transaction value should be an important determinant of returns. One should not expect a large return response to be associated with a very small (and hence largely immaterial) acquisition. The magnitude of the effect is somewhat reduced for non-IT firms (to 0.56%), but this remains an important consideration in acquisitions of all private firms.

For IT firms the payment method is the next most important factor; the presence of stock in the payment increases the announcement return by 0.65%. Huang & Walkling (1987), Fuller, Netter & Stegemoller (2002), Chang (1998) and others have found that acquisitions for stock produce greater returns that acquisitions for cash. I confirm this finding. However, these authors expected and reported that acquisitions for cash produce no abnormal announcement returns. For Huang & Walkling (1987) this finding was in the context of mergers, but for Chang (1998) this was found to hold for acquisitions of private firms.

The literature reasons that acquirers only pay in cash when they are certain of the valuation. Without uncertainty there is no reason for investors to believe that the combination of the two firms will be worth more or less than the value of the firm before the payment and the payment itself, and so no abnormal return. However, I can not support this claim; I find reduced but still positive and significant returns for

announcement of acquisitions of both IT firms and non-IT firms when the transaction is paid in cash alone.

There was a distinct boom effect associated with acquisitions in the 1990 to 1999 period, which exhibited higher abnormal returns by approximately 0.6% for IT firms and almost 1% for non-IT firms. This confirms several of the key findings of Moeller, Schlingemann & Stulz (2004 & 2005). My sample covered 25 years allowing me to analyze the 1980s, the boom of the 1990s and the bust that followed, as well as to make comparisons between these periods. I regard this as one of the major contributions of my research. The failure to consider the non-boom period was one of the weaknesses of Gompers & Xuan's analysis of this topic.

In addition, I have reported that there were comparatively few venture capital backed acquisitions during the boom period, and a disproportionately large number of non-venture backed acquisitions. With reference to the literature (Gilchrist, Himmelberg, & Huberman (2005), Bruner (2005), Rhodes-Kropf & Viswanathan (2003), Lovallo & Kahneman (2003)) I have put forward two possible explanations of this finding.

Firstly, managers of the acquirer may have acted rationally in response to the over-optimism of their investors, by using their inflated stock values to make acquisitions. Likewise, venture capitalists may acted rationally by exploiting public-market enthusiasm to secure IPOs for their firms. Together this would increase the number of non-venture backed acquisitions.

Secondly, managers of the acquirer may have acted irrationally, succumbing to cognitive bias, by overestimating the potential value of a target post acquisition and anchoring their offers on concurrent (and inflated) transaction values. Likewise venture capitalists may have overestimated the size of new markets and sought IPOs for firms that were better suited to acquisitions or would later fail (though the price venture capitalists have paid for any such action is currently unknown, and it may have been to their benefit). Again, taken together these factors would increase the number of non-venture backed acquisitions. It is likely that a combination of both the first and the second explanations presented partially contribute to the finding. However, it is also likely that other factors are the dominant influence in this result, and so I suggest this as an area of future research.

For IT firms, two characteristics of the acquirer are the next most important factors in predicting abnormal announcement returns to acquirers. Both the total assets and the leverage of the acquirer reduce announcement returns by approximately ½ of 1%. I support the findings of Loderer & Martin (1990) who claimed that large firms over pay for their targets. I also support the findings of Maloney, McCormick & Mitchell (1993) who proposed that leverage, as a measure of the firms' available cash, would be a strong and significant predictor of announcement returns. Furthermore, I found that the leverage of the acquirer was also endogenous to the presence of venture capital; venture capitalists apparently do seek out large, cash rich acquirers for their firms.

Morck, Shleifer & Vishny (1990), and Bradley, Desai & Kim (1988), Kusewitt (1985), Chaterjee (1986) and Hopkins (1987) found that the strategic fit between the target and the acquirer and the number of competitors that an acquirer has, respectively, were strong predictors of the abnormal returns. I can not support these findings for IT firms. While conglomerate acquisitions produced an approximately 0.4% increase in returns in my sample, this effect was not statistically significant. My measure of competitors was somewhat imperfect, representing the number of firms in the same six digit NAIC code rather than the actual number of competing bidders, and it produced a disappointing 0.15% increase in returns. However, I determined that both of these factors are components of the presence of venture capital. Venture capital backed firms are more likely to be acquired by a firm in the same industry (i.e. not in a conglomerate acquisition) and by a firm that has a larger number of direct competitors. Furthermore, in a multivariate context the number of competitors did become significant producing an approximate 0.4% increase. Thus this is an important consideration for IT firms once other effects are controlled for.

Finally I note that the location of the target was not a predictor of returns but was endogenous to the presence of venture capital as well. The merger and acquisition literature had considered location as a determinant of returns in an international context, but, with the majority of venture backed firms being located in California and Massachusetts, it was appropriate to consider state effects in this research.

My findings for acquisitions of privately held IT firms, and the expected findings from the literature, are summarized in table 5.1 below.

Table 5.1: Thesis findings for private IT targets compared with the expected findings from the literature

Variable	References	Literature Context	Literature Effect	Actual Effect	Result
Presence of Venture Capital	Gompers & Xuan (2005)	Acquisitions of private firms	Reduces abnormal returns. For stock purchases abnormal returns are negative	For IT firms the returns are reduced, but non-IT firms they are increased. The payment method does not affect this.	Literature findings are overturned.
Relative Transaction Value	Asquith, Bruner, Mullins (1983)	Mergers of public firms	Larger transactions produce larger returns	Larger transactions produce larger returns	Literature findings are supported.
Payment Method	Huang & Walkling (1987), Fuller, Netter & Stegemoller (2002), Chang (1998), Gompers & Xuan (2005)	Mergers of public firms, and acquisitions of public and private firms	Payment for stock produces a positive return. Payment for cash produces no return. There is a significant difference between payment method effects.	Both payment methods produce positive returns. Payment in cash produces significantly lower returns.	The literature findings are partially supported, but modified for private IT targets.
Boom Effect	Moeller, Schlingemann & Stulz (2004 & 2005)	Mergers and acquisitions of public firms	Increased returns in the boom period.	Increased returns in the boom period.	Literature findings are supported.
Total Assets (Acquirer)	Loderer & Martin (1990)	Acquisitions of public firms	Large firms over pay (which reduces returns)	Large firms over pay (which reduces returns)	Literature findings are supported.
Leverage (Acquirer)	Maloney, McCormick & Mitchell (1993)	Acquisitions of public firms	High leverage reduces returns.	High leverage reduces returns.	Literature findings are supported.
Strategic Fit	Morck, Shleifer & Vishny (1990), Gompers & Xuan (2005)	Acquisitions of public and private firms	Conglomerate acquisitions produce lower returns.	Conglomerate acquisitions produce higher returns, but this is not significant.	Literature findings are not supported for private IT targets.
No. of Competitors (Acquirer)	Bradley, Desai & Kim (1988), Kusewitt (1985), Chaterjee (1986), and Hopkins (1987)	Mergers and acquisitions of public firms	Higher competition reduces returns.	Higher competition increases returns, but this is not significant.	Literature findings are not supported for private IT targets.
Home State (Target)	Not considered	Not considered	No expected effect.	Being in a 'prominent' venture capital state reduces returns, but this is not significant.	Lack of significance does not allow a contribution to the literature.

As previously stated, one of my major findings is that the effect of the presence of venture capital is completely different for IT and non-IT firms. For non-IT firms the presence of venture capital systematically acts to increase the acquirer's abnormal announcement returns (rather than decrease them), and this effect is likewise robust to the inclusion of the control and exogenous variables. Furthermore my findings are qualitatively robust to changes to the definition of the IT sector to include all high-tech firms, thus non-IT firms could also be considered to be non-high tech firms.

The four major differences between non-IT firms and IT firms found in this analysis were that non-IT firms were involved in acquisitions that had: 1) a lower number of direct industry competitors for the acquirer, 2) a higher proportion of stock in the payment method, 3.) a higher likelihood of a conglomerate strategic fit, and 4.) a much more mature target. I have demonstrated that all of these factors are likely to increase returns on their own, and they are listed above in the order of the magnitude of their effects. After controlling for the number of competitors that an acquirer faced at the time of the acquisition, I found that for non-IT firms the presence of venture capital did act to reduce returns. Furthermore, in unreported tests, I found that non-IT firms secure significantly lower relative transaction values but comparable absolute transaction values, though it is unclear what effect this would have on returns.

Venture capitalists typically invest in high-growth firms capable of yielding the large internal rates of return that they demand from their investments. They typically also add considerable value to their firms through their networks and expertise. My findings are at least suggestive that venture capitalists select and/or behave differently in investments outside of the IT or high-tech sectors. While I can not provide an explanation of the effect of venture capital on the abnormal announcement returns of acquirers of non-IT firms, I would recommend that future research examine other aspects of venture capital participation in firms from these sectors; particularly with a view to determining whether these investments are as profitable and whether venture capitalists play very different roles.

5.4 Limitations and further research

All of the primary findings reported in this research are relatively robust; very similar results can be found using different event windows and different methods of calculating abnormal returns. Likewise, the results are largely robust to changes in the definition of the IT sector and very similar results are found using a broader high-tech mapping. Only results that depend upon the use of the pre-acquisition operational characteristics of the target firms should not be considered robust as they rely on self-reported data and the sample sizes are invariably small.

The magnitude of the venture capital effect for IT firm was essentially unchanged by the inclusion of exogenous and control variables, with the notable exception of the total assets measure. Despite the difficulties inherent in conducting an event study, I feel confident that the presence of venture capital is a crucial determinant of announcement returns.

Perhaps the largest limitation of this research is that it considers only short term announcement returns. In unreported tests I found that, in accordance with the findings of Moeller, Schlingemann & Stulz (2004 & 2005), long term returns are invariably negative for any acquisition, but I made no detailed analysis of the causal factors of the magnitude or duration of this poor performance.

Other limitations include that it uses only published acquisitions data that may under represent small acquisitions, that it considers only acquisitions of US private firms by US public firms, and that it depends upon primary NAIC codes to represent the target firms' major area of operation. An acquirer is under no legal obligation to disclose acquisitions below a certain threshold and as small acquisitions produce small effects (e.g. Asquith, Bruner, Mullins (1983)) this research may over state the abnormal returns. Likewise, acquisitions in other jurisdictions have been found to differ from those in the US, and venture capital participation theory (e.g. Li & Masulis (2004)) has also noted international differences in the use of reputations. As a result I do not expect my results to hold outside of the US. Only the use of the NAIC code is a minor limitation. As the targets are small and highly specialized it is likely that they will have one core area of operation.

To the best of my knowledge, this thesis and two unpublished papers represent the entire literature on venture capital backed acquisitions. Meanwhile the literature on venture capital backed initial public offerings is now large and well developed (see the literature review chapter). An acquisition is a more likely exit event for a venture capital backed firm (on the order of 2:1 compared with IPOs) and venture capitalists earn the majority of their income from acquisitions not IPOs. I therefore believe that this topic should be an area of much future research.

Of particular interest are the differences in control rights allocated to venture capitalists in firms that are acquired with respect to firms that achieve IPOs, as well as the nature and timing of financing milestones, the value added roles of venture capitalists, and the differences in product and operational characteristics of firms from these two groups. I would also recommend a comparison of the long term stock and operational performance of an acquirer of a venture backed firm with an acquirer of other entrepreneurial firms, and a further analysis of the role of research and development and commercialization of a technology in venture capital backed acquisitions. While Gompers & Xuan touched on the last two of these topics, my research brings their results into question.

Bibliography

AeA [American Electronics Association, www.aeanet.org] (February 2003), "Defining the High Tech Industry". www.aeanet.org/Publications/idmk_naics_pdf.asp?bhcp=1

Aghion, P., Bond S., Klemm A. & Marinescu I. (2004), "Technology and Financial Structure: Are Innovative Firms Different?", Journal of the European Economic Association, 2: 277 - 288

Akerlof, G. A. (1970), "The Market for Lemons: Qualitative Uncertainty and the Market Mechanism.", The Quarterly journal of economics, 84(3), 488 - 500.

Amit, R., Brander J.A., & Zott C. (1998), "Why do Venture Capital Firms Exist? Theory and Canadian Evidence", Journal of Business Venturing, 13: 441-466

André, P., Kooli M. & L'Her J.F. (2004), "The Long-Run Performance of Mergers and Acquisitions: Evidence from the Canadian Stock Market", Financial Management, Vol. 33, No. 4, Winter.

Asquith, P. & Kim E.H. (1982), "The Impact of Merger Bids on the Participating Firms' Security Holders", Journal of Finance, vol. 37, no. 5, pp. 1209-1228.

Asquith, P, Bruner R., & Mullins D. (1983), "The gains to bidding firms from merger", Journal of Financial Economics 11, 121-139

Barry, C.B., C.J. Muscarella, J.W. Peavy III, & M.R. Vetsuypens (1990), "The Role of Venture Capital in the Creation of Public Companies: Evidence from the going public process", Journal of Financial Economics, 27: 447-471

Bascha, A., & Walz U. (2001), "Convertible Securities and Optimal Exit Decisions in Venture Capital Finance", Journal of Corporate Finance 7, 285-306.

BC STATS [www.bcstats.gov.bc.ca] (2001), "Defining the British Columbia High Technology Sector Using NAICS", December www.bcstats.gov.bc.ca/data/bus_stat/busind/hi_tech/NAICSdef.pdf

BCTIA [British Columbia Technology Industry Association, www.bctia.org] (September 2004), "An Integrated Strategy for British Columbia's Technology Clusters", www.bctia.org/files/White_Paper/An_Integrated_Strategy_for_BC_Technology_Clusters.pdf

Beatty, R.P., and Ritter J. (1986), "Investment banking, reputation, and the underpricing of initial public offerings", Journal of Financial Economics 15, pp. 213-232

Benbasat, I. & Zmud R. (2003), "The Identity Crisis Within The Is Discipline: Defining And Communicating The Discipline's Core Properties", MIS Quarterly Vol. 27 No. 2, June pp. 183-194

Berger, N, A. and Udell F, G. 1998, "The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle", Journal of Banking & Finance, vol. 22, no. 6-8, pp. 613.

BLS [Bureau of Labor Statistics, stats.bls.gov] (July 2005), "High-technology employment: a NAICS-based update", Monthly Labor Review, stats.bls.gov/opub/mlr/2005/07/art6full.pdf

Booth, J. R. and Smith R. L. (1986), "Capital raising, underwriting and the certification hypothesis", Journal of Financial Economics 15, pp. 261-281

Bouresli, A.K., Davidson, W.N.,III and Abdulsalam, F.A. (2002), "Role of Venture Capitalists in IPO Corporate Governance and Operating Performance", Quarterly Journal of Business and Economics, vol. 41, no. 3/4, p. 71.

Bradley, M., Desai, A. and Kim, E.H. (1988), "Synergistic gains from corporate acquisitions and their division between the stockholders of target and acquiring firms", Journal of Financial Economics, vol. 21, no. 1, pp. 3-40.

Bradley, D., Jordan B., Roten I., and Yi H. (2001), "Venture capital and IPO lockup expiration: An empirical analysis," Journal of Financial Research, 24, pp.465-493.

Brander, J.A. & Egan E.J. (2005), "Returns to Acquisitions in the Information Technology Sector: Venture Capital and the Bargaining Hypothesis", University of British Columbia, Working Paper

Brander, J.A., Amit R., and Antweiler W. (2002) "Venture-Capital Syndication: Improved Venture Selection vs. the Value-Added Hypothesis", Journal of Economics and Management Strategy 11, no. 3:423-52.

Brav, Alon, Paul A. Gompers (1997), "Myth Or Reality: The Long-Run Underperformance Of Initial Public Offerings Evidence From Venture And Non Venture Capital-Backed Companies", Journal of Finance, Vol. 52, No.5: 1791-1821

Bruner, Robert F. (2005), "Profiles of the Outlying M&A Transactions, 1985 to 2000", SSRN, March 6, http://ssrn.com/abstract=681282

Carter, E.E. (1971), "A Behavioral Theory Approach to Firm Investment and Acquisition Decisions", Journal of Finance, vol. 26, no. 3, pp. 788-789.

Chan, Y. (1983), "On the Positive Role of Financial Intermediation in Allocation of Venture Capital in a Market with Imperfect Information", Journal of Finance, vol. 38, no. 5, pp. 1543-1568.

Chang, Saeyoung (1998), "Takeovers of Privately Held Targets Methods of Payment and Bidder Returns", Journal of Finance, Vol. 52, No.2: 773-784

Chatterjee, D., Richardson V.J. & Zmud R.W. (2001), "Examining The Shareholder Wealth Effects Of Announcements Of Newly Created Cio Positions" MIS Quarteriy Vol. 25 Wo. 1. March, pp. 43-70

Chatterjee & Sayan (1986), "Types of Synergy and Economic Value: The Impact of Acquisitions on Merging and Rival Firms", Strategic Management Journal, vol. 7, no. 2, pp. 119.

COMPUSTAT Balance Sheet and Income Statement Extracts [wrds.wharton.upenn.edu/ds/comp/tools/finstateextract.shtml], data downloaded August 2005.

Conrad, J., & Kaul, G. (1993), "Long-term Market overreaction or biases in computed returns?", Journal of Finance, XLVIII, 1.

Coutts J.A., Mills T.C., & Roberts J. (1994), "The market model and the event study method: A synthesis of the econometric criticisms", International Review of Financial Analysis, 1994, vol. 3, issue 2, pp. 149-171

CRSP Daily Stock [wrds.wharton.upenn.edu/ds/crsp/dsf], data downloaded August 2005.

Cumming, D.J. (2005), "Adverse Selection and Capital Structure: Evidence from Venture Capital", February 25, University of New South Wales Working Paper, Available at SSRN: http://ssrn.com/abstract=261693

Cumming, D.J., & MacIntosh J.G. (2003), "A Cross-Country Comparison of Full and Partial Venture Capital Exits", Journal of Banking and Finance 27, no. 3:511-48.

DeAngelo, H. & DeAngelo, L. (1985), "Managerial ownership of voting rights: A study of public corporations with dual classes of common stock", Journal of Financial Economics, vol. 14, no. 1, pp. 33-69.

Dehning, B., Richardson V.J. & Zmud R.W. (2003), "The Value Relevance Of Announcements Of Transformational Information Technology Investments", MIS Quarterly Vol. 27 No. 4, December, pp. 637-656

Dixit, Avinash K. and Pindyck, Robert S. (1994), "Investment Under Uncertainty", Princeton University Press, Princeton, NJ.

Dubini, P. (1989), "Which venture capital backed entrepreneurs have the best chances of succeeding?", Journal of Business Venturing, vol. 4, no. 2, pp. 123-132.

Ehrlich, S., De Noble A., Moore T. & Weaver R. (1994)."After the cash arrives: A comparative study of venture capital and private investor involvement in entrepreneurial firms", Journal of Business Venturing, vol. 9, issue 1, pages 67-82

Fairchild, R. (2004), "Financial Contracting Between Managers and Venture Capitalists - The Role of Value-Added Services, Reputation Seeking, and Bargaining Power", Journal of Financial Research, Vol. XXVI No. 4, Winter.

Fuller, K., Netter J., Stegemoller M. (2002), "What Do Returns To Acquiring Firms Tell Us: Evidence From Firms That Make Many Acquisitions", Journal of Finance, Vol. 57, No.4: 1763-1793

Gilchrist, S, Himmelberg, C.P. & Huberman G. (2005), "Do stock price bubbles influence corporate investment?," Journal of Monetary Economics, Elsevier, vol. 52(4), pages 805-827, May.

Giudici G. & Paleari S. (2000), "What Drives the Initial Market Performance of Italian IPOs? An Empirical Investigation on Underpricing and Price Support", Working Paper, University of Bergamo.

Gompers, P.A. (1995), "Optimal Investment, Monitoring, and the Staging of Venture Capital", Journal of Finance, vol. 50, no. 5, pp. 1461-1489.

Gompers, P.A. (1996), "Grandstanding in the Venture Capital Industry." Journal of Financial Economics 42, September, pp.133-156.

Gompers P.A & Lerner J. (1997). Venture Capital and the Creation of Public Companies: Do Venture Capitalists Really Bring More than Money? Journal of Private Equity, 1 (Fall 1997) 15-32.

Gompers, P.A., Lerner J. & Scharfstein D. (2005), "Entrepreneurial Spawning: Public Corporations and the Genesis of New Ventures, 1986-1999", Journal of Finance, 60, 577-614.

Gompers, P.A., and Xuan Y. (2004). "The Role of Venture Capitalists in the Acquisition of Private Companies" Working Paper, Harvard University Business School.

Gorman, M. and Sahlman W.A. (1989), "What do venture capitalists do?", Journal of Business Venturing 4, pp.231-248.

Hansen, R.G. (1987), "A Theory for the Choice of Exchange Medium in Mergers and Acquisitions", Journal of Business, vol. 60, no. 1, pp. 75-95.

Hellmann, T. (2002), "A theory of strategic venture investing", Journal of Financial Economics, vol. 64, no. 2, pp. 285-314.

Hellmann, T and Puri M. (2000), "The Interaction between Product Market and Financing Strategy: The Role of Venture Capital", Review of Financial Studies, 13, 4, 959-984.

Hellmann, T. and Puri M. (2002), "Venture Capital and the Professionalization of Start-Up Firms: Empirical Evidence", Journal of Finance, 57, 1, 169-197.

Hogan, T. and Hutson, E. (2005), "Capital structure in new technology-based firms: Evidence from the Irish software sector", Global Finance Journal, vol. 15, no. 3, pp. 369-387.

Hopkins, A. and Donald, H. (1987), "Acquisition Strategy and the Market Position of Acquiring Firms", Strategic Management Journal, vol. 8, no. 6, pp. 535.

Huang, Y. and Walkling, R.A. (1987), "Target abnormal returns associated with acquisition announcements: Payment, acquisition form, and managerial resistance", Journal of Financial Economics, vol. 19, no. 2, pp. 329-349.

Hyytinen, A. and Pajarinen, M. (2005), "Financing of technology-intensive small businesses: some evidence on the uniqueness of the ICT sector", Information Economics and Policy, vol. 17, no. 1, pp. 115-132.

Harrison, J. S., Hitt M. A., Hoskisson R. E. and Ireland R. D. (1991), "Synergies and postacquisition performance: Differences versus similarities in resource allocations." Journal of Management, 17(1): 173-190.

Industry Canada [www.ic.gc.ca] (2004), "ICT Sector Regional Report 2002", www.leadingedgebc.ca/usr_files/ICT_IndCan_2002.pdf

Jaffe, A.B. (1986), "Technological Opportunity and Spillovers of R&D: Evidence from Firms' Patents, Profits and Market Value", January. NBER Working Paper No. W1815. http://ssrn.com/abstract=242123

Jain, B.A. & Kini, O. (1995), "Venture Capitalist Participation and the Post-issue Operating Performance of IPO Firms", Managerial and Decision Economics (1986-1998), vol. 16, no. 6, pp. 593.

Jain, B.A. & Kini, O. (2000), "Does the presence of venture capitalists improve the survival profile of IPO firms?", Journal of Business Finance & Accounting, vol. 27, no. 9/10, pp. 1139.

Jones, K. & Tullous, R. (2002), "Behaviors of pre-venture entrepreneurs and perceptions of their financial needs", Journal of Small Business Management, vol. 40, no. 3, pp. 233.

Jorion, P., Lu Z., and Shi C. (2005), "Informational effects of regulation FD: Evidence from rating agencies", Journal of Financial Economics, Volume 76, Issue 2, May 2005, pp.309-330

Kaplan, S. and Schoar A. (2005), "Private Equity Performance: Returns, Persistence and Capital Flows," The Journal of Finance, forthcoming.

Kelm, K.M., Narayanan, V.K. & Pinches, G.E. (1995), "The response of capital markets to the R&D process", Technological Forecasting and Social Change, vol. 49, no. 1, pp. 75-88.

Knight, R. M. (1989), "Technological innovation in Canada: A comparison of independent entrepreneurs and corporate innovators", Journal of Business Venturing, 4(4): 281-288

Kortum, S. & Lerner, J. (2001), "Does venture capital spur innovation?" in Advances in the Study of Entrepreneurship, Innovation, & Economic Growth JAI, , pp. 1-44.

Kusewitt, B, J. & Jr (1985), "An Exploratory Study of Strategic Acquisition Factors Relating to Performance", Strategic Management Journal, vol. 6, no. 2, pp. 151.

Lefley, F. (1997), "Approaches to risk and uncertainty in the appraisal of new technology capital projects", International Journal of Production Economics, vol. 53, no. 1, pp. 21-33.

Lerner, J (1994), "Venture Capitalists and the Decision to go Public", Journal of Financial Economics, 35 (1), 293--316.

Lerner, J (1995), "Venture Capitalists and the Oversight of Private Firms," Journal of Finance 50 (March 1995): 301-18.

Lerner, J. (1998), "'Angel' financing and public policy: An overview", Journal of Banking & Finance, vol. 22, no. 6-8, pp. 773-783.

Loderer, C, Martin & Kenneth (1990), "Corporate Acquisitions by Listed Firms: The Experience of a Comprehensive Sample", Financial Management, vol. 19, no. 4, pp. 17.

Lovallo, D. & Kahneman, D. (2003), "Delusions of success - How optimism undermines executives' decision", Harvard Business Review, 81:7

Li, X. & Masulis R. (2004), "Venture Capital Investments by IPO Underwriters: Certification, Alignment of Interest or Moral Hazard?", SSHRC Working Paper.

Ljungqvist, A. and Richardson M. (2003), "The cash flow, return and risk characteristics of private equity", Working paper, New York University.

MacKinlay, Craig A. (1997), "Event Studies in Economics and Finance", Journal of Economic Literature, Vol. XXXV, March, pp. 13-39.

MacMillan, I.C., Kulow D.M. and Khoylian R. (1988), "Venture Capitalists¦ Involvement in Their Investments: Extent and Performance.", Journal of Business Venturing 4: 27 v47.

MacMillan I.C., Siegel R. and Narashima P. (1985), "Criteria Used by Venture Capitalists to Evaluate New Business Proposals", Journal of Business Venturing 1 (1) pp119-28.

Maidique, M.A. (1980), "Entrepreneurs, champions, and technological innovations." Sloan Management Review, 21: 59-76.

Maloney, T, M., McCormick, E, R., & Mitchell L, M. (1993), "Managerial Decision making and Capital Structure", The Journal of Business, vol. 66, no. 2, pp. 189.

Mark, S. (1999), "The financing of small firm product innovation within the UK", Technovation, 19, 12, pp. 707-719.

Matlin G. (1979), "What Is The Value Of Investment In Information Systems?", MIS Ouarterly I September 1979 pp. 5-36

Megginson, W.L. & Weiss, K.A. (1991), "Venture Capitalist Certification in Initial Public Offerings", Journal of Finance, vol. 46, no. 3, Papers and Proceedings, Fiftieth Annual Meeting, American Finance Association, Washington, D. C., December 28-30, 1990, pp. 879-903.

Moeller, S.B., Schlingemann, F.P. & Stulz, R.M. (2004), "Firm size and the gains from acquisitions", Journal of Financial Economics, vol. 73, no. 2, pp. 201-228.

Moeller, T. (2005), "Let's make a deal! How shareholder control impacts merger payoffs", Journal of Financial Economics, vol. 76, no. 1, pp. 167-190.

Morck, A., Shleifer R. & Vishny R. (1990), "Do Managerial Objectives Drive Bad Acquisitions?", Journal of Finance, March.

Myers, S.C. & Majluf N.S.(1984), "Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have", 13 J. Fin. Econ. 187

Oakey, R. (1984), "Finance and innovation in British small independent firms", Omega, vol. 12, no. 2, pp. 113-124.

Orlikowski, W & Iacono, S (2001). "Desperately Seeking the 'IT' in IT Research: A Call to Theorizing the IT Artifact" Information Systems Research 7 (12:2), June, pp. 121-134.

Pauly, M. (1974), "Overinsurance and Public Provision of Insurance", 87 Quarterly Journal of Economics, pp.531-536.

Pettit, Richardson, R., Singer & F, R. (1985), "Small Business Finance: A Research Agenda", Financial Management, vol. 14, no. 3, pp. 47.

Porter M., (1980), "Competitive Strategy", The Free Press, New York.

Quigg, Laura (1993), "Empirical testing of real option-pricing models", The Journal of Finance. Jun, Vol.48, Iss. 2, pp. 621-641.

Rhodes-Kropf, M. & Viswanathan, S. (2003), "Market Valuation and Merger Waves", Journal of Finance, Forthcoming

Ritter, J (1991), "The Long-Run Performance of Initial Public Offerings," Journal of Finance, Vol. 46, No. 1 (March 1991), pp. 3-27.

Rothschild M. & Stiglitz J. (1976), "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information", 90 Q.J. Econ. 629.

Ruback, R.S. (1983), "Assessing competition in the market for corporate acquisitions", Journal of Financial Economics, vol. 11, no. 1-4, pp. 141-153.

Sahlman (1990), "The structure and governance of venture-capital organizations", Journal of Financial Economics 27, pp.473-521.

Sahlman, W. & Stevenson, H. (1985), "Capital Market Myopia" Journal of Business Venturing, 1: 7,30.

Sapienza, H. (1992), "When do Venture Capitalists Add Value?", Journal of Business Venturing, 7(1): 9-28.

Sapienza, H.J., Manigart, S. & Vermeir, W. (1996), "Venture capitalist governance and value added in four countries", Journal of Business Venturing, vol. 11, no. 6, pp. 439-469.

Schertler, A. (2002), "The Certification Role of Private Equity Investors: Evidence from Initial Public Offerings on the Nouveau Marché and the Neuer Markt," EIFC - Technology and Finance Working Papers 10, United Nations University, Institute for New Technologies.

Shepherdson, P. (1985), "Some hints on financing new technologies", Long range planning, vol. 18, no. 6, pp. 34-39.

Shleifer, A. & Vishny, R.W. (2003), "Stock market driven acquisitions", Journal of Financial Economics, vol. 70, no. 3, pp. 295-311.

Song, M.H. & Walkling, R.A. (2000), "Abnormal returns to rivals of acquisition targets: A test of the acquisition probability hypothesis'", Journal of Financial Economics, vol. 55, no. 2, pp. 143-171.

Sorensen, M. (2004) "How Smart is Smart Money: An Empirical Two-Sided Matching Model of Venture Capital", Mimeo, University of Chicago.

Standard & Poor's CUSIP service bureau [www.cusip.com] (2005), "What's CUSIP?", www.cusip.com/NASApp/cusipweb/com/sp/apps/cusipaccess/html/whats.html

Sundbo, J (1999), "The Theory of Innovation : Entrepreneurs, Technology and Strategy" Edward Elgar Publishers, ISBN: 1858988322

Sundbo, J, Henten, A., Fuglsang, L. and Fussing-Jensen, C. (1999), "Information and Communication Technologies - Danish Service Firms Innovation Activities and Use of ICT based on a survey". Report No. 2. Service Development, Internationalisation and Competence Development. ISSN 1399-1809.

Thomson SDC Platinum Mergers & Acquisitions [www.tfibcm.com/update.asp], data downloaded July 2005.

Thomson VenturExpert Portfolio Companies [vx.thomsonib.com], data downloaded July 2005.

Timmons, J.A. & Bygrave, W.D. (1986), "Venture capital's role in financing innovation for economic growth", Journal of Business Venturing, vol. 1, no. 2, pp. 161-176.

Tyebjee, T.T. & Bruno A.V. & McIntyre S.H. (1983), "Growing Ventures Can Anticipate Marketing Stages," Harvard Business Review, 83, January-February, pp.62-66

Tyebjee, T.T. & Bruno, A.V. (1985), "The entrepreneur's search for capital", Journal of Business Venturing, vol. 1, no. 1, pp. 61-74.

US Census [www.census.gov] (2002) "2002 NAICS United States Structure: Code list", www.census.gov/epcd/naics02

Van Auken, H.E. (2001), "Financing small technology-based companies: The relationship between familiarity with capital and ability to price and negotiate investment", Journal of Small Business Management, vol. 39, no. 3, pp. 240.

Van Auken, H.E. and Neeley, L. (1996), "Evidence of bootstrap financing among small start-up firms", Journal of Entrepreneurial and Small Business Finance, vol. 5, no. 3, pp. 235.

Wang, C.K., Wang, K. & Lu, Q. (2003), "Effects of venture capitalists participation in listed companies", Journal of Banking & Finance, vol. 27, no. 10, pp. 2015-2034.

Xi L. & Masulis R. (2004), "Venture Capital Investments by IPO Underwriters: Certification, Alignment of Interest or Moral Hazard?", Vanderbilt University, Working Paper

Appendix I Classification of the IT sector

The table (A1.1) below provides my mapping of six digit NAIC codes to the IT sector. It also reports the number of acquisitions present in each NAIC code. The results presented in this thesis are relatively robust to changes of this mapping and very similar results are found using a broader high-tech mapping.

Table A1.1: NAIC code definition of the IT sector

NAIC	NAIC Description	Acquisitions
333295	Semiconductor Machinery Manufacturing	2
334111	Electronics & Computer Manufacturing	78
334112	Computer Storage Device Manufacturing	39
334113	Computer Terminal Manufacturing	14
334119	Other Computer Peripheral Equipment Manufacturing	129
334210	Telephone Apparatus Manufacturing	107
334220	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	91
334290	Other Communications Equipment Manufacturing	71
334413	Semiconductor and Related Device Manufacturing	221
334611	Software Reproducing	1360
335921	Fiber Optic Cable Manufacturing	1
423430	Computer and Computer Peripheral Equipment and Software Merchant Wholesalers	114
443120	Computer and Software Stores	50
511210	Software Publishers	227
516110	Internet Publishing and Broadcasting	24
517110	Wired Telecommunications Carriers	267
517212	Cellular and Other Wireless Telecommunications	2
517410	Satellite Telecommunications	1
517910	Other Telecommunications	41
518111	Internet Service Providers	516
518210	Data Processing, Hosting, and Related Services	124
519190	All Other Information Services	2
541511	Custom Computer Programming Services	279
541512	Computer Systems Design Services	326
541513	Computer Facilities Management Services	9
541519	Other Computer Related Services	228
611420	Computer Training	14
811212	Computer and Office Machine Repair and Maintenance	14
Total		**4351**

The primary disadvantage of using the 6-digit NAIC level rather than a broader level of aggregation is that some IT firms are involved in more than one 6-digit industry. The

NAIC identification is based on the self-identified most important activity of the firm. It is possible that a target firm with significant IT activities might list its primary activity as a non-ICT code (possibly in some electronics industry code). I would then miss the acquisition of such an enterprise. However, the target firms tend to be fairly small and specialized, and my application of this definition is based on targets.

As a parting note, readers might be interested to know that the various datasets were assembled and processed on a pair of Asus servers acquired from a venture-backed IT firm. This firm had failed to find a public acquirer and was placed in receivership in 2004. The servers were bought at a public asset sale, and I report that my bargaining was superb. They made this type of data processing intensive research a real option for me.