# CHANGES IN VENTURE CAPITAL FUNDING AND THE PROCESS OF CREATING NASCENT FIRM VALUE

by

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# ABSTRACT

STEPHEN GLENN MARTIN. Changes in venture capital funding and the process of creating nascent firm value (Under the direction of DR.TAO-HSIEN DOLLY KING)

In Chapter 1, I examine the role of venture capital syndication in a firms' ability to efficiently time the initial public offering market, as well as the benefits of syndication to the issuing firms and venture capitalists. The results indicate that there is a positive relationship between the level of venture capital syndication and IPO market timing. I also find a positive relationship between venture capital syndication and initial returns, as well as the extent to which an offering prices above the midpoint of the initial filing range. Finally, the results indicate that there is a positive, relationship between venture capital syndication and the initial IPO filing range.

In Chapter 2, I examine the effects of seed accelerator program participation on subsequent follow-on funding. I find that seed accelerator participation is significantly related to subsequent follow-on funding, after controlling for firm characteristics as well as macro-level variables. The results indicate that firms that participate in an accelerator program are more likely to receive follow-on funding in the three years that follow their initial seed funding. I also find that the follow-on funding of accelerated firms exhibits favorable characteristics, as compared to firms that do not participate in such a program.

Chapter 3 studies the recent initial public offering trends in the market for real estate investment trusts, in an effort to determine if there is support for the primary theories related to the decline in initial public offerings. The results support the *Economies of Scope Theory*, and are inconsistent with the *Regulatory Overreach Theory,* with respect to small-firm real estate investment trust initial public offerings. The results also provide limited support for the *Regulatory Overreach Theory,* with respect to the impact of regulations on the volume of large-firm real estate investment trust initial public offerings.

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# CHAPTER 1: THE ROLE OF VENTURE CAPITAL SYNDICATION IN INITIAL PUBLIC OFFERING MARKET TIMING AND PRICING

## 1.1 Introduction

The market timing of initial public offerings (IPOs) has been a well-documented phenomenon since it was first investigated by the Securities and Exchange Commission (SEC) in 1963, and Ibbotson and Jaffee (1975) established the initial foundation for the extant literature on the topic. There is a recognized tendency for IPOs to be clustered around certain time periods. These clusters, or waves, of higher-than-average IPO activity, often termed "Hot Issue Markets," create pronounced cycles in the number of initial public offerings per month and year, as well as impact initial returns of the clustered offerings (Ibbotson, Sindelar, and Ritter (1988, 1994) and Lowery and Schwert (2002)).

A long line of research has emerged to analyze these IPO waves. While the literature has not dispositively explained the clustering of new equity issues, a number of theories have been presented as to the phenomenon's existence and causes. The seminal paper Lerner (1994b) provides support for the proposition that firms seek to issue initial public stock when equity values are high, and further, that venture capital (VC) firms are particularly talented at this market timing. More recently, several models have attempted to explain IPO market timing by focusing on an information spillover hypothesis, in which initial "pioneer" firms issue public equity, which then triggers a wave of

subsequent "follower" firms going public. According to the theory, the overall result is observable waves of IPOs (Lowery and Schwert (2002)).

Another branch of literature examines a relatively new possible explanation for IPO waves. Schultz (1993), for example, argues that more firms issue initial equity when stock prices increase. While this behavior is unrelated to managers' ability to predict future returns, the author suggests that the result is the observed long-run underperformance of IPOs. Since the theory is not based on an issuer's ability to time the IPO market, and rather relies solely on the observation of high market prices, it is referred to as "Pseudo Market Timing." Other notable research has examined the consequences of market timing with an eye towards explaining its causes. (See, for example, Alti (2005, 2006)). While the numerous studies approach IPO market timing from different perspectives, and a distinct lack of theoretical consensus persists, there is considerable overlap in theories.

Although there is vast support for the proposition that firms time the market, as well as the fact that market timing can benefit the issuing company and its initial investors (Ibbotson and Jaffee (1975), Ibbotson, Sindelar, and Ritter (1988, 1994), and Lerner (1994b)), an unexplored aspect of the IPO market-timing phenomenon is the extent to which venture capital syndication, which has become an accepted normal (Lerner (1994a)), affects market timing. This gap in the literature provides an opportunity for fruitful research. Since there is support for the theory that firms time the market with their equity offerings, and venture capitalists play a significant role in the managerial decision making process of going public (Keuschnigg (2004), Barry, et al. (1990), and Gompers (1995)), it poses a fundamental question: To what extent does venture capital

syndication affect a firm's ability to efficiently time the IPO market? It is this question that the analysis herein undertakes to answer. To my knowledge no literature has addressed this issue.

Based on a sample of 3,014 initial public offerings, I examine the role of venture capital syndication in the firms' ability to efficiently time the IPO market, as well as the benefits of syndication to the issuing firms and venture capitalists. In studying the affects of syndication on IPO market timing and pricing, this paper addresses two interlinked issues. First, I analyze the impact of the level of venture capital syndication on the market timing of the IPOs during the sample period. My findings indicate that there is a positive relation between the level of VC syndication and IPO market timing. I find that, on average, the syndication of an IPO leads to the IPO going public during a month in which the average monthly return is 26%, compared to 20% for non-syndicated firms. The average for all IPOs is 24%. Further, using an the monthly percentage of IPOs that priced above the midpoint of their original filing range as an alternative measure of market hotness, I find that, on average, syndicated firms go public during periods in which the average monthly percentage of IPOs that price above the midpoint of their range is 47%. This is compared to 44% for non-syndicated IPOs. The average across the entire sample is 46%.

To further analyze the relation between venture capital syndication and IPO market timing, I use multivariate regression based on a number of specifications. I find that there is a significant, positive relationship between whether a firm is syndicated by more than one venture capitalist and both measures of market timing. Additionally, I find that there is also a significant, positive relation between the level of VC syndication and

each measure of market timing. All of the models suggest that the syndication of venture capital increases a firm's ability to time the IPO market, and that the level of such syndication contributes positively to this ability.

As a second analysis of this study, I examine the benefits of syndication and efficient IPO market timing, in terms of the firm, as well as the primary and secondary markets. Specifically, I examine the effects of VC syndication on initial returns, pre-IPO gain, and initial IPO price range. The literature has suggested a number of benefits to venture capitalists from the deliberate underpricing of equity offerings. (Lerner (1994b)).

I find a positive, and significant, relation between venture capital syndication and initial returns. The result holds when testing only the U.S. IPOs, as well as those of countries with 10 or more IPOs. Both the presence of a VC syndicate, in addition to the level of such syndication, increase the initial returns related to the offering. I also find a significant, positive relationship between VC syndication and the extent to which an offering ultimately prices above the midpoint of the initial filing range. Finally, the result indicate that there is a positive, significant, relationship between syndication and the initial filing range itself.

This paper makes the following contributions to the literature. First, I extend the IPO market timing research by examining the effect of venture capital syndication on a firm's ability to efficiently time the new equity market. This is a topic that, to my knowledge, has not been addressed in the literature previously. I empirically examine the relation between VC syndication and a number of measures of market timing. Again, I establish a strong, and statistically significant link between them. This relationship is confirmed in a number of robustness tests, as well as controlling for other variables that

are commonly thought to play a role in initial public offering dynamics. Second, in addition to helping fill the literary gap surrounding IPO market timing, particularly with respect to syndicated venture capital-backed firms, this study contributes to the literature by examining the benefits of such market timing to issuers, and venture capitalists. In particular, I find that syndicated firms enjoy higher initial returns. A third contribution this work makes to the extant literature is related to venture capital syndication itself. There have been a number of theories advanced as to why venture capital firms choose to syndicate their investments. Most of these theories, however, are based on operational and monitoring benefits to the venture capital firms. For example, Lerner (1994a) suggests that syndication of investments may lead to better decision making when choosing which firms to invest in, contribute to desirable benefits in the structure of the firm's capital, and that venture capital firms may engage in "windrow dressing" similar to that which has been documented in pension funds (Lakonishok, Shleifer, Thaler, and Vishny (1991)). This study contributes to the literature by proposing IPO market timing and pricing as additional benefits of VC syndication. To my knowledge, no other paper has previously proposed such syndication benefits.

This paper is structured as follows. Section 1.2 reviews the literature on IPO market timing and venture capital syndication. Section 1.3 describes the data sources and sample, and identifies the characteristics of the IPOs and venture capital firms in the study. Section 1.4 provides the empirical analysis and results of the research. Section 1.5 includes concluding remarks.

## 1.2 Literature Review

### 1.2.1 IPO Market Timing

The market timing of initial public offerings by issuers has been a persistent question since the Securities and Exchange Commission (SEC) first studied the apparent phenomenon in 1963. Ibbotson and Jaffee (1975) first provided the foundation in the literature for what has been characterized as the "hot issues" market. In the seminal paper, a hot market is defined as a month in which the average first-day return is above the median month's average first-day return. Initial return is traditionally measured from the offer price to the closing market price (Ibbotson and Jaffee (1975) and Ritter (2011)). This first-day return is also referred to as IPO "underpricing." While other measures have been used, most revolving around volume (Ibbotson, Sindlelar, and Ritter (1994)), monthly average first-day returns, as outlined in Ibbotson and Jaffee (1975), is still followed as the standard measure of market timing.

Ibbotson and Jaffee (1975) document the hot issue market phenomenon while focusing primarily on the predictability of first month new issue premia. A significant positive relation between initial returns and future IPO volume, and the resulting clustering or waves of IPOs, has also been well-established in a broad range of subsequent studies from biotechnology firms (Lerner 1994b) to research analyzing the general market for IPOs (Lowry and Schwert (2002)), to name just a few. This long line of literature, and the established observations that an increased number of companies go public after observing the greatest amount of underpricing, causing clustering of IPOs in waves, has presented a puzzle for 40 years. Conventional logic would suggest that firms would prefer to go public when initial returns are the lowest (Lowry and Schwert (2002)).

Although the companion puzzles of hot issue market waves, and the apparent desire on the part of issuing firms to go public when initial returns in the market are highest, remain at least partially unexplained, they have spawned a number of interesting theories attempting to account for the phenomena. A number of notable studies highlight the primary theories.

As mentioned above, Lerner (1994b) studies biotechnology firms in an attempt to explain IPO waves. He finds that the companies in the sample went public when equity valuations were high, and conversely used private financing when values where low. The research further documents that seasoned venture capitalists appeared to be "particularly proficient" at taking companies public near market peaks. The author further provides explanations for the desire on the part of issuing firms to achieve large initial returns in their equity offerings. The paper suggests that issuing initial public equity when valuations are high minimizes the dilution of the value of ownership interests in the firms retained by the founders and venture capitalists. As a second suggested rationale for the findings, Lerner (1994b) argues that the deliberate underpricing of initial equity offerings leaves a good taste with investors. This theory has been advanced in a number of studies as a rationale to explain why both venture capital firms and underwriters desire larger initial returns. The theory argues that venture capitalists must repeatedly return to the public equity market with the stock of portfolio firms. Therefore, high historical initial returns can help them ensure that they have a good "reputation" with offerings (Lerner (1994b)).

Additional notable research related to IPO market timing has focused on its affects on issuing firms. Baker and Wurgler (2002) suggests that market timing has an

impact on capital structure. Specifically, the paper argues that an issuing firm's capital structure is the "cumulative outcome of past attempts to time the equity market." Alti (2006) also examines the impact of market timing on capital structure. The paper reports that hot issue market firms issue substantially more equity, and lower their leverage ratios by more than cold-market firms. According to their findings, immediately after going public, hot market firms increase their leverage ratios, by issuing more debt, than cold market firms. The paper finds, however, that the effect of market timing on leverage disappears within two years of the IPO.

In a broader context, literature has studied the implications of IPO waves on the equity markets in general. For example, Persons and Warther (1997) and Stoughton, Wong, and Zechner (2001) both suggest that IPO waves are not inconsistent with market efficiency, based on the rational information at the time of the IPO and information effects, respectively. Building on the idea that IPOs convey information to managers of future offerings, more recent research has focused on information spillovers to explain hot issue markets. Both Lowry and Schwert (2002) and Benveniste, Ljungqvist, Wilhelm, and Yu (2003) present evidence of an information spillover effect in IPOs. Each paper finds that IPO volume is highly sensitive to the outcomes of other recent initial public offerings. Lowry and Schwert (2002) additionally presents a theory that suggests that IPO cycles and high initial returns can be explained with a model whereby information learned during the IPO registration period impacts future issuing firms' decisions to go public. They posit that initial returns of recent IPOs contain information on the market's valuation of future IPOs, which managers then act on in determining when to undertake an IPO.

Alti (2005) also studies information as a focal point in initial public offering timing. The paper develops a model which is an extension of the information spillover line of research. The author's theory suggests that, since offering prices are set based on investors' indications of interest, the outcome of an IPO reflects information that was previously private. The model begins with a set of "pioneer" firms going public. After observing the outcomes of those IPOs, "follower" firms choose to either go public or wait to issue equity. Under this information spillover theory, Alti (2005) argues that IPO market valuations, rather than the issuing firms' immediate financing needs, drive the decision to go public. In line with the information theory of market timing, Baker and Wurgler (2002), also find that firms issue relatively more equity than debt just before periods of low market returns.

Despite the wide array of literature focused on IPO market timing, the topic is surprisingly unsettled. Numerous theories exist as to both why IPO waves occur and the impact they have on issuing firms and the equity markets. This fact reflects the overwhelming presence of a multitude of influences on the initial public offering process, and the reality that these factors often conflict with one another.

### 1.2.2 Venture Capital Syndication

Although investment syndication by venture capital firms has existed for a number of decades, Lerner (1994a) provides the foundational basis for literature on the topic. The seminal paper provides three possible rationales for the syndication of venture capital investments. First, the paper suggest that VC syndication may lead to better decisions as to which firms to invest in. As a second justification for syndication, the paper cites the theory found in Admati and Pfleiderer (1994) that syndication helps

overcome information asymmetries between investors. Finally, Lerner (1994a) argues that a third explanation for venture capital syndication is that it allows venture capitalists to "window dress" in a similar fashion to the practice of pension companies, which have been found to buy into firms so they can represent themselves as investors in the companies in their marketing materials. (Lakonishok, Shleifer, Thaler, and Vishny (1991)).

Other theories for syndication have also been suggested. For example, Locket and Wright (2001) used data from the UK to examine a diversification motive as a basis for venture capital syndication. Brander, Amit, and Antweiler (2002) also present two primary rationales for venture capital syndication. The first, called the second-opinion hypothesis, like Lerner (1994a), argues that syndicating venture capital investments provides an informed second-opinion related to portfolio firms. The second theory, referred to as the value-added hypothesis, suggests that additional VCs provide complimentary management skills to the syndicate. Their findings, based on Canadian data, support the value-added theory. Specifically, they support this conclusion with the finding that syndicated investments have higher returns. Casamatta and Haritchabalet (2007), however, suggests that the second-opinion hypothesis is the driving force for VC syndication. While Hochberg, Ljungqvist, and Lu (2007) find that VC firms that are better networked experience significantly better fund performance.

While numerous studies have analyzed venture capital syndication, the literature is surprisingly lacking related to the impact of syndication on a firms' ability to time the IPO market. To my knowledge no study has examined this issue. This paper approaches the topic with two primary inquiries. First, I examine whether venture capital syndication

increases a firm's ability to time the IPO market. Keuschnigg (2004) finds that venture capitalists not only finance, but also advise and bring value to portfolio firms. Barry, et al. (1990) further suggest that venture capitalists specialize their investments in firms to provide intensive monitoring, and serve on the board of portfolios companies. If venture capital firms are providing these types of non-pecuniary benefits to the firms they invest in, one would expect that an increased level of venture capital syndication would lead to an increased ability to time the IPO market.

As a second inquiry, I examine the possible benefits from venture capital syndication, in terms of the pricing of the offering. I test the IPO pricing in three separate ways. First, I explore the impact of VC syndication on initial returns. A number of benefits have been suggested in the literature providing venture capital firms with an incentive to underprice of equity offerings. (Lerner (1994b)). The initial return adjusts the price of the stock to reflect what the value placed on it by the secondary market. If VC syndication allows a firm to price it's offering more efficiently, one would expect this to be reflected in initial returns. Additionally, the extent of VC syndication may impact investor optimism related to the stock on the first day of public trading. This theory is consistent with the literature which has suggested that investor sentiment plays a significant role in initial public offerings, both during the process of allocating the share, as well as after they become public. (Ljungqvist, Nanda, and Singh (2006) and Lowry (2003)). Additionally, I propose that larger syndication of the venture-backing leads to additional analyst coverage and other benefits of IPO exposure. This hypothesis is consistent with the literature that issuing firms seek analyst coverage related to their IPOs, and may even "purchase" coverage with IPO underpricing. In this regard, Cliff and

Denis (2005) find a positive relationship between analysis coverage as well as the presence of an all-star analyst on the research staff of the lead underwriter, and IPO underpricing. The authors further argue that "underpricing is, in part, compensation for expected post-IPO analysis coverage from highly ranked analysis."

I also test how the primary market views the stock, with respect to VC syndication. To examine this issue, I use the extent to which the stock sold, in the primary market, above the mid-point of its initial SEC filing range, This "pre-IPO gain/loss" is measured as a percentage of the mid-point of the initial filing range, and provides an indication of the primary market's view of the offering. As a final inquiry related to VC syndication, I explore the impact of such syndication on the initial IPO filing price range. One would expect that the breadth of such range would be related to the uncertainty surrounding the offering. Therefore, venture capital syndication, and the extent of such syndication may play a role in the size of the initial public offering price range.

## 1.3 Data and Sample Selection

In this section I describe the sample selection process, and descriptive statistics of the initial public offerings and venture capital firms in the sample. From ThompsonOne's Private Equity Database, I initially collect all IPOs available which occurred during the period from 1980 through 2011. Such information includes IPO characteristic information including the company name, company nation, SIC code, date of IPO, offering proceeds, offering price, first day closing price, lead underwriter, and venture capital firm names and characteristics. I also collect data related to two measures of IPO

market "hotness" from Jay Ritter's website:[1] Monthly average first-day percentage return[2] and the monthly percentage of IPOs that priced above the midpoint of the original filing price. Both measures are used in independent regressions as a measure of market hotness. Finally, I collect data related to the Underwriter Prestige Ranking, based on the model of underwriter ranking of Carter and Manaster (1990) and also provided on Jay Ritter's website.

From the initial data set I exclude all IPOs that do not meet certain criteria, as well as those for which full information is not available. Specifically, based on conventional finance-related research practice, I exclude all IPOs of less than $1,500,000, offerings priced below $5.00 per share, and the offerings of financial firms. Additionally, as all data is not available prior to 1980 or since the close of 2011, all IPOs prior to 1980 and those in 2012 are also excluded from the IPO sample.

The selection process yields a sample consisting of 3,014 IPOs from 34 countries.[3] All tests are conducted on two subsets of the IPO sample. First, multivariate regressions are performed on the sample including all U.S. initial public offerings. Second, a subset of the data including only the countries with ten or more IPOs during the sample period is used for the multivariate regressions.[4] Baseline results are reported based on the United States IPOs only, which includes 2,715 initial public offerings. The data includes 1,934 IPOs that were backed by syndicated venture capitalists, and 781 offerings backed by a single venture capital firm.

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[1] Jay Ritter's website is located at: http://bear.warrington.ufl.edu/ritter/ipodata.htm

[2] This measure of market hotness dictates that an IPO is considered to have taken place during a "hot issue market" period if it occurred in a month in which the average first-day return is greater than the median first-day return of the sample.

[3] Table 1 provides the frequency distribution of the IPO sample among the different countries in the initial data.

[4] Countries with ten or more IPOs include Canada, China, Germany, Japan, South Korea, and the United States.

## 1.4 Empirical Analysis

### 1.4.1 Descriptive statistics of initial public offerings and venture capital firms

Table 1 provides the frequency distribution of the IPO sample among the 34 countries in the initial data of 3,014 IPOs from 1980 through 2011. As discussed above, all tests were conducted on two subsets of the IPO data: The entire set of data including only the IPOs in the United States, as well as the subset of the data including the U.S. IPOs and those from countries with ten or more IPOs during the sample period. Countries with 10 or more IPOs include Canada, China, Germany, Japan, South Korea, and the United States.

Table 2 outlines the frequency distribution of U.S. IPOs from 1980 through 2011, by year, as well as the proportion of IPOs that were backed by a syndicate of venture capital firms compared to IPOs that were backed by a single venture capital firm. During the sample period 1,934 IPOs were syndicate-backed, while 781 involved a single venture capital firm. The percentage of the total number of IPOs for each category is also reported for each year. I use the two-digit SIC code to group IPO companies into industry categories. Table 3 provides the SIC Classifications and corresponding descriptions for the IPO companies. [5]

Table 4 provides an overview of the characteristics of the sample of initial public offerings. The statistics are reported for the entire United States sample, as well as split

[5] There are no IPO codes starting with 6 as, following convention, I have excluded financial firms from the sample.

TABLE 1: Frequency distribution of IPO sample by country

Observations are IPOs from 1980 through 2011 from 34 countries. I exclude IPOs of less than $1,500,000, offerings below $5.00 per share, and the offerings of financial firms. Data is collected from ThompsonOne's Private Equity Database.

| Country | Frequency | Percent |
|---|---|---|
| Argentina | 3 | 0.10% |
| Australia | 1 | 0.03% |
| Austria | 1 | 0.03% |
| Bahamas | 1 | 0.03% |
| Belgium | 5 | 0.17% |
| Bermuda | 5 | 0.17% |
| Brazil | 7 | 0.23% |
| Canada | 69 | 2.29% |
| China | 86 | 2.85% |
| France | 9 | 0.30% |
| Georgia | 1 | 0.03% |
| Germany | 14 | 0.46% |
| Greece | 2 | 0.07% |
| India | 9 | 0.30% |
| Ireland | 3 | 0.10% |
| Israel | 5 | 0.17% |
| Italy | 4 | 0.13% |
| Japan | 12 | 0.40% |
| Mexico | 1 | 0.03% |
| Netherlands | 7 | 0.23% |
| Philippines | 1 | 0.03% |
| Poland | 1 | 0.03% |
| Russia | 2 | 0.07% |
| South Africa | 1 | 0.03% |
| South Korea | 26 | 0.86% |
| Spain | 7 | 0.23% |
| Sweden | 1 | 0.03% |
| Switzerland | 9 | 0.30% |
| Turkey | 2 | 0.07% |
| United Kingdom | 4 | 0.13% |
| United States | 2715 | 90.08% |
| Total | 3014 | |

TABLE 2: Frequency distribution of U.S. IPOs by year

Yearly volume and percentage of the total sample of U.S. IPOs from 1980 through 2011. Syndicated volume and percentage report the number of IPOs each year that were backed by a syndicate of venture capital firms, and the corresponding percentage relative to the total for a given year. Non-Syndicated volume and percentage report the number and percentage of IPOs that involved a single venture capital firm in the given year. Total number of IPOs for each category are also reported.

| | Total IPOs | | Syndicated IPOs | | Non-Syndicated IPOs | |
|---|---|---|---|---|---|---|
| Year | Number | Percent of Total by Year | Number | Percent of Total | Number | Percent of Total |
| 1980 | 22 | 0.81% | 13 | 59.09% | 9 | 40.91% |
| 1981 | 43 | 1.58% | 29 | 67.44% | 14 | 32.56% |
| 1982 | 19 | 0.70% | 14 | 73.68% | 5 | 26.32% |
| 1983 | 105 | 3.87% | 72 | 68.57% | 33 | 31.43% |
| 1984 | 45 | 1.66% | 29 | 64.44% | 16 | 35.56% |
| 1985 | 32 | 1.18% | 22 | 68.75% | 10 | 31.25% |
| 1986 | 86 | 3.17% | 71 | 82.56% | 15 | 17.44% |
| 1987 | 73 | 2.69% | 54 | 73.97% | 19 | 26.03% |
| 1988 | 30 | 1.10% | 19 | 63.33% | 11 | 36.67% |
| 1989 | 33 | 1.22% | 23 | 69.70% | 10 | 30.30% |
| 1990 | 38 | 1.40% | 27 | 71.05% | 11 | 28.95% |
| 1991 | 111 | 4.09% | 75 | 67.57% | 36 | 32.43% |
| 1992 | 139 | 5.12% | 104 | 74.82% | 35 | 25.18% |
| 1993 | 155 | 5.71% | 92 | 59.35% | 63 | 40.65% |
| 1994 | 109 | 4.01% | 76 | 69.72% | 33 | 30.28% |
| 1995 | 159 | 5.86% | 124 | 77.99% | 35 | 22.01% |
| 1996 | 223 | 8.21% | 147 | 65.92% | 76 | 34.08% |
| 1997 | 130 | 4.79% | 94 | 72.31% | 36 | 27.69% |
| 1998 | 87 | 3.20% | 58 | 66.67% | 29 | 33.33% |
| 1999 | 245 | 9.02% | 171 | 69.80% | 74 | 30.20% |
| 2000 | 216 | 7.96% | 172 | 79.63% | 44 | 20.37% |
| 2001 | 46 | 1.69% | 32 | 69.57% | 14 | 30.43% |
| 2002 | 32 | 1.18% | 19 | 59.38% | 13 | 40.63% |
| 2003 | 38 | 1.40% | 29 | 76.32% | 9 | 23.68% |
| 2004 | 96 | 3.54% | 78 | 81.25% | 18 | 18.75% |
| 2005 | 81 | 2.98% | 62 | 76.54% | 19 | 23.46% |
| 2006 | 93 | 3.43% | 62 | 66.67% | 31 | 33.33% |
| 2007 | 87 | 3.20% | 61 | 70.11% | 26 | 29.89% |
| 2008 | 11 | 0.41% | 7 | 63.64% | 4 | 36.36% |
| 2009 | 23 | 0.85% | 16 | 69.57% | 7 | 30.43% |
| 2010 | 55 | 2.03% | 43 | 78.18% | 12 | 21.82% |
| 2011 | 53 | 1.95% | 39 | 73.58% | 14 | 26.42% |
| Total | 2715 | | 1934 | | 781 | |

among the syndicate-backed IPOs, and offerings that involve a single venture capital firm. Average Initial Return is computed over the entire sample period, as (vt – OP)/OP, where vt is the closing bid price on the first day of public trading, and OP is the offering price of the initial public offering, following convention established in Beatty and Ritter (1986). Table 4 reports average offering price, average offering proceeds, average initial return, and average age of issuing firm. With respect to underwriters and venture capitalists involved in each IPO Table 4 provides the average underwriter ranking, as well as the average number of VCs in each syndicate. On average 6 syndicated venture capital firms participated in the IPOs that were syndicate-backed. Finally, average monthly first-day returns is based on the Ibbotson and Jaffee (1975) measure of IPO issue market hotness. Average monthly percentage priced above the midpoint is based on the Ritter measure of IPO issue market hotness (Ibbotson, Sindelar, and Ritter (1994).

Descriptive statistics related to the venture capital firms are reported in Table 5. I again separate the sample into two categories reporting the descriptive statistics for IPOs that were backed by a syndicate of venture capital firms, and initial public offerings that were backed by a single venture capital firm. The venture capital firms involved in the IPO transactions are matched with characteristics data from ThompsonOne's Private Equity Database related to a database of 7,452 venture capital firm in existence from 1980 through 2011.

As reported in Table 5, based on the venture capital firms represented in the sample of initial public offerings, the average age of the venture firm is 16.64, compared to 16.88 and 16.52 for the venture capital firms among the syndicated IPOs, and non-

TABLE 3: Frequency distribution of U.S. sample IPOs by industry

Observations are U.S. IPOs from 1980 through 2011 from 34 countries. I exclude IPOs of less than $1,500,000, offerings below $5.00 per share, and the offerings of financial firms. Data is collected from ThompsonOne's Private Equity Database.

| Industry Categories | Number | Percentage |
|---|---|---|
| Agriculture, Forestry & Fishing | 4 | 0.15% |
| Mining | 26 | 0.96% |
| Construction | 32 | 1.18% |
| Manufacturing | 1034 | 38.08% |
| Transportation, Communications & Utility | 659 | 24.27% |
| Wholesale Trade | 86 | 3.17% |
| Retail Trade | 221 | 8.14% |
| Services | 652 | 24.01% |
| Public Administration | 5 | 0.18% |
| Total | 2715 | |

TABLE 4: Descriptive statistics for sample of IPOs

Descriptive statistics for sample of United States IPOs from 1980 through 2011. I separate the sample into two categories reporting the descriptive statistics for IPOs that were backed by a syndicate of venture capital firms and IPOs that were backed by a single venture capital firm. Average Initial Return is computed over the entire sample period, as (vt – OP)/OP, where vt is the closing bid price on the first day of public trading, and OP is the offering price of the initial public offering, following convention established in Beatty and Ritter (1986). Underwriter Prestige Ranking is based on the model of underwriter ranking of Carter and Manaster (1990) and provided on Jay Ritter's website (http://bear.warrington.ufl.edu/ritter/ipodata.htm). Average monthly 1st-day returns is based on the Ibbotson and Jaffee (1975) measure of IPO issue market hotness. Average monthly percentage priced above the midpoint is based on the Ritter measure of IPO issue market hotness (Ibbotson, Sindelar, and Ritter (1994). Note that the average offering price above midpoint, and average price range, as a percentage of the midpoint are based on a sample of 1772 U.S. offerings, and 115 offerings from countries with more than 10 IPOs.

| | All IPOs | Syndicated IPOs | Non-Syndicated IPOs |
|---|---|---|---|
| Number of IPOs | 2715 | 1934 | 781 |
| Average Initial Return | 0.18 | 0.23 | 0.11 |
| Average Offering Price ($) | $13.85 | $12.45 | $13.10 |
| Average Offering Proceeds ($ Millions) | $79.24 | $78.54 | $80.82 |
| Average Age of Issuing Firm at IPO (Years) | 9.42 | 8.37 | 12.20 |
| Average Number of VCs in Syndicate | 4.6 | 6.2 | 1 |
| Average Offering Price Above Midpoint | 0.05 | 0.05 | 0.04 |
| Average Price Range as a Percentage of Midpoint | 0.14 | 0.15 | 0.13 |
| Average Monthly 1st Day Returns (Percent) | 0.24 | 0.26 | 0.20 |
| Average Monthly % Priced Above Midpoint (Percent) | 0.46 | 0.47 | 0.44 |

syndicated IPOs, respectively. The average number of IPOs the venture capital firms participated in prior to the instant offering, is 18.38 for all IPOs, 18.74 for syndicated IPOs, and 17.64 for non-syndicate-back IPOs. Average proceeds are also very similar for the 3 groups at $802 million, $807 million, and $810, respectively. The proceeds of offerings in which the VCs have participated on average during the 3-year period prior to the instant IPOs are $406 million for all IPOs, $402 million for syndicated-IPOs, and $471 million for non-syndicated IPOs. The number of initial public offerings in which the VCs have participated in, on average, during the 3-year period prior to the instant initial public offerings were 7.48 for all IPOs, 6.82 for syndicated-IPOs, and 7.74 for non-syndicated IPOs. Finally, average time to exit for the venture capital firms that participated in all IPOs is 4.38 years. With respect to venture capital syndicate-based offerings, the average time to exit is 4.78 year, compared to 3.14 years for non-syndicate-backed IPOs.

To control for differences in the experience and reputation among the venture capital firms involved in the equity offerings, I use a VC Rank variable. This variable is computed based on the sample of IPOs, and for robustness is calculated using a number of possible measures of VC quality. In particular, I initially calculate a number of different measures of VC Rank for both the non-syndicated IPOs, as well as the syndicated initial public offerings, including average age of the VCs involved in the IPO, average number of previous IPOs among the VCs in the instant IPO, average amount of IPO proceeds from previous offerings among the VCs in the instant IPO, average number of IPOs during the previous 3-year rolling period among the VCs in the instant IPO, and average amount of IPO proceeds from previous offerings that occurred during the

TABLE 5: Descriptive statistics for venture capital firms

Descriptive statistics for venture capital firms in sample of United States IPOs from 1980 through 2011. I separate the sample into two categories reporting the descriptive statistics for IPOs that were backed by a syndicate of venture capital firms and IPOs that were backed by a single venture capital firm. All statistics are reported as the average.

| | All IPOS | Syndicated IPOS | Non-Syndicated IPOs |
|---|---|---|---|
| Age of VC Syndicate (Average) | 17 | 17 | 17 |
| Number of Prior IPOs for Syndicate (Average) | 18 | 19 | 18 |
| Proceeds from Prior IPOs for Syndicate (Average $ Million) | $802 | $807 | $810 |
| Proceeds for Syndicate (Average, 3-Year Rolling) | $406 | $402 | $471 |
| Number of IPOs for Syndicate (Average, 3-Year Rolling) | 7 | 7 | 8 |
| Time to VC Exit (Average Years) | 4 | 5 | 3 |

previous 3-year rolling period among the VCs in the instant IPO.[6] The 3-year rolling average number of IPOs is used as the primary measure of venture capital firm quality, expertise, and reputation in the multivariate regressions.

### 1.4.2 Impact of Venture Capital Syndication on IPO Market Timing

As a first analysis of this paper, I study the relationship between venture capital syndication and a firm's ability to efficiently time the market. I first split the sample into two groups: IPOs with a syndication of venture capital firms, and IPOs in which only a single venture capitalist is involved. Among the literature, Ibbotson and Jaffee (1975) first provided the foundational definition of a "hot" issues market, defined as a month in which the average initial return is above the median month's average first-day return. According to convention, initial return is defined as the percentage first-day return, measured from the offer price to the closing market price (Ritter (2011)). Based on the above definition of a hot IPO market, there is a significant differential in this paper's sample of syndicated firms' apparent ability to time the hot issue market. As can be seen in Table 4, using the measure of monthly average first-day returns, syndicated offerings occurred during months when the average initial return is 25.93%. This is in comparison to 19.56% for non-syndicated IPOs.

A second measure of initial public offering market "hotness," developed in the literature, is the percentage of IPOs that priced above the midpoint of the original file price range (Ibbotson, Sindelar, and Ritter (1994)). The original file range is the offering price range in the original Securities and Exchange Commission registration. Shortly

[6] VC Ranks are computed as averages taking the number of VCs in each offering into account. For example, to compute the average age of the VCs involved in a particular offering, the ages, at the time of the instant IPO, of all VCs that participated in the offering are computed based on the founding date of the VC firms, and then averaged relative to the number of VC firms participating.

before the actual offering, the issuer and underwriter set a final offering price. This measure suggests that the percentage of firms that ultimately price their offering above the midpoint of the registered range is an indication of how hot the IPO market is at that time. Based on data obtained from Jay Ritter's website, this market hotness measure is included as a variable to check the efficiency of IPO market timing. Using this measure of initial public offering market hotness, the average monthly percentage of IPOs that priced above the midpoint is 46.29%. Syndicate-backed IPOs went public during months when the average percentage of all IPOs that month that priced above their midpoint is 47.15%. This is contrasted with the result of 43.94% for non-syndicate-backed initial public offerings. The results with respect to this issue suggest a substantial difference in a firm's ability to time the IPO market, based on whether the offering was backed by a syndicate of venture capital firms. Based on both of the conventional measures of market timing, the IPOs that were syndicated present results that suggest they more successfully timed the market for IPOs.

To further examine the relationship between venture capital syndication and market timing, I use multivariate regression models of the two primary market timing measures. The multivariate regression model is as follows:

$$\text{Market Hotness}_t = \alpha + \beta_1 \times \text{Syndication}_i$$

$$+ \beta_2 \text{ x Amount of Offering}_i$$

$$+ \beta_3 \times \text{Age of Firm}_i$$

$$+ \beta_4 \times \text{Underwriter Rank}_i$$

$$+ \beta_5 \times \text{Venture Capital Rank}_i$$

$$+ \beta_6 \times \text{NASDAQ Return}_{t-1} + \varepsilon_i$$

where, *Market Hotness*$_t$ denotes the specific IPO market hotness measure used in the particular regression: Monthly average first-day returns measure and Monthly average percentage that priced above the midpoint filing range. Results for each are delineated accordingly. *Syndication*$_i$ denotes either a dummy variable indicating whether the venture capital was syndicated, or the number of venture capital firms participating in the initial public offering, depending on the model. In the models with a Syndication dummy variable zero represents those offering that did not involve syndicated venture capital, and one denotes those offerings with more than one venture capitalist involved. *Amount of Offering*$_i$ is the natural log of the amount of the initial public offering. Since it has been found that initial returns can be affected by the size of the offering (Ritter 1984), this variable controls for this effect. *Age of Firm*$_i$ is the age of the issuing company at the time of the IPO. Since the age of a firm can affect the information asymmetry associated with the company, this variable allows for this fact in the model. *Underwriter Rank*$_i$ is the rank of the lead underwriter handling the initial public offering. Using the method outlined by Carter and Manaster (1990) to determine the rank of underwriters on the basis of prestige, I use this variable to control for the effect of the quality of the underwriter on the results. *Venture Capital Rank*$_i$ is the average number of IPOs in which the VCs in the offering were involved in the previous 3-year period. Five independent measures of venture capital expertise were tested, and the average, rolling, number of initial public offerings that the venture capital firms were involved in during the 3-year period prior to each IPO is used throughout this study. *NASDAQ Return*$_{t-1}$ denotes the NASDAQ composite return for the quarter prior to the instant offering.

Table 6 reports the results related to the regressions of Market Hotness on Syndication, as well as the other variables. I find a positive relation between whether an initial public offering is syndicated and the hotness of the market at the time of the offering. Using both measures of market hotness, in Models 1 and 3, in the regression on United States firms, the coefficients are positive and significant at the 1% level. More particularly, Model 1, which presents the results using the average monthly initial returns as the measure of market hotness, indicates that there is a 5% increase in such monthly average when the firm is syndicated. When using the percentage of firms that priced above the midpoint of their offering range, the results indicate a 2.4% difference.

The results with respect to the level of VC syndication also indicate that there is a positive relationship between the level of syndication and the ability of the firm to time the IPO market. When testing the United States offerings using the average monthly initial returns as the measure of market hotness, I find a positive and significant relationship between such measure and the level of VC syndication, as can be seen in Model 2. The results with respect to Model 4, which using the percentage of firms that priced above the midpoint provide similar results. In reviewing the results related to the regressions of the sample of offerings from all countries with more than 10 IPOs, the results indicate that, among these offerings, there is a positive, and significant relationship between initial public offering market timing and both the syndication dummy variable and (Models 1 and 3), as well as the level of venture capital syndication (Models 2 and 4).

TABLE 6: Regressions of market hotness on venture capital syndication and control variables

This table reports the multivariate regressions for the sample of IPOs from 1980 through 2011. I exclude IPOs of less than $1,500,000, offerings below $5.00 per share, and the offerings of financial firms. The results are presented for regressions of U.S. IPOs only, as well as those for all countries with 10 or more initial public offerings during the sample period. The dependent variable is each of the two measures of market timing, *Market Hotness,* depending on the Model. The dependent variable for Models 1 and 2 is average monthly 1st day returns, based on Ibbotson and Jaffee (1975). The dependent variable for Models 3 and 4 is the monthly % of IPOs that priced above the midpoint of their initial filing range, based on Ibbotson, Sindelar, and Ritter (1994). *Syndication Dummy* is a dummy variable indicating whether the venture capital was syndicated. Zero represents those offering that did not involve syndicated venture capital, and one denotes those offerings with more than one venture capitalist involved. *Syndication Level* denotes the number of participating venture capital firms in the IPO syndication. *Amount of Offering* is the natural log of the amount of the initial public offering. *Age of Firm* is the age of the issuing company at the time of the IPO. *Underwriter Rank* is the rank of the lead underwriter handling the initial public offering, using the method outlined by Carter and Manaster (1990). *Venture Capital Rank* is the average number of IPOs in which the VCs in the offering were involved in the previous 3-year period. *NASDAQ Return* denotes the NASDAQ composite return for the quarter prior to the instant offering. Parameter estimates are presented with t-statistics below. * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

TABLE 6: Continued

| | USA | | | | All Countries with 10 or more IPOs | | | |
|---|---|---|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 1 | Model 2 | Model 3 | Model 4 |
| Syndication Dummy | 0.0516*** | | 0.0246*** | | 0.0425*** | | 0.0174*** | |
| | (4.67) | | (3.01) | | (3.87) | | (2.84) | |
| Syndication Level | | 0.0025** | | 0.0014** | | 0.0017** | | 0.0011** |
| | | (2.05) | | (2.36) | | (1.96) | | (2.18) |
| *Firm Characteristic Variables* | | | | | | | | |
| Amount of Offering (ln) | 0.0957*** | 0.0932*** | 0.0548*** | 0.0527*** | 0.0632*** | 0.0892*** | 0.0506** | 0.0428** |
| | (7.63) | (7.62) | (3.89) | (3.88) | (5.45) | (5.18) | (2.53) | (2.37) |
| Age of Firm (Years)) | -0.0034*** | -0.0037*** | -0.0022*** | -0.0014*** | -0.0028*** | -0.0024*** | -0.0020* | -0.0018* |
| | (-5.36) | (-5.54) | (-3.75) | (-3.86) | (-4.27) | (-4.22) | (-1.94) | (-1.86) |
| Underwriter Rank | 0.0012 | 0.0010 | 0.0044** | 0.0041** | 0.0018 | 0.0014 | 0.0039** | 0.0038** |
| | (0.68) | (0.57) | (2.52) | (2.46) | (1.09) | (1.07) | (2.46) | (2.24) |
| Venture Capital Rank | 0.0048** | 0.0047** | 0.0015* | 0.0010** | 0.0037** | 0.0031** | 0.0012* | 0.0019** |
| | (2.49) | (2.32) | (1.98) | (2.09) | (2.43) | (2.38) | (1.73) | (1.96) |
| *Macro-Economic Variables* | | | | | | | | |
| NASDAQ Composite Return | -.0017* | -.0012* | -.0016* | -.0012* | -.0008* | -.0006* | -.0017* | -.0005* |
| | (-1.92) | (-1.78) | (-1.89) | (-1.71) | (-1.83) | (-1.69) | (-1.76) | (-1.67) |
| Constant | -0.2024*** | -0.1620*** | 0.2330*** | 0.2554*** | -0.2003*** | -0.0833*** | 0.2284*** | 0.1843*** |
| | (-5.64) | (-4.92) | (7.50) | (9.08) | (-5.45) | (-4.73) | (5.32) | (5.15) |
| Observations | 2715 | 2715 | 2715 | 2715 | 2922 | 2922 | 2922 | 2922 |
| Adjusted R-Squared | 0.22 | 0.21 | 0.17 | 0.16 | 0.19 | 0.18 | 0.14 | 0.11 |

### 1.4.3 Impact of syndication on IPO pricing

The second goal of this paper is to examine the impact of venture capital syndication on initial returns, pre-IPO gain, and the initial IPO price range. To examine the relationship between VC syndication and how the markets price the security underlying the initial public offering I use three measures of market pricing. First, I examine the impact of venture capital syndication on initial returns. Based on Beatty and Ritter (1986) and the well-developed literature on the topic, initial returns are defined as the first-day return, relative to the offering price: (vt – OP)/OP, where vt is the closing bid price on the first day of public trading, and OP is the offering price. This paper follows this convention.

The initial return is a measure of the secondary market's adjustment to the valuation of the stock offered. A number of benefits to venture capital firms have been suggested in the literature, providing venture capitalists with an incentive to underprice of equity offerings. Most of the benefits inure to the venture capitalist, indirectly over time, at the expense of the firm. (Lerner (1994b)). The initial return adjusts the price of the stock to reflect what the value placed on it by the secondary market. As a first measure, this paper focuses on examining the impact of venture capital syndication on the initial return of the stock. Table 4 reports descriptive statistics related to the offering firms. The average initial return for IPOs for the group with syndicated venture capital is 21%. This is in stark comparison to 14% among the IPOs that were backed by a single venture capital firm. The average initial return for the entire sample of all IPOs is 18%.

As a second measure of IPO pricing, I test how the primary markets view the stock. To examine this issue, I use the extent to which the stock sold, in the primary

market, above the mid-point of its initial SEC filing range. This "pre-IPO gain/loss" is measured as a percentage of the mid-point of the initial filing range, and provides an indication of the primary market's view of the offering. It is the effect of venture capital syndication on this pre-IPO gain/loss that I test in this part of this paper. The average pre-IPO gain for the sample is 5%, with averages of 5% and 4% for syndicated and non-syndicated IPOs, respectively.

The third measure of the impact of venture capital syndication on IPO pricing used is the initial IPO filing range. When announcing an initial public offering, firms are required to disclose, along with other information, a projected IPO price range to the Securities and Exchange Commission on Form S-1. While the initial filing price range is frequently adjusted prior to the initial public offering, this initial price range provides the first indication of the firm, and its underwriter's, expectation with respect to the price of the stock. One would expect that the breadth of such range would be related to the uncertainty surrounding the offering. Therefore, venture capital syndication, and the extent of such syndication may play a role in the size of the initial public offering price range. I calculate the size of the price range, as a percentage of the midpoint of the filing range. This measure provides an intuitive metric to measure how the firm, and it's underwriters view the uncertainty of the pricing of the stock. The sample average initial pricing range is 14%. Syndicated IPOs have an average price range of 15%, compared to 13% for non-syndicated offerings.

Each model specification regresses one of the three measures of IPO pricing as the dependent variable on either the VC syndication dummy variable or the level of

syndication, as well as the control variables. The multivariate regression model is structured as follows:

$$\text{IPO Pricing Measure}_i = \alpha + \beta_1 \times \text{Syndication}_i \quad (1)$$
$$+ \beta_2 \text{ x Ln Amount}_i$$
$$+ \beta_3 \times \text{Age of Firm}_i$$
$$+ \beta_4 \times \text{Underwriter Rank}_i$$
$$+ \beta_5 \times \text{VC Rank}_i$$
$$+ \beta_6 \times \text{Market Hotness}_{t-1}$$
$$+ \beta_7 \times \text{NASDAQ Return}_{t-1} + \varepsilon_i$$

where, *Market Pricing Measure*$_i$ denotes the individual measure of market pricing: Initial return, pre-IPO gain, and initial IPO price range, depending on the model specification.[7] *Syndication*$_i$ denotes either a dummy variable indicating whether the venture capital was syndicated, or the number of venture capital firms participating in the initial public offering, depending on the model. In the models with a Syndication dummy variable zero represents those offering that did not involve syndicated venture capital, and one denotes those offerings with more than one venture capitalist involved. *Amount of Offering*$_i$ is the natural log of the amount of the initial public offering. Since it has been found that initial returns can be affected by the size of the offering (Ritter 1984), this variable controls for this effect. *Age of Firm*$_i$ is the age of the issuing company at the time of the offering. Since the age of a firm can affect the information asymmetry associated

[7] Initial return is defined as (vt – OP)/OP, where vt is the closing bid price on the first day of public trading, and OP is the offering price (Beatty and Ritter (1986)). Pre-IPO gain is defined as the percentage that the final IPO price was above the midpoint of the initial filing range. Initial price range is defined as the overall initial price range expressed as a percentage of the midpoint of such IPO price range.

with the company, this variable allows for this fact in the model. *Underwriter Rank*$_i$ is the rank of the lead underwriter handling the initial public offering.[8] *Venture Capital Rank*$_i$ is the average number of IPOs in which the VCs in the offering were involved in the previous 3-year period. *Market Hotness*$_i$ is the percentage of IPOs that priced above the midpoint of the filing range in the month in which the instant IPO occurred. *NASDAQ Return*$_{t-1}$ denotes the NASDAQ composite return for the quarter prior to the instant offering.

Table 7 reports the results related to the regression of initial returns on the venture capital syndication dummy variable, and the level of such venture capital syndication, as well as the control variables. I find a significant, positive relationship between VC syndication and initial returns, in both the model using the syndication dummy variable as the primary explanatory variable of interest, as well as the model with the level of VC syndication as the primary variable of interest. In Model 1, the syndication dummy variable indicates that there is a 14% increase in the initial return of the firm if the venture capital is syndicated. The increase in initial returns when testing the sample of U.S. firms together with IPOs from all countries with 10 or more IPOs, is 12%. With respect to the level of syndication, Model 2 reports that there is an increase of 1% for each VC syndicate added to the offering in both US. IPOs and those from the sample including all countries with 10 or more IPOs. The results indicate that there is significant, positive relation between venture capital syndication and initial return.

[8] Underwriter Rank calculations are based on the Carter and Manaster (1990) Underwriter Prestige Ranking model.

TABLE 7: Regressions of initial return on venture capital syndication and control variables

This table reports the multivariate regressions for the sample of IPOs from 1980 through 2011. I exclude IPOs of less than $1,500,000, offerings below $5.00 per share, and the offerings of financial firms. The results are presented for regressions of U.S. IPOs only, as well as those for all countries with 10 or more initial public offerings during the sample period. The dependent variable is *Initial Return*, and is computed as (vt – OP)/OP, where vt is the closing bid price on the first day of public trading, and OP is the offering price of the initial public offering, following convention established in Beatty and Ritter (1986). *Syndication Dummy* is a dummy variable indicating whether the venture capital was syndicated. Zero represents those offering that did not involve syndicated venture capital, and one denotes those offerings with more than one venture capitalist involved. *Syndication Level* denotes the number of participating venture capital firms in the IPO syndication. *Amount of Offering* is the natural log of the amount of the initial public offering. *Age of Firm* is the age of the issuing company at the time of the IPO. *Underwriter Rank* is the rank of the lead underwriter handling the initial public offering, using the method outlined by Carter and Manaster (1990). *Venture Capital Rank* is the average number of IPOs in which the VCs in the offering were involved in the previous 3-year period. *IPO Market Hotness* is the monthly percentage of IPOs that priced above the midpoint of their initial filing range, based on Ibbotson, Sindelar, and Ritter (1994). *NASDAQ Return* denotes the NASDAQ composite return for the quarter prior to the instant offering. Parameter estimates are presented with t-statistics below. * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

TABLE 7: Continued

| | USA | | Countries with 10 or more IPOs | |
|---|---|---|---|---|
| | Model 1 | Model 2 | Model 1 | Model 2 |
| Syndication Dummy | 0.1473*** | | 0.1243*** | |
| | (6.92) | | (4.63) | |
| Syndication Level | | 0.0102** | | 0.0082** |
| | | (2.51) | | (2.33) |
| *Firm Characteristic Variables* | | | | |
| Amount of Offering (ln) | 0.1183** | 0.1264** | 0.1201** | 0.1211** |
| | (2.43) | (2.51) | (2.47) | (2.53) |
| Age of Firm (Years)) | -0.0067*** | -0.0062*** | -0.0042*** | -0.0058*** |
| | (-5.87) | (-5.97) | (-4.73) | (-4.82) |
| Underwriter Rank | 0.0114** | 0.0101** | 0.0103** | 0.0089** |
| | (2.44) | (2.57) | (2.35) | (2.12) |
| Venture Capital Rank | 0.0053** | 0.0051** | 0.0059* | 0.0038* |
| | (1.98) | (2.01) | (1.83) | (1.92) |
| *Macro-Economic Variables* | | | | |
| IPO Market Hotness | 0.7131*** | 0.6143*** | 0.6392*** | 0.6539*** |
| | (7.37) | (6.44) | (5.83) | (5.93) |
| NASDAQ Composite Return | -.0035* | -.0031* | -.0026 | -.0025 |
| | (-1.73) | (-1.89) | (-1.54) | (-1.57) |
| Constant | -0.7027*** | -0.6318*** | -0.649*** | -0.5832*** |
| | (-8.43) | (-8.21) | (-7.72) | (-7.09) |
| Observations | 2715 | 2715 | 2922 | 2922 |
| Adjusted R-Squared | 0.45499 | 0.44611 | 0.4173 | 0.4082 |

The findings are consistent with the literature in the finding that venture capital firms provide young firms with benefits beyond financing, such as advice, monitoring, and general expertise. (Keuschnigg (2004) and Barry, et al. (1990). Further, venture capital syndication has been found to offer benefits in providing increased expertise and monitoring (Lerner (1994a). The results here suggest that an additional benefit provided by venture capital syndication is an increase in initial returns.

The second measure used to test the impact of venture capital syndication on IPO pricing is pre-IPO gain/loss. Table 8 reports the results of the regressions of the pre-IPO gain/loss on the syndication dummy and level of syndication variables, as well as the control variables.[9] The coefficients indicate that there is a positive relationship between whether an initial public offering is syndicated and the extent to which the offering is ultimately priced above the midpoint of the initial filing range. With respect to the sample of U.S. firms only, as well as that of the U.S. and all countries with 10 or more IPOs, the coefficients are positive and significant at the 5% level. The coefficients on the level of syndication, however, are not significant in the model specification (Models 2 and 4). This was found when testing both samples of IPOs. The results suggest that a venture capital syndication impacts the primary market's pricing of the offering. If there is a syndicate of venture capitalists involved in the offering the offering is priced at a higher price above the midpoint of the initial filing range. Based on the findings, however, the level of such venture capital syndication does not appear to play a significant role in such pricing.

[9] Regressions of pre-IPO gain/loss are performed on a reduced sample of 1772 U.S. firms and a 15 IPOs from countries with 10 or more IPOs, due to price range information being unavailable for all firms in the overall sample.

TABLE 8: Regressions of pre-IPO gain on venture capital syndication and control variables

This table reports the multivariate regressions for the sample of IPOs from 1980 through 2011. I exclude IPOs of less than $1,500,000, offerings below $5.00 per share, and the offerings of financial firms. In addition, initial IPO price range is not available for all firms in the base sample. Therefore, the sample for regressions related to pre-IPO gain/loss includes 1,772 U.S. offerings, and 115 offerings from countries with more than 10 IPOs. The results are presented for regressions of U.S. IPOs only, as well as those for all countries with 10 or more initial public offerings during the sample period. The dependent variable is *Pre-IPO Gain/Loss,* and is calculated the difference between the midpoint of the initial IPO filing range and the final offering price, expressed as a percentage of the mid-point of the initial filing range. *Syndication Dummy* is a dummy variable indicating whether the venture capital was syndicated. Zero represents those offering that did not involve syndicated venture capital, and one denotes those offerings with more than one venture capitalist involved. *Syndication Level* denotes the number of participating venture capital firms in the IPO syndication. *Amount of Offering* is the natural log of the amount of the initial public offering. *Age of Firm* is the age of the issuing company at the time of the IPO. *Underwriter Rank* is the rank of the lead underwriter handling the initial public offering, using the method outlined by Carter and Manaster (1990). *Venture Capital Rank* is the average number of IPOs in which the VCs in the offering were involved in the previous 3-year period. *IPO Market Hotness* is the monthly percentage of IPOs that priced above the midpoint of their initial filing range, based on Ibbotson, Sindelar, and Ritter (1994).

TABLE 8: Continued

| | USA | | Countries with 10 or more IPOs | |
|---|---|---|---|---|
| | Model 1 | Model 2 | Model 1 | Model 2 |
| Syndication Dummy | 0.0242** | | 0.0184** | |
| | (2.44) | | (2.41) | |
| Syndication Level | | -0.0012 | | -0.0011 |
| | | (-0.73) | | (-0.42) |
| *Firm Characteristic Variables* | | | | |
| Amount of Offering (ln) | -0.0023** | -0.0025** | -0.0027** | -0.0034** |
| | (-2.06) | (-2.31) | (-2.31) | (-2.47) |
| Age of Firm (Years)) | -0.0003** | -0.0001*** | -0.0004** | -0.0001*** |
| | (-2.35) | (-2.94) | (-2.48) | (-2.74) |
| Underwriter Rank | 0.0007** | 0.0008** | 0.0009** | 0.0013** |
| | (2.00) | (2.16) | (2.32) | (2.52) |
| Venture Capital Rank | 0.0008** | 0.0007** | 0.0012** | 0.0010** |
| | (2.43) | (2.23) | (2.51) | (2.12) |
| *Macro-Economic Variables* | | | | |
| IPO Market Hotness | 0.0059 | 0.0087* | 0.0042 | 0.0053* |
| | (1.39) | (1.73) | (1.18) | (1.87) |
| NASDAQ Composite Return | -.0012* | -.0011* | -.0009* | -.009* |
| | (-1.94) | (-1.92) | (-1.89) | (-1.71) |
| Constant | 0.0933*** | 0.0149*** | 0.0812*** | 0.0127*** |
| | (8.35) | (11.10) | (7.04) | (9.17) |
| Observations | 1772 | 1772 | 1887 | 1887 |
| Adjusted R-Squared | 0.1706 | 0.1462 | 0.1634 | 0.1421 |

The third measure of IPO pricing tested is the initial IPO price range.[10] It would be expected that the breadth of the IPO pricing range would be related to the uncertainty surrounding the offering, and that venture capital syndication may impact the size of the initial public offering price range. Table 9 reports the results with respect to regressions of the measure of the pricing range on the syndication variables. In both models, when analyzing the samples of U.S. IPOs only, as well as that of the U.S. offerings together with those from all countries with 10 or more offerings, the results indicate a significant, positive relationship between the size of the initial filing price range and venture capital syndication. The coefficient of .0332 in Model 1, suggests that syndicated initial public offerings have a significant increase in the initial IPO pricing range. The other models produce similar results. The findings are counterintuitive to what would be expected, if syndicates of venture capitalists reduce risk in the offering. One would expect, based on a reduction in uncertainty, and therefore a smaller initial pricing range, associated with a larger VC syndication. The results suggest that as additional VCs are added to the syndication, the pricing range of the initial public offering increases.

One possible explanation for the counterintuitive findings with respect to the size of the offering price range relates to the firm's ability to extract the highest price out of the IPO process. After an initial public offering announcement, along with the initial expected price range, the firm and the underwriter of the security, present the offering to prospective buyers. This "road show" is designed to generate excitement and interest in the new issue of stock, and accumulate a number of buyers of the stock in the primary

[10] Regressions of initial IPO filing range are performed on a reduced sample of 1772 U.S. firms and 115 IPOs from countries with 10 or more IPOs, due to price range information being unavailable for all firms in the overall sample.

TABLE 9: Regressions of initial IPO price range on venture capital syndication and control variables

This table reports the multivariate regressions for the sample of IPOs from 1980 through 2011. I exclude IPOs of less than $1,500,000, offerings below $5.00 per share, and the offerings of financial firms. In addition, initial IPO price range is not available for all firms in the base sample. Therefore, the sample for regressions related to pre-IPO gain/loss includes 1,772 U.S. offerings, and 115 offerings from countries with more than 10 IPOs. The results are presented for regressions of U.S. IPOs only, as well as those for all countries with 10 or more initial public offerings during the sample period. The dependent variable is *IPO Initial Filing Price Range,* and is calculated as the size of the initial filing price range, expressed as a percentage of the midpoint of the filing range. *Syndication Dummy* is a dummy variable indicating whether the venture capital was syndicated. Zero represents those offering that did not involve syndicated venture capital, and one denotes those offerings with more than one venture capitalist involved. *Syndication Level* denotes the number of participating venture capital firms in the IPO syndication. *Amount of Offering* is the natural log of the amount of the initial public offering. *Age of Firm* is the age of the issuing company at the time of the IPO. *Underwriter Rank* is the rank of the lead underwriter handling the initial public offering, using the method outlined by Carter and Manaster (1990). *Venture Capital Rank* is the average number of IPOs in which the VCs in the offering were involved in the previous 3-year period. IPO Market Hotness is the monthly percentage of IPOs that priced above the midpoint of their initial filing range, based on Ibbotson, Sindelar, and Ritter (1994). *NASDAQ Return* denotes the NASDAQ composite return for the quarter prior to the instant offering. Parameter estimates are presented with t-statistics below. * indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.

TABLE 9: Continued

| | USA | | Countries with 10 or more IPOs | |
|---|---|---|---|---|
| | Model 1 | Model 2 | Model 1 | Model 2 |
| Syndication Dummy | 0.0332** | | 0.0245** | |
| | (2.44) | | (2.14) | |
| Syndication Level | | 0.0017* | | 0.0012* |
| | | (1.89) | | (1.83) |
| *Firm Characteristic Variables* | | | | |
| Amount of Offering (ln) | -0.0027** | -0.0026** | -0.0021* | -0.0018* |
| | (-2.00) | (-2.07) | (-1.83) | (-1.73) |
| Age of Firm (Years)) | -0.0002** | -0.0002*** | -0.0003** | -0.0002** |
| | (-2.46) | (-2.75) | (-2.22) | (-2.31) |
| Underwriter Rank | 0.0015*** | 0.0013** | 0.0027*** | 0.0022** |
| | (2.91) | (2.55) | (2.45) | (1.97) |
| Venture Capital Rank | 0.0013*** | 0.0013*** | 0.0030*** | 0.0026*** |
| | (3.77) | (3.72) | (3.31) | (3.14) |
| *Macro-Economic Variables* | | | | |
| IPO Market Hotness | 0.0092* | 0.0122** | 0.0031* | 0.0072** |
| | (1.74) | (2.29) | (1.68) | (1.97) |
| NASDAQ Composite Return | -.0008* | -.0007* | -.0004* | -.0004* |
| | (-1.87) | (-1.83) | (-1.75) | (-1.74) |
| Constant | 0.0809*** | 0.1029*** | 0.0709*** | 0.0829*** |
| | (9.60) | (11.65) | (8.73) | (9.03) |
| Observations | 1772 | 1772 | 1887 | 1887 |
| Adjusted R-Squared | 0.1871 | 0.1588 | 0.1734 | 0.1572 |

market. One would expect that offerings that are backed by a syndicate of venture capitalists, as opposed to a single VC, would have more credibility during this process. A possible explanation for the positive relationship between the initial IPO price range and VC syndication is that the larger price range allows the firm additional potential upside to increase the IPO price, without having to amend the initial IPO filings. IPOs that are more largely syndicated may be viewed as offering a better opportunity to increase the price during the road show. If that is the case, the underwriters may be pricing these firms with a wider range to allow room to capture the greater upside potential of syndicated offerings if demand for the stock is strong.

## 1.5 Conclusion

Market timing of initial public offerings, creating clusters or waves offerings in hot issue markets, by firms issuing public equity has been a well-documented phenomenon. Although there is a fair amount of support for the proposition that firms time the market, as well as how market timing can benefit the issuing company, underwriters, and venture capitalists, the extent to which venture capital syndication affects a firm's ability to efficiently time the IPO market, is an unexplored area of the literature.

In this paper, I examine the role of venture capital syndication in the firms' ability to efficiently time the IPO market, as well as the benefits of syndication to the issuing firms and venture capitalists. I find a positive, significant relationship between venture capital syndication and IPO market timing, using both measures of market timing primarily espoused in the literature. All of the models suggest that the syndication of

venture capital increases a firm's ability to time the IPO market, and that the level of such syndication contributes positively to this ability.

As a second analysis of this study, I examine the benefits of syndication and efficient IPO market timing, in terms of the firm, as well as the primary and secondary markets. I find a positive, and significant, relation between venture capital syndication and initial returns. Both the presence of a venture capital syndicate, in addition to the level of such syndication, increase the initial returns related to the offering. I also find a significant, positive relationship between VC syndication and the extent to which an offering ultimately prices above the midpoint of the initial filing range. Finally, the results indicate that there is a positive, significant, relationship between syndication and the initial filing range. While the results with respect to the relationship between VC syndication and initial IPO filing range are different than expected, I offer a theory that explains the relationship.

This paper contributes to the literature in a number of significant ways. First, it extends the initial public offering research by examining the effect of venture capital syndication on a firm's ability to efficiently time the new equity market, as well as the impact on offering pricing. This is a topic that, to my knowledge, has not been addressed in the literature previously. Second, in addition to helping fill the literary gap surrounding IPO market timing, this study contributes to the literature by examining the benefits of such market timing to issuers, and venture capitalists. A third contribution this work makes to the existing literature is that it advances initial public offering market timing and pricing as additional benefits of Venture capital syndication.

# CHAPTER 2: SEED ACCELERATORS: A NEW APPROACH TO FIRM VALUE CREATION

## 2.1 Introduction

Venture capital seed accelerators represent a relatively new and development in the process of funding young companies. While there have been various forms of incubators and other entities that assist in the growth of new firms, the modern form of the seed accelerator is a relatively new phenomenon, and are unique in a number of key respects. First, seed accelerators are often owned and operated by venture capital firms, which changes the dynamics of their relationship with the start-up firm. Second, accelerator programs typically offer mentoring to young firms for a few months, which forces the firm and venture capitalist to develop and evaluate the costs and benefits of the potential venture in a very short time frame. Third, accelerators are unique in that they normally admit competitive cohorts of start-ups, rather than working with individual companies through the early-stage process.[11]

These unique characteristics potentially present a different development path for young companies. The early, intense involvement of venture capital firms in the development of the start-up potentially alters the growth, structure, and ultimately financing of young companies that participate in these programs. In addition, since they are operated by, and have evolved at the hands of, venture capital firms themselves,

[11] They often create open competitions through which entrepreneurs vie for the opportunity to participate in the program (Miller and Bound (2011)).

accelerators provide a unique view of the effects of venture capital monitoring, mentoring, and financial support on the companies they invest in.

One possible area in which accelerator program participation may have an impact on the development cycle of new firms is how they are funded. As has been well established in the literature, venture capital has traditionally been analyzed in terms of the role it plays in providing financing to firms that might not otherwise be able to obtain such funding. (Sahlman (1990); Gompers (1995); and Lerner (1994a). The literature develops the primary theories associated with venture capitalists role as financial intermediaries, and their function with respect to reducing potential agency costs and information asymmetry.

Central to these theories are the control mechanisms used to ameliorate such issues. There are three common control mechanisms described in the literature related to venture capital financing: 1) staged capital infusions; 2) the syndication of investments; and 3) the use of convertible securities. Of these mechanisms, it has been suggested that staged capital funding is the most potent (Sahlman (1990)). The staging of financing provided to young companies, provides venture capital firms with the opportunity to monitor firm progress and founder actions, gather firm-specific information, and maintain an option to abandon projects that do not meet expectations. The monitoring and information gathering functions of venture capital firms are at the core of their role as financial intermediaries.

Venture capital organizations have an incentive to make investments in firms as early as possible for three primary reasons. First, early investment ensures that they have the option to invest in the company in the future, in the presence of a competitive

environment for investment companies. Second, venture capital firms can "purchase" the opportunity to gather information about project-specific and agency uncertainties that is endogenous to the firm. Third, early involvement in the company allows the venture capitalist to mentor the owners with respect to their product and company.

Seed accelerators seem to be designed to serve these interests particularly well. They allow the venture capital firm to become intimately acquainted with the new company, its product, and its founders as early as possible. This benefit serves a number of functions, including monitoring, mentoring, as well as reducing information asymmetry. Additionally, the structure of the program provides a financial benefit as well. By allowing the venture capitalist, through the accelerator program, to take an equity ownership interest in the new company, it ensures that the venture capital firm secures an option to participate in the equity of the new company, at a very early stage, and at a relatively low cost.

Despite the increasing importance of seed accelerators in today's venture capital environment, there is little research or literature related to these programs, and more particularly, the financial affects they have on the firms they finance. There have been a small number of studies analyzing the benefits of seed accelerators to the larger community and economy (Miller and Bound (2011)). However, there is a dearth of literature related to the firm-level affects. Additionally, to my knowledge, no study has investigated the possible effects that these start-up programs have on early-stage financing, in particular.

In this paper, I explore the effect of seed accelerator program participation on subsequent follow-on funding.[12] The first goal of this paper is to determine whether accelerator participation affects *ex post* follow-on funding. Since most young firms financed by venture capitalists require continued funding to survive and grow, follow-on funding is considered a key signal of firm growth and positive expectations of the future. Further, the characteristics of such funding is impacted by the health and structure of the firm.

I find that seed accelerator participation is positively related to subsequent follow-on funding, after controlling for firm characteristics as well as macro-level variables such as venture capital market investments, venture capital commitments, and the NASDAQ Composite Index. The results indicate that firms that participate in an accelerator program are more likely to receive follow-on funding in the three years that follow their initial seed funding. To my knowledge this paper offers the first findings related to this aspect of the start-up funding, and the benefits of accelerator programs in this regard.

After finding that a significant relationship exists between accelerator program participation and follow-on funding, a second goal of this paper is to examine how the characteristics of the follow-on funding differ between accelerator participants and non-accelerated firms. If accelerator programs offer benefits, one would expect that they would continue through the early-stage financing of the firm. I study the total amount raised, the amount of individual rounds, as well as the number and time between such rounds, during the three years following initial seed funding. I find that the follow-on funding of accelerated firms exhibits favorable characteristics, as compared to firms that

[12] Follow-on funding is defined as any financing received by the firm after the date of the initial seed funding, and includes equity and debt financing.

did not participate in such a program. Specifically, I find a significant, positive relationship between accelerator program participation and the total amount of follow-on funding raised. The results show that firms that attend such a program raise more funds during the three years following such participation. In addition, I find a positive relationship between the average amount of individual funding rounds, as well as the average time between funding rounds, and accelerator participation. Finally, I document a negative relationship between the number of funding rounds and accelerator participation. After examining the relationship between accelerator participation and follow-on funding, as well as the characteristics of such funding, I explore possible causes of such findings, and present three hypotheses for the findings.

This study adds to the extant literature in a number of important ways. First, the research fills a large gap related to one of the newest funding vehicles, venture capital seed accelerators. It provides an examination of the effects of participation in these programs on one of the most important metrics for young firm success, follow-on funding. To my knowledge, this study stands alone in this regard, as there has been no literature related to the firm-level affects of these funding programs. This is important for entrepreneurs, start-up firms, venture capitalists, and investors because it sheds light on how the amount of funding and financing characteristics of early-stage companies are impacted by accelerator participation.

Second, this study adds to the literature in that it provides a foundation from which to examine the long-term effects of accelerator programs on the firms they finance, as they mature into larger private and public companies. At the rate these programs are growing, they stand to impact a significant number of new companies. This paper

provides a foundation for studying how these new funding tools influence important firm characteristics, such as financing, capital structure, and corporate governance.

The remainder of this paper is structured as follows. Section 2.2 reviews the relevant literature and provides my hypotheses. Section 2.3 describes the data and sample selection. Section 2.4 presents the methodology and empirical results. Section 2.5 concludes.

## 2.2 Literature Review and Hypotheses

### 2.2.1 Venture Capital's Role in Growing Young Companies

The benefits of venture capital to the growth of young firms, job creation, and economic growth as a whole is well-documented (Dushnitsky and Lenox (2006)). A primary function of venture capital firms is the role they play as a financial intermediary, providing capital to firms that might not otherwise by able to attract funding. These firms are often early-stage, technology-related companies that have a high degree of uncertainty. Specifically, there are two primary concerns with respect to these types of young firms. First, they often have a high degree of information asymmetry, due to firm-specific uncertainty related to the potential costs and benefits associated with the company's projects. Second, there are potential agency conflicts related to the decisions of the founders. The function performed by the venture capitalist is based primarily on reducing the uncertainties that are endogenous to the firm, and the resulting barriers to financing that these companies face in the financial marketplace.

With respect to information asymmetry, Gompers (1995) suggests that venture capitalists specifically concentrate investments in early-stage, technology-related companies where information asymmetries are the highest. These financial intermediaries

create relationships that are structured in a way that allows them to gather relevant firm-specific information. Barry, et al. (1990) further find results consistent with the theory that venture capitalists specialize their investments in firms where they can provide intensive monitoring services in an effort to ameliorate potential agency conflicts.

To address the uncertainties associated with early-stage firms, venture capitalists use a number of control mechanisms. The three primary tools used are: 1) Staged-capital infusions, 2) syndication of investments, and 3) funding contract-related controls such as convertible securities. How these mechanisms are used by venture capitalists has been widely examined (Sahlman (1990); Gompers (1995); Gompers and Lerner (2004)). Of the different tools used by venture capitalist, it has been suggested that staged-financing is the most effective. (Sahlman (1990)).

Staged funding serves a number of functions in the relationship between venture capitalist and the young firms they finance. First, it reduces both information asymmetry and potential agency conflicts by facilitating frequent monitoring of the firm. Requiring that a financed company seek frequent funding, and more importantly the reevaluation involved at the time of the new funding round, keeps the founder on a tight leash (Gompers and Lerner (2004)). This monitoring of firm progress at the time a decision whether to provide further funding is made, is the primary review of nascent companies (Gompers (1995)).[13]

A second primary function staged funding serves relates to the options held by the venture capital firm. Requiring the company to seek frequent financing rounds reduces losses from poor decisions on the part of the venture capitalist (Gompers and Lerner

[13] Gorman and Sahlman (1989) find that, between rounds of funding, lead venture capitalists visit entrepreneurs approximately once per month on average, spending about four or five hours at the company during each visit. In addition, they are provided with monthly financial reports.

(2001)). Venture capitalists maintain the option to not provide funding if, after gathering information, it appears there is little probability of the company going public or enjoying some other profitable exit (Gompers (1995)).

Li (2008) examines this option in greater detail, and suggests that the decision whether to extend further financing to a firm is a real option. Specifically, the venture capitalist has the choice to either invest additional funds, or hold the option to invest until further information can be obtained. When to exercise the option is a balance between the incentive to wait to invest until exogenous, market-based uncertainty is resolved over time, and the motive to invest sooner to obtain information about uncertainty that is endogenous to the firm (Li (2008)). Li notes that, since often project-specific information is gathered primarily when investment in the firm is taking place, venture capital organizations have an incentive to invest now, so they can obtain information regarding project-specific uncertainty. Learning about the potential costs and benefits associated with a firm and its operations, through investing in the firm, is a key method of controlling information asymmetry and agency conflicts, used by venture capitalists. The running costs of staged, ongoing investment facilitate the accumulation of information, which informs the intermediary's option to fund the company further, or abandon the project.

It is also well established in the extant literature that venture capital organizations serve a specialized role beyond providing pecuniary assistance. Venture capitalists act as mentors, monitors, and networkers, while maintaining a close relationship with the firms they fund. To that end, Keuschnigg (2004) finds that venture capitalists not only finance, but also advise and bring value to portfolio firms, as well as the economy as a whole,

through boosted innovation-based growth. Kanniainen and Keuschnigg (2003) suggests that venture capitalists, represent "informed capital," and screen and advise start-up entrepreneurs. This non-pecuniary assistance benefits both the venture capitalist and the founders, as they share at least some common interests in the success of the firm. Barry, et al. (1990) further establish that venture capital firms serve on the board of portfolios companies, and provide benefits to young firms beyond funding. Hellman and Puri (2002) further examine empirical evidence from a hand-collected data set related to technology startups to ascertain the impact of venture capitalists on the development path of new firms. Their findings suggest that venture capital involvement provides benefits in terms of helping companies increase human resources, and other types of company development.

### 2.2.2 Seed Accelerator Programs

An analysis of seed accelerator programs must begin with the fact that they are a product of the evolution of the business incubator, which has existed for a number of decades. Business incubators, like accelerators, provide business services such as office space, facilities, telecommunications systems, as well as advice and other knowledge-based services.

Grimaldi, Rosa, and Grandi (2005) provide a survey of the types of incubators. While the study was conducted prior to the advent of the modern seed accelerator, it provides a helpful outline of the evolution of business incubators. The work provides a framework for the evolution of the incubator concept, which has lead to the advent of accelerators. Grimaldi, Rosa, and Alessandro Grandi (2005) identified four types of incubators: Business Innovation Centers, University Business Incubators, Independent

Private Incubators, and Corporate Private Incubators. They also suggest that the evolution of incubator business models has been driven by changing company requirements and needs. Based on this overriding idea, the study differentiates the types of incubators into two categories based on the range of services offered. The first of these two categories, which can be thought of as framing each end of a spectrum of business models, are Business Innovation Centers and Regional Public Incubators. These organizations are oriented towards providing tangible assets and market commodities, and allow companies to benefit from access to large-scale physical assets and support at a low cost.

On the other end of the spectrum are Independent Private Incubators and Corporate Private Incubators. These organizations focus on the provision of financing and more intangible, high-value assets. They often offer technological support and a readily-available network of knowledge based services, which have become increasingly important for start-ups over the past two decades. This second category of business incubators also operate based on a shorter time-frame in how they serve start-ups.

According to the study, University Business Incubators can be found somewhere between these two ends of business services. The paper suggests that University Business Incubators are similar to Business Innovation Centers in that they rely on fees and public subsidies. Their objective, however, is different. Their primary focus is to provide businesses with access to technological knowledge and other human-capital infrastructure available at universities. They differ from Business Innovation Centers in that they do not tend to be less time-sensitive. Finally, the authors readily acknowledge that there is a wide-range of other business models, each lying somewhere on this spectrum.

Hansen, et al. (2000) analyze whether business incubators were a fleeting phenomenon or a lasting method of funding start-ups. Their conclusions suggest that networked incubators play an increasing role in start-up finance because they provided a benefit that neither large corporations, nor venture capitalists could offer: Value through preferential network access, the fostering of entrepreneurial drive, and economies of scale. More particularly, incubators offer entrepreneurial benefits, which is an element that large companies struggle to maintain. Interestingly the paper also suggests that, unlike venture capitalists, startup incubators are able to provide an increased level of organized network benefits. Numerous other studies have examined the effects of business incubators on the financial aspects of businesses, including a number of studies that find that start-ups that participate in business incubators are more successful in the long-term.

The extant literature related to incubators, however, does not include analysis of seed accelerators, which is a more recent incarnation of business services organizations. Created as an evolutionary extension of the traditional business incubator, the modern seed accelerator shares some, but not all, of the characteristics of the incubator. For example, like incubators, seed accelerator programs often provide office space, business advice, and other knowledge-based services. They, however, differ from their incubator counterparts in a number of key ways.

First, accelerators are often owned and operated by venture capital firms. Therefore, from the outset the goals of the organization are different from the traditional incubator. An extension of this difference is the fact that accelerators often provide short-term funding to the start-ups they accept into the program. This funding typically is

accompanied with an agreement that the venture capital accelerator acquire an interest in the venture (Miller and Bound (2011)). The equity interest in the company forms a different type of relationship with the young firm, and is the basis of the option held by the venture capitalist. This differs markedly from traditional incubators, which normally do not play an ownership role in the companies they support.

A second primary distinction between business incubators and venture capital accelerators is the time-frame within which they operate. Seed accelerators initially provide time-limited support. Whereas companies participating in an incubator program often have no set time-frame limitations on their relationship, accelerators seek to turn business ideas into viable businesses based on a very short, intense, time schedule. Although the venture capital firm often continues to fund the business that participated in the accelerator, typically the accelerator program itself often lasts for only a few months (Miller and Bound (2011)).

A third characteristic unique to accelerators is their focus on teamwork. They normally admit cohorts or classes of start-ups, rather than individual companies. All of the founders in a cohort enter at the same time, and leave the program at the same time. Additionally, accelerators focus on small teams of founders, rather than individual founders (Miller and Bound (2011)). As a part of the application process founder teams are often required to include individuals that are skilled in different aspects of the start-up. This likely plays a key role in increasing the likelihood of firm success.

A final primary difference between business incubators and seed accelerator programs is the process of choosing start-ups to support. Accelerators are highly-competitive. They often create a competition through which entrepreneurs vie for the

opportunity to participate in the program (Miller and Bound (2011)). While traditional incubators typically have an application process and there are frequently limited resources available for a small number of firms, it is normally not presented as a competition.

While, to my knowledge, there has been no literature analyzing the firm-level benefits of accelerator programs, one study should be noted. Kim and Wagman (2012) study accelerator programs, and their findings suggest possible inefficiencies in equity fees, class size, information shared with investor, and the process of granting entrepreneurs access to investors. They suggest that seed accelerators choose a class size that is too small relative to the social optimum. The authors also point out that this inefficiency can be mitigated by providing an entrepreneur-in-residence. Kim and Wagman (2012), however, focuses on seed accelerator programs, rather than the firms they fund.

### 2.2.3 Seed Accelerator Programs as a New Path of Venture Capital Funding

Venture capital organizations play an important role as financial intermediaries, by providing funding, as well as mentoring, to young firms that otherwise might not be able to obtain this type of assistance. To ameliorate information asymmetry and agency concerns in the relationship between the venture capitalist and the firms it invests in, a number of techniques are used. One of the most effective of these tools is that of staged-funding rounds, because it requires that the firm undergo periodic reevaluation. During the process of reexamining the firm, before making the decision to extend further financing, venture capital companies learn about the potential costs and benefits associated with the company, its operations, and its founders.

The initial investment in a company provides the venture capitalist with a preliminary option to retain an ongoing equity interest in the firm. The initial investment in the company gives the financer time to evaluate the firm's product or service, and its owners. Ongoing, staged capital infusions provide the financer with a renewing option to provide further funding, wait to extend financing, or abandon the project. The dual motives of acquiring/preserving the option to invest in the company in the future, and obtaining project-specific information, result in an incentive for the venture capital firm to invest in the firm as early as possible. Further, competition among venture capital organizations to identify new firms to invest in, puts pressure on them to find start-ups at a young age.

This paper examines seed accelerators as a tool developed by venture capitalists to assist in their efforts to evaluate, acquire an interest in, mentor, and monitor young company that have a high degree of uncertainty. To fully consider the impact of these funding vehicles, it is important to understand how an accelerator operates. The acceleration process sheds light on how these new funding vehicles benefit firms and their financers.

Seed accelerator programs accept applications from prospective firms that are interested in entering the program. From these applications the program chooses a cohort, or class, of entering firms. The application process if open, yet highly competitive. Only a small number of start-sup are chosen for each class. At this stage, the accelerator is primarily looking for two components in an ideal candidate: a great idea, and a team of founders that seems able to accomplish their goal.

Once the class of firms is chosen, they typically relocate to the geographic area where the accelerator is located. Since the acceleration process involves intense mentoring and monitoring, it is imperative that the firm be onsite through the process. The seed accelerator program provides initial seed funding to the firm. Depending on the policies of the program, the seed funding is normally based either on a fixed amount, or a sliding scale depending on the number of founders. Accelerator seed funding normally ranges from $7,500 to $100,000 per firm, with approximately $20,000 being the average. The seed funds are contributed to the start-up in exchange for a small ownership interest in the company. This equity ownership share is typically between 2% and 10% of the firm.

During the course of the accelerator program, the firms attend focused events that are designed to help them develop their ideas, focus their resources, and produce a product or service. Since the programs are time-limited, there is intense pressure among the firms to succeed. At the end of the program, which typically last two to three months, the firms pitch their product or service to a group of investors, in what is called “Demo Day.” Often these investors include both venture capitalists from within the accelerator program, and investors that are not directly connected with the program. Following the presentation of their product/service, the companies negotiate further funding.

Since often founders have little more than an idea when they enter the accelerator program, this is the earliest opportunity for venture capitalists to become intimately involved with the firm. I hypothesize that this early involvement helps both the firm and venture capitalist in a number of important ways. For example, the intense program process should help firms develop their ideas and grow quickly. It offers a chance for

product and founder mentoring and monitoring, before both have proceeded very far in the development of the company. In this way, the venture capital firm can play an integral role in shaping the firm into a viable going concern, and one that they can provide funding support for in the future.

Based on this relationship, one would expect that accelerator program participation would alter the funding cycle of the young company. One way that such funding may be changed is the likelihood that a start-up firm ultimately receives follow-on funding.[14] While the success of a young firm can be measured using a number of metrics, in the financial industry follow-on funding is widely-considered the best measure of early-stage success, and serves as a signal as to the investor's perspective of the future of the company. The continued endorsement of the company, through further funding, is one of the best way to gauge whether it has been successful up to that point. This logic leads to the following hypothesis:

H1: Seed accelerator participation increases the likelihood that a firm will receive follow-on funding during the three years following initial seed financing.[15]

After examining whether a relationship exists between seed accelerator participation and follow-on funding, I explore the characteristics of such funding. Again, if the early, intense involvement of the venture capital firm in the product development, firm structure, and overall growth process of the company impacts the relationship between the firm and its financers, one would expect that the characteristics of the follow on funding would differ for firms that participated in an accelerator program when

[14] Follow-On Funding is defined as any funding received by the firm after the initial seed funding round, including both equity and debt financing.

[15] I limit my analysis to three years following seed funding because it is expected that the impact of seed accelerator participation diminishes over time.

compared to companies that did not. To examine this issue I evaluate four follow-on funding characteristics related to the early-stage financing structure for young start-up companies.

First, I examine whether the total amount raised by the firm, during the three years that follow initial seed funding, differs between companies that participate in accelerators and firms that do not. It is expected that firms that participate in a seed accelerator program raise a larger total amount of follow-on funding in the years that follow such participation. This suggests the following hypothesis:

H2: Seed accelerator participation increases the total amount of follow-on funding raised by the firm during the three years following initial seed financing.

Second, I test whether accelerator program participation results in a change in the average size of the individual funding rounds. A positive relationship between the maturity of the firm and the size of funding rounds has been well documented in the literature (Gompers and Lerner 2004). If accelerator participation benefits the firm in terms of its growth, one would expect that these firms would exhibit a difference in the size of their early-stage funding rounds.

In addition, staged capital infusions serve as an effective control mechanism to ameliorate both information asymmetry and potential agency conflicts. Therefore, if accelerator program participation reduces these concerns, one would expect that firms that participate in such programs would receive larger individual rounds of funding. This logic leads to the following hypothesis:

H3: Seed accelerator participation increases the amount of individual follow-on funding rounds during the three years following initial seed financing.

Third, building on the above ideas, if accelerated firms receive larger amounts of funding, in larger individual rounds, these early-stage firms would be expected to raise fewer rounds of funding overall. This suggests the following hypothesis:

H4: Seed accelerator participation decreases the number of follow-on funding rounds during the three years following seed funding.

Lastly, I turn to the issue of whether accelerator participation affects the time between funding rounds of accelerator participants. Gompers (1995) suggests that there is an inverse relationship between duration of funding, as a measure of the intensity of monitoring, and expected agency costs. If seed accelerator participation decreases agency conflicts, as well as information asymmetry, resulting in an increased size of the individual funding rounds a firm receives, this would be expected to be reflected in the duration of funding associated with the firms that participate in these programs. This leads to the following hypothesis:

H5: Seed accelerator participation increases the time between follow-on funding rounds during the three years following initial seed financing.

After examining the relationship between accelerator participation and follow-on funding, as well as the characteristics of such funding, I suggest three possible causes of such findings, based on benefits to both the firm and venture capitalist.

## 2.3 Data and Sample Selection

The primary data for this study is a unique data sample, initially consisting of 105,034 technology-related firms from Crunchbase.[16] The data was collected through an

[16] It is well-established in the literature that, on average, more than seventy percent of venture capital investments are in high technology firms (e.g., communication, computers, electronics, biotechnology, and medical/health) (Gompers (1995)). Therefore the Crunchbase sample lends itself to examining funding within the venture capital industry.

API agreement with CrunchBase, and includes corporate, product, executive, and financial data for both companies and accelerator programs. The sample provides a detailed picture of the structure and characteristics of early-stage venture capital investments, including the amount and timing of seed and follow-on funding rounds, investor information, and firm characteristics such as date of founding, age of founders, and location of firm.

Venture capital firm data is collected from VentureXpert. Data related to industry-wide venture capital investments is collected from the National Venture Capital Association. This data includes both the total amount invested, as well as the number of deals, both per quarter for the venture capital industry as a whole. The total amount of investor commitments made to venture capital firms as well as investments by region, per quarter, is also collected from the National Venture Capital Association. Quarterly average NASDAQ Composite Index is used as a further macroeconomic-level control variable. For each of the venture capital investments and commitments, as well as the NASDAQ Composite Index, I create an index based on the first quarter of 2005 as the base year.

Since the scope of this study is focused primarily on the effect of accelerator program participation on follow-on funding, I restrict the data sample to firms for which funding rounds, and other pertinent information is available. After removing firms that lack needed information, as well as those that received seed funding prior 2005 and after

2010, the selection process yields 7,419 firms that received seed funding between 2005 and 2010.[17]

The overall sample includes 1,712 firms that participated in 63 different venture capital accelerator programs, and 5,707 firms that did not participate in such a seed accelerator program.[18] 1,341 of the accelerated firms are based in the United States, while 3,908 of the non-accelerated companies are U.S. Firms. Table 10 provides a breakdown of seed accelerator programs by country, while Table 11 provides the distribution of the firms attending such programs by country.

I also create a sample of matching, non-accelerated, firms for each accelerated firm. The firms are first matched based on the date of seed funding, and second based on the amount of seed funding, both by quarter. The firm with the closest match for each of these criteria is used. This process produces a final sample of 3,424 matched firms.

Finally, to examine the characteristics of follow-on funding rounds, I also create a sample consisting solely of matched pairs of firms that received funding during the three years following seed funding. Each match includes one firm that attended an accelerator and one that did not. The matching process here is the same as described above, first based on the date of seed funding, and second according to the amount of such funding. The sample of firms that received follow-on funding, for funding characteristic analysis, consists of a total of 1,226 matched firms that received follow-on funding in the three years following initial financing.

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[17] Because I test the relationship between seed accelerator participation and follow-on funding, during the three years following initial seed funding, as well as the characteristics of such funding, I limit the sample to firms that received initial seed funding on or before December 31, 2010.

[18] For the purposes of this study, I have defined an accelerator as a fixed-term, cohort-based program that offers seed funding and mentorship, in exchange for an equity interest in the firm.

TABLE 10: Frequency distribution of seed accelerator programs by country

This table reports the frequency of seed accelerator programs by country, as well as the percentage of the total number of seed accelerator programs in the sample. A Seed Accelerator Program must invest in companies in exchange for equity, at the seed stage, have cohorts or classes, provide a program of support for such cohorts, and have an open application process. The sample size is 63 seed accelerator programs. The sample is collected from Crunchbase.

| Country | Frequency | Percent |
|---|---|---|
| Argentina | 1 | 1.59% |
| Belgiam | 1 | 1.59% |
| Canada | 4 | 6.35% |
| China | 1 | 50.00% |
| Czech Republic | 1 | 1.59% |
| Denmark | 1 | 1.59% |
| Finalnd | 1 | 1.59% |
| Egypt | 1 | 1.59% |
| Great Britain | 7 | 11.11% |
| India | 1 | 1.59% |
| Italy | 4 | 6.35% |
| Japan | 1 | 50.00% |
| Netherlands | 1 | 1.59% |
| Singapore | 1 | 1.59% |
| South Africa | 1 | 1.59% |
| Spain | 2 | 3.17% |
| Thailand | 1 | 1.59% |
| Ukrain | 1 | 1.59% |
| United States | 32 | 50.79% |
| Total | 63 | |

TABLE 11: Distribution of seed accelerator-participating firms by country

This table reports the frequency and percentage of firms that attended a seed accelerator program during the sample period, by country. The sample is collected from Crunchbase.

| Country | Frequency | Percent |
|---|---|---|
| Argentina | 19 | 1.11% |
| Australia | 13 | 0.76% |
| Austria | 8 | 0.47% |
| Bahrian | 1 | 0.06% |
| Belgium | 2 | 0.12% |
| Brazil | 9 | 0.52% |
| Canada | 43 | 2.50% |
| Chile | 3 | 0.17% |
| China | 4 | 0.23% |
| Czech Republic | 2 | 0.12% |
| Denmark | 7 | 0.41% |
| Egypt | 5 | 0.29% |
| Estonia | 4 | 0.23% |
| Finalnd | 1 | 0.06% |
| France | 12 | 0.70% |
| Germany | 39 | 2.27% |
| Ghana | 5 | 0.29% |
| Great Britain | 56 | 3.26% |
| India | 8 | 0.47% |
| Indonesia | 1 | 0.06% |
| Ireland | 10 | 0.58% |
| Israel | 4 | 0.23% |
| Italy | 44 | 2.56% |
| Jordan | 1 | 0.06% |
| Lebanon | 2 | 0.12% |
| Latvia | 2 | 0.06% |
| Lithuania | 1 | 0.06% |
| Malaysia | 1 | 0.06% |
| Mexico | 3 | 0.17% |
| Netherlands | 23 | 1.34% |
| Nigeria | 1 | 0.06% |
| Poland | 1 | 0.06% |
| Portugal | 1 | 0.06% |
| Singapore | 16 | 0.93% |
| South Africa | 1 | 0.06% |
| Spain | 13 | 0.76% |
| Sweden | 3 | 0.17% |
| Switzerland | 1 | 0.06% |
| Turkey | 1 | 0.06% |
| Ukrain | 3 | 0.17% |
| United States | 1341 | 78.10% |
| Uruguay | 2 | 0.12% |
| Total | 1717 | |

Table 12 reports descriptive statistics related to the preliminary data, as well as the matched-firms sample. Panel A reports firm-specific characteristics. Statistics related to whether firms received follow-on funding is provided in Panel B. Differences in the amount of seed and follow-on funding is reflected in Panels C and D. Panel E and F provide statistics related to the number and timing of individual follow-on funding rounds, respectively.

## 2.4 Methodology and Empirical Results

### 2.4.1 Seed Accelerator Program Impact on Follow-on Funding

According to the literature venture capital organizations have an incentive to make investments and become involved in firms as early as possible for three primary reasons. First, venture capital firms can "purchase" the opportunity to gather information about project-specific and founder uncertainty that is endogenous to the firm. Second, investment ensures that they have the option to invest in the company in the future, in the presence of a competitive environment for start-up companies. Third, involvement in the company allows the venture capitalist to mentor the owners with respect to their product, as well as business operations. In this section I examine whether investment in firms through venture capital-created accelerator programs results in the firms having a higher likelihood of receiving follow-on funding, as well as the characteristics of such funding, when compared to firms that have not participated in such a program.

Table 12 reports descriptive statistics related to the firms in the matched sample. The statistics in Panel B suggest that accelerated firms enjoy a higher likelihood of receiving follow-on funding, when compared to their non-accelerated counterparts. In the sample, 35% of firms that participated in an accelerator program received follow-on

TABLE 12: Descriptive statistics related to matched seed accelerator-participating firms

This table reports descriptive statistics related to the matched sample of firms that attended an accelerator program. The data is collected from Crunchbase. The sample is split into two groups: Firms that attended a seed accelerator program, and those that did not. The sample is further into two subcategories: United States firms, and firms from all countries. Panel A reports the mean and median of key firm characteristics. Panel B presents the follow-on funding characteristics. Panel C reports the seed and follow-on funding round amounts. Panel D presents Seed and follow-on funding round amounts. Panel E reports the characteristics of the individual funding rounds of the firms in the sample. Panel F reports the follow-on funding round timing.

TABLE 12: Continued

*Panel A: Firm Characteristics*

| | Accelerated Firms | | | | Non-Accelerated Firms | | | |
|---|---|---|---|---|---|---|---|---|
| | USA (1,341 Firms) | | All Countries (1,712 Firms) | | USA (1341 Firms) | | All Countries (1,712 Firms) | |
| | Mean | Median | Mean | Median | Mean | Median | Mean | Median |
| Age of Founders (Years) | 27.33 | 31 | 27.5 | 33 | 28.5 | 32 | 29.25 | 34 |
| Number of Founders | 2.48 | 2 | 2.31 | 2 | 2.62 | 2 | 2.58 | 3 |
| Age of Firms (Months) | 4 | 16 | 5 | 18 | 9 | 18 | 14 | 19 |
| Number of Employees | 14 | 6 | 17 | 5 | 9 | 6 | 15 | 4 |

*Panel B: Follow-On Funding Characteristics*

| | Accelerated Firms | | | | Non-Accelerated Firms | | | |
|---|---|---|---|---|---|---|---|---|
| | USA (1,341 Firms) | | All Countries (1,712 Firms) | | USA (1,341 Firms) | | All Countries (1,712 Firms) | |
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| Firms without Follow-On Funding | 814 | 60.70% | 1104 | 64.49% | 902 | 67.26% | 1234 | 72.08% |
| Firms with Follow-On Funding | 527 | 39.30% | 608 | 35.51% | 439 | 32.74% | 478 | 27.92% |

*Panel C: Seed & Follow-On Funding Round Amount*

| | Accelerated Firms | | | | Non-Accelerated Firms | | | |
|---|---|---|---|---|---|---|---|---|
| | USA (1,341 Firms) | | All Countries (1,712 Firms) | | USA (1,341 Firms) | | All Countries (1,712 Firms) | |
| | Mean | Median | Mean | Median | Mean | Median | Mean | Median |
| Seed Funding Amount ($ Thousands) | $20 | $22 | $20 | $18 | $52 | $130 | $48 | $183 |
| Total Follow-On Funding ($ Thousands) | $4,603 | $2,250 | $3,996 | $1,400 | $3,713 | $1,750 | $3,313 | $1,200 |

TABLE 12: Continued

*Panel D: Seed & Follow-On Funding Round Amount*

| | Accelerated Firms | | | | Non-Accelerated Firms | | | |
|---|---|---|---|---|---|---|---|---|
| | USA (1,341 Firms) | | All Countries (1,712 Firms) | | USA (1,341 Firms) | | All Countries (1,712 Firms) | |
| | Mean | Median | Mean | Median | Mean | Median | Mean | Median |
| Round 1 Funding Amount ($ Thousands) | $1,405 | $850 | $1,025 | $650 | $948 | 775 | 841 | 725 |
| Round 2 Funding Amount ($ Thousands) | $3,412 | $1,625 | $3,175 | $1,500 | $2,956 | 1,550 | 2,606 | 1,475 |
| Round 3 Funding Amount ($ Thousands) | $5,777 | $3,150 | $5,578 | $2,900 | $4,398 | 2,475 | 4,094 | 1,650 |
| Round 4 Funding Amount ($ Thousands) | $5,743 | $1,550 | $4,886 | $1,375 | $4,174 | 1,425 | 3,852 | 1,175 |
| Round 5 Funding Amount ($ Thousands) | $5,676 | $1,100 | $4,606 | $1,049 | $3,882 | 1,050 | 3,289 | 975 |

*Panel E: Follow-On Funding Characteristics*

| | Accelerated Firms | | | | Non-Accelerated Firms | | | |
|---|---|---|---|---|---|---|---|---|
| | USA (1,341 Firms) | | All Countries (1,712 Firms) | | USA (1,341 Firms) | | All Countries (1,712 Firms) | |
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| Number of Follow-On Funding Rounds (Average) | 1.68 | | 1.64 | | 1.92 | | 1.78 | |
| Firms with 1 Round of Follow-On Funding | 527 | 39.30% | 613 | 35.81% | 398 | 29.68% | 424 | 24.77% |
| Firms with 2 Rounds of Follow-On Funding | 212 | 15.81% | 231 | 13.49% | 262 | 19.54% | 263 | 15.36% |
| Firms with 3 Rounds of Follow-on Funding | 70 | 5.22% | 74 | 4.32% | 112 | 8.35% | 82 | 4.79% |
| Firms with 4 Rounds of Follow-On Funding | 8 | 0.60% | 10 | 0.58% | 18 | 1.34% | 16 | 0.93% |
| Firms with 5 Rounds of Follow-On Funding | 3 | 0.22% | 4 | 0.23% | 12 | 0.89% | 7 | 0.41% |

TABLE 12: Continued

*Panel F: Seed & Follow-On Funding Round Timing*

| | Accelerated Firms | | | | Non-Accelerated Firms | | | |
|---|---|---|---|---|---|---|---|---|
| | USA (1,341 Firms) | | All Countries (1,712 Firms) | | USA (1,341 Firms) | | All Countries (1,712 Firms) | |
| | Mean | Median | Mean | Median | Mean | Median | Mean | Median |
| Time Between All Rounds (Days) | 268 | 254 | 249 | 221 | 214 | 202 | 204 | 188 |
| Time Between Seed & Round 1 Funding (Days) | 231 | 226 | 213 | 212 | 187 | 184 | 174 | 168 |
| Time Between Round 1 & Round 2 Funding (Days) | 321 | 308 | 295 | 262 | 285 | 264 | 253 | 242 |
| Time Between Round 2 & Round 3 Funding (Days) | 373 | 322 | 352 | 288 | 335 | 306 | 287 | 268 |
| Time Between Round 3 & Round 4 Funding (Days) | 338 | 316 | 318 | 338 | 285 | 262 | 258 | 240 |
| Time Between Round 4 & Round 5 Funding (Days) | 320 | 312 | 293 | 336 | 273 | 256 | 241 | 238 |

funding, as compared to 28% for firms that did not attend such a program. When comparing only the United States firms, 39% of accelerated firms received follow-on funding, whereas only 33% of non-accelerate firms received such funding.

Table 12 also presents results related to the amount of funding accelerated and non-accelerated firms receive, respectively. Panel C suggests that, while accelerated firms on average receive a much smaller amount of initial seed funding, they ultimately are able to raise a larger amount of follow-on funding during the first three years. These findings hold for firms from the United States, as well as those from the sample of all countries. Non-accelerated firms receive, on average, $28,000 more in initial seed funding then their accelerated counterparts. Despite this additional initial funding, the accelerated firms receive 21% more follow-on funding in the three years that follow. In fact, in each of the rounds of financing that follows the initial seed round, the accelerated firms receive a significantly larger amount of funding.

As is reflected in Panels E and F of Table 12, differences in the number of rounds and the timing of such rounds indicate that the financing associated with accelerated firms is also more favorable. Accelerated firms seem to have longer durations between rounds, as well as fewer rounds during the three years following seed funding, on average. These preliminary findings are consistent with the theory that accelerator programs provide venture capitalists with a benefit that results in favorable financing in the years that follow participation in a program.

To further analyze the relationship between seed accelerator participation and early-stage firm funding, I use multivariate regression analysis. My research is split into two primary parts. I first examine whether seed accelerator participation affects *ex post*

follow-on funding. Based on the characteristics of accelerator programs, one would expect that participation would increase the likelihood that a firm ultimately receives follow-on funding.

After finding that a significant relationship exists between accelerator program participation and follow-on funding, I turn to an analysis of the characteristics of the follow-on funding received by accelerated firms, as compared to that raised by companies that did not attend an accelerator program. If these programs offer benefits, one would expect that such benefits continue through the early-stage financing of the firms, and can be observed in the characteristics of the follow-on funding.

### 2.4.2 The Relationship Between Seed Accelerator Program Participation and Follow-on Funding

In this section, I examine the impact of accelerator participation on the binary dependent variable representing receipt of follow-on funding. The goal is to determine whether Seed Accelerator participation affects a firm's *ex post* follow-on funding during the first three years following initial seed funding, based on the following hypothesis:

H1: Seed accelerator participation increases the likelihood that a firm will receive follow-on funding during the three years following initial seed financing.

To examine this relationship, I use a multivariate regression model based on the equation of following the form:

$$success\ measure_i = f(accelerator\ participation_i, control\ variables_i)$$

In this system, $success\ measure_i$ represents the binary dependent dummy variable indicating whether the firm obtained follow-on funding within the three years following initial seed funding. The primary explanatory variable of interest, *Accelerator*

$participation_i$ represents a dummy variable based on whether the firm participated in a seed accelerator program.

To capture firm-specific characteristics, I select a set of control variables including venture capital quality rank of the firm, location rank of the firm, age of the firm, and average age of the founders. I use venture capital commitments, venture capital investments, and the NASDAQ Composite Index to control for venture capital industry and mac-economic factors. The model also controls for time effects in the system.

More specifically, I regress the follow-on funding dependent variable on the seed accelerator participation dummy variable, and control variables, using a probit model, as follows:

$$\begin{aligned} \textit{Follow-On Funding}_i = {} & \alpha + \beta_1 \, x \, \textit{Accelerator Participation}_i \\ & + \beta_2 \, x \, \textit{VC Quality Rank}_{i,t-1} + \beta_3 \, x \, \textit{Location Rank}_{i,t-1} \\ & + \beta_4 \, x \, \textit{Founder Age}_{i,t} + \beta_5 \, x \, \textit{Age of Firm (months)}_t \\ & + \beta_6 \, x \, \textit{VC Commitments Index}_{i,\,t-}1 + \beta_7 \, x \, \textit{VC Market Investments Index}_{i,t-1} \\ & + \beta_8 \, x \, \textit{NASDAQ Index}_{i,t-1} + \varepsilon_i \end{aligned} \tag{1}$$

where, $Follow\text{-}On\ Funding_i$ denotes whether the individual firm received follow-on funding during the three years following initial seed funding. A one indicates that the firm received follow-on funding, while a zero represents that the firm did not receive such funding. $Accelerator\ Participation_i$ represents the primary explanatory variable of interest, and denotes a dummy variable of one if the firm participated in a seed accelerator, and zero if the firm did not participate in such a program. $VC\ Quality\ Rank_{i,t-1}$ denotes a ranking of the lead venture capital firm, as of the end of the quarter preceding

seed funding. Venture capital quality is thought to be a determinant of early-stage firm success (Megginson and Weiss (1991)). The venture capital firm ranking is created based on the amount of funds invested in start-up companies during the three years preceding the funding of the instant firm, using data collected from VentureXpert. This quarterly ranking is used in the regressions to account for differences among venture capital firms.[19] *Location Rank*$_{t,t-1}$ denotes the rank of the location of the individual firm, as of the end of the quarter following seed funding. This is a quarterly ranking of locations, based on the amount of venture capital investment by region, as compiled from the National Venture Capital Association. This ranking is used in the regressions to account for difference in investment across locations of individual firms. This data is unavailable for all countries. Therefore, it is included in regressions of the sample of United States firms only. The variable is not included in regressions of the sample including firms from countries other than the United States. *Founder Age*$_{i,t}$ denotes the average age of the founders involved in the individual firm at the time of seed funding. *Age of Firm*$_{i,t}$ denotes the age of the firm at the time of seed funding. *VC Commitments Index*$_{i,t-1}$ denotes the new capital commitments to venture capital companies by outside investors in the quarter preceding seed funding for the individual firm, as compiled by the National Association of Venture Capital.[20] The Index is calculated using the first quarter of 2005 as the base time period. Table A provides details related to the VC Capital Commitments Index for each quarter in the sample. *VC Investments Index*$_{i,t-1}$ denotes the level of venture capital investments in the quarter preceding the firm's seed funding. I use

[19] A rank of the venture capital firms is also calculated using the number of venture capital investments in the three years prior to the seed investment, with results that do not significantly differ from the results herein.

[20] For the purposes of this study, "capital commitments," "fundraising," and "fund closes" are used interchangeably. Compiled by the National Venture Capital Association, from Thomson Reuters data.

National Venture Capital Association data to calculate a venture capital investments index, with the first quarter of 2005 serving as the base time period. Table B provides details related to the VC Investments Index for each quarter in the sample. *NASDAQ* $Index_{i,t-1}$ denotes the average NASDAQ Composite Index in the quarter preceding seed funding of the individual firm. For consistency with the other control variables, the NASDAQ Composite Index is converted into an index using the first quarter of 2005 as the base time period.

The base multivariate regression is run on the sample of all, unmatched, firms. To ensure that the change in follow-on funding does not stem from location and VC quality, Model 2 includes the location rank, and Model 3 includes both location rank and VC Quality Rank, in the regressions related to US firms. Only VC Quality Rank is included in the regressions of the sample of firms from all countries, because location rankings are not available for all countries. Table 13 reports the marginal effects of the probit regression of follow-on funding on accelerator participation, firm characteristics variables, and controls for venture capital industry and macroeconomic effects.[21] In all three models the coefficient on the primary variable of interest, the dummy variable indicating whether the firm participated in a seed accelerator, is positive and statistically significant. Consistent with my hypothesis, accelerator program participation has a positive impact on whether a start-up receives follow-on funding, in the three years following initial seed funding.

[21] The marginal effects for each independent variable in Tables 5 and 6 are calculated holding all other independent variables at their mean values.

TABLE 13: Base regressions of follow-on funding on accelerator participation with all firms in sample

This table reports the probit regression results of regressions of follow-on funding on accelerator participation, as well as the control variables, with the data sample of all firms. The sample includes 5,343 firms in the U.S. only sample, and 7,524 firms in the sample from all countries. In this regression specification, *Follow-On Funding* is a dummy variable, and denotes whether the individual firm received follow-on funding during the three years following initial seed funding. A one indicates that the firm received follow-on funding, while a zero represents that the firm did not receive such funding. *Accelerator Participation* represents the primary explanatory variable of interest, and denotes a dummy variable of one if the firm participated in a seed accelerator, and zero if the firm did not participate in such a program. *VC Quality Rank* denotes a ranking of the lead venture capital firm, as of the end of the quarter preceding seed funding. The venture capital firm ranking is created based on the amount of funds invested in start-up companies during the three years preceding the funding of the instant firm, using data collected from VentureXpert. *Location Rank* denotes the rank of the location of the individual firm, as of the end of the quarter following seed funding. This is a quarterly ranking of locations, based on the amount of venture capital investment by region, as compiled from the National Venture Capital Association. This data is unavailable for all countries. Therefore, the Location Rank variable is included in regressions of the sample of United States firms only. The variable is not included in regressions of the sample including firms from countries other than the United States. *Founder Age* denotes the average age of the founders involved in the individual firm at the time of seed funding. *Age of Firm* denotes the age of the firm at the time of seed funding. *VC Commitments Index* denotes the new capital commitments to venture capital companies by outside investors in the quarter preceding seed funding for the individual firm, as compiled by the National Association of Venture Capital. The Index is calculated using the first quarter of 2005 as the base time period. Table A provides details related to the VC Capital Commitments Index for each quarter in the sample. *VC Investments Index* denotes the level of venture capital investments in the quarter preceding the firm's seed funding. I use National Venture Capital Association data to calculate a venture capital investments index, with the first quarter of 2005 serving as the base time period. Table B provides details related to the VC Investments Index for each quarter in the sample. *NASDAQ Index* denotes the average NASDAQ Composite Index in the quarter preceding seed funding of the individual firm. For consistency with the other control variables, the NASDAQ Composite Index is converted into an index using the first quarter of 2005 as the base time period. Year dummies are included in the specification, but not reported. Z-Scores are reported in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

TABLE 13: Continued

| | USA | | | All Countries | |
|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 1 | Model 2 |
| Accelerator Participation | 0.0413** | 0.0343** | .0308** | .0239** | .0219* |
| | (2.07) | (2.27) | (2.43) | (2.12) | (1.67) |
| *Firm Characteristic Variables* | | | | | |
| Average Founders Age (Years) | .0047* | .0045* | .0038 | .0016 | .0016 |
| | (1.12) | (1.56) | (1.38) | (1.61) | (1.12) |
| Age of Firm (Years) | .0213** | .0183** | .0108* | .0061** | .0061* |
| | (2.49) | (2.07) | (1.72) | (2.12) | (1.77) |
| Location Rank | | .0179** | .0153** | | |
| | | (2.31) | (2.37) | | |
| VC Quality Rank | | | .0119** | | .0073 |
| | | | (2.09) | | (1.22) |
| *Macro-Economic Variables* | | | | | |
| VC Investments Index | .0103* | .0087* | .0083* | .0093* | .0031* |
| | (1.89) | (1.73) | (1.91) | (1.89) | (1.83) |
| VC Commitments Index | .0087* | .0056 | .0049 | .0043 | .0024 |
| | (1.68) | (1.45) | (1.21) | (1.16) | (.97) |
| Nasdaq Index | .0192 | .0188 | .0183 | .0114 | .0093 |
| | (1.52) | (1.43) | (.92) | (1.18) | (.74) |
| Constant | -86.0429* | -85.8430* | -82.0568** | 68.24* | 67.94* |
| | (1.89) | (1.92) | (2.37) | (1.69) | (1.74) |
| Observations | 5343 | 5343 | 5343 | 7524 | 7524 |
| Pseudo R-Squared | 0.1203 | 0.1783 | 0.1897 | 0.1043 | 0.1783 |

Based on the average follow-on funding rate of 33.40% for the base sample, seed accelerator participation is associated with a 9% increase in the probability of receiving follow-on funding, based on the sample of US firms only, using Model 3. With respect to regressions of the sample including firms from all countries, based on Model 2 accelerator participation is associated with an increase of 7% in the probability of follow-on funding, based on an average follow-on funding rate of 28.80%. This result is significant at the 10% level. The results suggest a significant relationship between seed accelerator programs and follow-on firm funding.

I also find that an increase in the age of the firm results in a higher probability of follow-on funding, by 3% and 2% for US and firms from all countries, respectively. More favorable venture capital quality and location ranks, each also make it more likely that a United States firm will receive follow-on funding, by 3% and 5%, respectively.

To further examine the relationship between accelerator program participation and follow-on funding, I create a sample of matched pairs of firms. Each matched pair contains two firms, one that attended an accelerator program and one that did not. The firms are first matched based on the date of seed funding, and then based on the amount of such seed financing. The matching process involves pairing the firms using the closest match on each of the two parameters, in order.[22]

Table 14 reports the marginal effects of the multivariate regressions related to the matched data set. The primary variable of interest is again the dummy variable indicating whether the firm participated in a seed accelerator program. In all of the models the coefficient on the primary variable of interest, the coefficient on this variable is positive

[22] To facilitate use of the entire sample of firms that attended an accelerator program, firms that did not attend such a program are matched multiple times, if necessary.

and statistically significant. The results are consistent with my hypothesis that accelerator program participation has a positive impact on whether a start-up receives follow-on funding, in the three years following initial seed funding.

As can be seen in Table 14, the results show a significant positive relation between follow-on funding and accelerator program participation. Based on the average follow-on funding rate of 36.02% among US firms, seed accelerator participation is associated with a 14% increase in the probability of receiving follow-on funding, using Model 3. With respect to firms from all countries, in which the average follow-on funding rate is 31.72%, seed accelerator attendance increases the likelihood of receiving follow-on funding by 12%, based on Model 2. The results suggest a significant relationship between seed accelerator programs and follow-on funding.

With respect to changes in the characteristics of the firm, I also find that a one-year increase in the average age of the founders results in a higher probability of follow-on funding, by 3% for US firms. An increase of one year in the age of the firm results in a 6% and 8% increase in the likelihood of follow-on funding for U.S. firms and companies from all countries, respectively. An increase in the ranking of the venture capitalist results in a higher probability of 4% for U.S. firms, and 3% for firms from all countries. A higher location rank associated with U.S. firms results in an increase in the probability of receiving follow-on funding by 5%.

The voluntary nature of the application process for participation in seed accelerator programs, coupled with the fact that firms are selected by a seed accelerator program after an application process, presents an area for possible criticism of my

TABLE 14: Regressions of follow-on funding on accelerator participation with matched sample of firms

This table reports the probit results of regressions of follow-on funding on accelerator participation, as well as the control variables with the data sample of all firms. The firms are matched first based on the date of seed funding, and second based on the amount of seed funding, both by quarter. The firm with the closest match for each of these criteria is used. The sample includes 2,682 firms in the U.S. only sample, and 3,434 firms in the sample from all countries. In this regression specification, *Follow-On Funding* is a dummy variable, and denotes whether the individual firm received follow-on funding during the three years following initial seed funding. All other variables are defined as in Table 4. Year dummies are included in the specification, but not reported. Z-Scores are reported in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

| | USA | | | All Countries | |
|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 1 | Model 2 |
| Accelerator Participation | 0.0531*** | 0.0511*** | 0.0507** | 0.0439** | .0422** |
| | (3.16) | (2.63) | (2.49) | (2.41) | (2.17) |
| *Firm Characteristic Variables* | | | | | |
| Average Founders Age (Years) | .0213** | .0188** | .0116* | 0.0117 | .0097 |
| | (2.49) | (2.42) | (1.89) | (1.54) | (1.27) |
| Age of Firm (Years)) | .0267*** | .0256** | .0219** | 0.0293** | .0263** |
| | (3.62) | (2.51) | (2.41) | (2.33) | (2.51) |
| Location Rank | | 0.0239*** | .0182** | | |
| | | (3.16) | (2.45) | | |
| VC Quality Rank | | | .0149*** | | .0098** |
| | | | (3.74) | | (2.48) |
| *Macro-Economic Variables* | | | | | |
| VC Investments Index | 0.0173*** | 0.0144** | .0133** | 0.0144* | .0108* |
| | (3.09) | (2.49) | (2.09) | (1.78) | (1.83) |
| VC Commitments Index | 0.0259** | 0.01254** | .0116* | 0.0079 | .0074* |
| | (2.03) | (2.01) | (1.83) | (1.55) | (1.83) |
| Nasdaq Index | 0.0134** | 0.0098 | .0093 | 0.0037* | .0018 |
| | (1.98) | (1.63) | (1.58) | (1.68) | (1.53) |
| Constant | -188.92** | -188.53** | -187.16** | -168.34** | -154.32* |
| | (-2.22) | (-1.49) | (-1.57) | (-1.34) | (-1.65) |
| Observations | 2682 | 2682 | 2682 | 3434 | 3434 |
| Pseudo R-Squared | 0.2493 | 0.2745 | 0.3178 | 0.1793 | 0.1903 |

analysis. It could be argued that it is possible that the characteristics of firms participating in these programs are systematically different than firms that do not. For example, firms may have founders with different attributes or different types of products. These unobserved characteristics could have an effect on the results of a study of the funding of firms. To ameliorate this possible concern, I use also use an instrumental variable, two-stage least squares approach, for robustness.

The instrument used should satisfy two properties: 1) Z must be correlated with accelerator participation, and 2) Z is not correlated with the dependent variable in the second-stage regression. I use two such variables. The first is the number of founders. The second such variable used is the percentage of firms funded by the venture capitalist operating the accelerator program, that have been participants in such program. Both variables meet each criteria for inclusion as explanatory variables in the first stage of the two-stage regression.

I run two stage least square regressions, of accelerator participation on the instrumental and other control variables. I then use the predicted results in a second stage of the regressions to evaluate the results as compared to those found herein. The results do not significantly differ from those here with respect to the primary variable of interest, accelerator participation. This further supports the conclusion that accelerator participation is positively related to follow-on funding.

### 2.4.3 Characteristics of Seed Accelerator Program Participant Follow-on Funding

In this section, I investigate whether the characteristics of the follow-on funding differ between accelerator program participants and non-accelerator program firms. The goal is to determine whether program participants exhibit more favorable funding round

characteristics. To explore the characteristics of the following-on funding of firms that have participated in seed accelerator programs, as compared to firms that have not, I use four regression models based on an equation of following the form:

$$\textit{follow-on funding characteristics}_i = f(\textit{accelerator participation}_i, \textit{control variables}_i)$$

In this system, $\textit{follow-on funding characteristics}_i$ represents the dependent variable specific to each of the models: Total follow-on funding, average amount of individual funding rounds, average number of follow-on funding rounds, and time between funding rounds. Each of regression equations is based on funding during the three years that follow initial seed funding.

As with the probit regression equation in Section 2.4.1, the primary explanatory variable of interest, $\textit{Accelerator participation}_i$ represents a dummy variable based on whether the firm participated in a seed accelerator program. The set of control variables, similar to that used in the initial regressions above, is used to capture firm-specific characteristics, including venture capital quality rank, location rank of the firm, average age of the founders, and age of the firm. Again, I use venture capital commitments, venture capital investments index, and the NASDAQ composite index to control for venture capital industry, and mac-economic factors. The models also control for time effects in the system.

2.4.3.1 Total Amount of Follow-on Funding

To explore the characteristics of follow-on funding among firms, I first investigate the total funds raised by the firm in the three years following initial seed

funding. If participation in such programs benefit the firm, accelerates its growth, and reduces agency and information asymmetry concerns, one would expect that the following hypothesis would hold:

H2: Seed accelerator participation increases the total amount of follow-on funding raised by the firm during the three years following initial seed financing.

To test this hypothesis I use the following regression equation:

$$\begin{aligned} \textit{Follow-On Funding}_i \textit{ (total \$ amount)} = {} & \alpha + \beta_1 \textit{ x Accelerator Participation}_i \\ & + \beta_2 \textit{ x VC Quality Rank}_{i,t-1} + \beta_4 \textit{ x Location Rank}_{i,t-1} \\ & + \beta_5 \textit{ x Founder Age}_{i,t} + \beta_6 \textit{ x Age of Firm}_t \\ & + \beta_7 \textit{ x VC Commitments Index}_{i,\,t-1} + \beta_8 \textit{ x VC Investments Index}_{i,t-1} \\ & + \beta_9 \textit{ x NASDAQ Index}_{i,t-1} + \varepsilon_i \end{aligned} \qquad (2)$$

In this regression equation the total amount of follow-on funding raised in the three years following initial seed funding is the dependent variable. The primary explanatory variable of interest is the dummy variable associated with accelerator participation. The control variables are as discussed in Section 2.4.1. I find that the total amount of follow-on funding raised has a positive relationship with accelerator program participation.

Table 15 presents the results of the regression based on the matched set of data. I find a significant positive relationship between the total amount of follow-on funding raised during the three years following seed funding, and accelerator program participation. For the data set containing only United State firms, such participation increases the total follow on funding by $520,000 during such time period, and the result

is significant at the 1% level. The increase in total follow-on funding is $369,000 when testing the matched sample of firms from all countries, and is significant at the 5% level. These findings support the theory that accelerator participation has a significant impact on follow-on funding in the three years following seed funding.

I also find a positive relationship between both the average age of founders and the age of the firm, and total follow-on funding. As could be expected, an increase in the venture capital quality rank, and the location rank, both result in an increase in total follow-on funding.

2.4.3.2 Amount of Individual Follow-on Funding Rounds

Next, I turn my attention to the individual follow-on funding rounds. I first test whether accelerator participation results in a change in the average size of the individual funding rounds. A positive relationship between the maturity of the firm and the size of funding rounds has been well documented in the literature (Gompers and Lerner (2004)).

Accelerators are thought to assist companies in their early-stage growth. Additionally, a second primary benefit of seed accelerator programs is thought to be early mentoring and monitoring on the part of venture capitalists. Based on these two primary benefits, one would expect that participation in such a program would result in an increased growth rate, and reduced agency and information asymmetry concerns. Both of these results would be expected to lead accelerator participants to enjoy an increase in the size of individual funding rounds. This logic leads to the following hypothesis:

H3: Seed accelerator participation increases the amount of individual follow-on funding rounds during the three years following initial seed financing.

TABLE 15: Regressions of follow-on funding characteristics on accelerator participation with matched data

This table reports results from regressions related to the characteristics of follow-on funding. The sample includes 1,054 firms in the U.S. only sample, and 1,226 firms in the sample from all countries. Panel A reports the results of regressions of total follow-on funding on seed accelerator participation and the control variables. Panel B reports the results of regressions of the size of follow-on funding rounds on seed accelerator participation and the control variables. The explanatory variables are defined in the same manner as in Table 6. Year dummies are included in the specification, but not reported. T-statistics are reported in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

| | *Panel A: Total Follow-On Funding* | | *Panel B: Size of Funding Rounds* | |
|---|---|---|---|---|
| | Total Follow-On Funding | | Size of Follow-On Funding Rounds | |
| | U.S. | All Countries | U.S. | All Countries |
| Accelerator Participation | 0.5203*** | 0.3693** | .2782** | .1471** |
| | (3.27) | (2.49) | (2.41) | (2.57) |
| *Firm Characteristic Variables* | | | | |
| Average Founders Age (Years) | 0.0643* | 0.0943* | .0732 | .0821 |
| | (1.73) | (1.87) | (1.59) | (1.07) |
| Age of Firm (Years) | 0.0343*** | 0.0742** | .0631* | .1193 |
| | (2.71) | (2.03) | (1.92) | (1.53) |
| VC Quality Rank | 0.0875** | 0.1683* | .1293** | .2010* |
| | (2.39) | (1.72) | (2.03) | (1.93) |
| Location Rank | 0.0708** | | .0932* | |
| | (2.16) | | (1.79) | |
| *Macro-Economic Variables* | | | | |
| VC Investments Index | 0.1463*** | 0.0732** | .1253* | .0831* |
| | (4.29) | (2.56) | (1.71) | (1.67) |
| VC Commitments Index | 0.1183** | 0.0104 | .0632* | .0329 |
| | (2.41) | (1.59) | (1.83) | (.92) |
| Nasdaq Index | 0.0343* | 0.0253 | .0491 | .0382 |
| | (1.73) | (1.19) | (1.32) | (1.19) |
| Observations | 1054 | 1226 | 1054 | 1226 |
| Adjusted R-Squared | 0.2754 | 0.2194 | 0.2103 | 0.1728 |

This hypothesis is tested using the following regression equation.

$$\textit{Average size of follow-on funding rounds}_i = \alpha + \beta_1 \textit{ x Accelerator Participation}_i \quad (3)$$
$$+ \beta_2 \textit{ x Total \$ Amount Raised}_i + \beta_3 \textit{ VC Quality Rank}_{i,t-1}$$
$$+ \beta_4 \textit{ x Location Rank}_{i,t-1} + \beta_5 \textit{ x Founder Age}_{i,t} + \beta_6 \textit{ x Age of Firm}_t$$
$$+ \beta_7 \textit{ x VC Commitments Index}_{i,\,t-1} + \beta_8 \textit{ x VC Investments Index}_{i,t-1}$$
$$+ \beta_9 \textit{ x NASDAQ Index}_{i,t-1} + \varepsilon_i$$

The dependent variable in this second regression equation related to the characteristics of follow-on funding, is the average size of follow-on funding rounds. Again, the primary explanatory variable of interest is the dummy variable associated with accelerator participation. The control variables are as discussed in Section 2.4.1. I find that the average size of follow-on funding rounds is positively related to accelerator program participation.

The results, presented in Table 15, demonstrate a positive relationship between the average size of individual funding rounds and accelerator participation. Specifically, among the United State firms, it results in an increase of approximately $278,000 in the average size of individual funding rounds. The increase is $147,000 for firms from all countries. Both findings are significant at the 5% level. While a number of the results related to other variables in this regression were not significant, I do find that, for firms in the United State, there is a significant relation between the age of the firm, venture capital quality rank, and the rank of the location of the firm. With respect to firms from all counties, only the venture capital rank is statistically significant.

2.4.3.3 Number of Follow-on Funding Rounds

Building on the above ideas, if accelerated firms receive larger amounts of funding, in larger individual rounds, these early-stage firms would be expected to raise fewer rounds of funding overall. To evaluate this issue, I test whether seed accelerator participation impacts the total number of financing rounds during the first three years following seed funding, leading to the following hypothesis:

H4: Seed accelerator participation decreases the number of follow-on funding rounds during the three years following initial seed financing.

I use the following regression equation to test this hypothesis:

$$\begin{aligned} \textit{Number of follow-on funding rounds}_i = {} & \alpha + \beta_1 \, x \, \textit{Accelerator Participation}_i \\ & + \beta_2 \, x \, \textit{Total \$ Amount Raised}_i + \beta_3 \, x \, \textit{VC Quality Rank}_{i,t-1} \\ & + \beta_4 \, x \, \textit{Location Rank}_{i,t-1} + \beta_5 \, x \, \textit{Founder Age}_{i,t} + \beta_6 \, x \, \textit{Age of Firm}_t \\ & + \beta_7 \, x \, \textit{VC Commitments Index}_{i,\,t-1} + \beta_8 \, x \, \textit{VC Investments Index}_{i,t-1} \\ & + \beta_9 \, x \, \textit{NASDAQ Index}_{i,t-1} + \varepsilon_i \end{aligned} \qquad (4)$$

In this regression equation the number of follow-on funding rounds in the three years following initial seed funding is the dependent variable. The primary explanatory variable of interest is the dummy variable associated with accelerator participation, while the control variables are as discussed in Section 2.4.1. I find that the number of follow-on funding rounds has a negative relationship with accelerator program participation.

The results are reported in Table 16. I find a significant negative relationship between the number of follow-on funding rounds and accelerator program participation. This finding supports the theory that accelerator participation decreases agency and

information asymmetry concerns in the relationship between the firm and its financers. More particularly, I find that such participation decreases the number of follow-on funding rounds by .23 rounds, when testing the sample of United States firms exclusively. When running the regression on the sample of firms from all countries, the results indicate that accelerator participation decreases the number of follow-on funding rounds by .11 rounds.

2.4.3.4 Time Between Follow-on Funding Rounds

As a final component of my analysis, I turn to the issue of whether accelerator participation affects the time between funding rounds of accelerator participants. If agency and information asymmetry concerns are reduced by early venture capital involvement through an accelerator program, it would be expected that this would be reflected in the duration of funding associated with the firms that participate in these programs. This leads to the following hypothesis:

H5: Seed accelerator participation increases the time between follow-on funding rounds during the three years following initial seed financing.

I test this hypothesis with the following regression equation:

$$\begin{aligned} \textit{Average Time Between Follow-On Funding Rounds}_i = \quad & (5) \\ & a + \beta_1 \, x \, \textit{Accelerator Participation}_i \\ & + \beta_2 \, x \, \textit{Total \$ Amount Raised} + \beta_3 \, \textit{VC Quality Rank}_{i,t-1} \\ & + \beta_4 \, x \, \textit{Location Rank}_{i,t-1} + \beta_5 \, x \, \textit{Founder Age}_{i,t} + \beta_6 \, x \, \textit{Age of Firm}_t \\ & + \beta_7 \, x \, \textit{VC Commitments Index}_{i,\,t-1} + \beta_8 \, x \, \textit{VC Investments Index}_{i,t-1} \\ & + \beta_9 \, x \, \textit{NASDAQ Index}_{i,t-1} + \varepsilon_i \end{aligned}$$

TABLE 16: Regressions of follow-on funding characteristics on accelerator participation with matched data

This table reports results from regressions related to the characteristics of follow-on funding. The sample includes 1,054 firms in the U.S. only sample, and 1,226 firms in the sample from all countries. Panel A reports the results of regressions of number of follow-on funding rounds, in the three years following initial seed funding, on seed accelerator participation and the control variables. Panel B reports the results of regressions of the time between the follow-on funding rounds, in the three years following initial seed funding, on seed accelerator participation and the control variables. The explanatory variables are defined in the same manner as in Table 6. Year dummies are included in the specification, but not reported. T-statistics are reported in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

| | *Panel A: Number of Funding Rounds* | | *Panel B: Time Between Funding Rounds* | |
|---|---|---|---|---|
| | Number of Follow-On Funding Rounds | | Time Between Follow-On Funding Rounds | |
| | U.S. | All Countries | U.S. | All Countries |
| Accelerator Participation | -.2369** | -.1143 | .0832** | .1429* |
| | (-2.27) | (-1.61) | (2.53) | (1.81) |
| *Firm Characteristic Variables* | | | | |
| Average Founders Age (Years) | -.0246 | -.0351* | .0134* | .0392 |
| | (-1.48) | (-1.82) | (1.72) | (1.58) |
| Age of Firm (Years) | -.0385 | -0503 | .0243** | .0349** |
| | (-1.05) | (-1.14) | (2.09) | (2.37) |
| VC Quality Rank | .0057* | .0183 | -.0392** | -.0083** |
| | (1.87) | (1.41) | (-2.49) | (-2.38) |
| Location Rank | -.0732* | -.1102 | .0283* | .0528** |
| | (-1.67) | (-1.49) | (1.82) | (2.39) |
| *Macro-Economic Variables* | | | | |
| VC Investments Index | -.0832** | -.0524* | .0592* | .0093* |
| | (-2.17) | (-1.73) | (1.75) | (1.69) |
| VC Commitments Index | -.0345* | -.0193 | .0392* | .0194 |
| | (-1.87) | (-.93) | (1.71) | (1.22) |
| Nasdaq Index | .0082 | .0103 | .0039 | .0014 |
| | (.82) | (.61) | (1.61) | (1.01) |
| Observations | 1054 | 1226 | 1054 | 1226 |
| Adjusted R-Squared | 0.1784 | 0.0932 | 0.1284 | 0.0754 |

The dependent variable in this regression is the average time elapsed (duration) between two adjacent rounds of financing for a firm. Like the other regression equations, the primary explanatory variable of interest is the dummy variable associated with accelerator participation. The other control variables are as discussed in Section 2.4.1. I find that the average time between follow-on funding rounds is negatively related to accelerator program participation.

As can be seen in Table 16, I find that there is a significant positive relationship between accelerator participation and the average time between follow-on funding rounds. Such program attendance increases the average time between rounds by approximately 29 days for United States firms, and 51 days when analyzing firms in all countries. This finding further supports the theory that accelerated firms enjoy lower agency conflicts and information asymmetry.

### 2.4.4 Causes of Follow-on Funding Characteristics

In this study, I find a significant positive relationship between accelerator program participation and follow-on funding. I also find that accelerators also impact the characteristics of a firm's follow-on funding in a favorable way. These results suggest that the funding of firms, after they have participated in an accelerator program, differs as compared to firms that do not attend such a program. There are a number of possible rationales for the differences in funding patterns. I present three possible hypotheses for future research.

1. Agency conflict benefits. Participation in an accelerator program reduces potential agency conflicts, through intense early-stage monitoring. The process of attending the program allows the venture capitalist to observe

the founders and assists them in choosing firms to invest in with the lowest potential agency conflicts.

2. Information asymmetry benefits. Acceleration reduces information asymmetry. This rationale for more favorable funding of accelerated firms suggests that these companies have lower firm-specific information asymmetry between the firm and the venture capitalists.

3. Firm-specific benefits. Accelerator participation provides firms with accelerated mentoring, product and firm development, and publicity. Through the acceleration process, the founders are able to test ideas quickly, receive feedback from experienced investors, spend less time "chasing funds," and put the financing they do receive to work more quickly. All of these factors result in a firm that develops faster than their non-accelerated counterparts.

These three hypotheses suggest that either the firm is changed by the process of acceleration, or its relationship with investors is altered. In particular, the first two hypotheses, are based primarily on improvements in the relationship between the firm and its investors, the venture capitalist. The third hypothesis suggests that the primary benefits of acceleration inure directly to the firm being accelerated which then results in more favorable funding.

While the results of this study are consistent with the three proposed hypotheses, the individual findings shed light on which factors may be at play. All three hypothesis suggest a finding that accelerated firms would have a higher likelihood of receiving follow-on funding, and that the total amount raised would be larger. However, my

findings with respect to the amount of the individual funding rounds, time between such rounds, and overall number of rounds suggest that the primary benefit from accelerator programs may be in its impact on the relationship between the firm and the investors.

Since the primary rationale presented in the extant literature for staged funding rounds is that this type of financing structure allows the venture capital firm to both monitor agency conflicts, and reduce information asymmetry, the results herein suggest that acceleration significantly alters these factors in follow-on funding. Accelerated firms receive larger amounts of funding per round, have fewer overall rounds, and enjoy longer periods of time between such rounds. This suggests that accelerator programs may offer venture capitalists the opportunity to reduce potential agency conflicts and information asymmetry, and they provide more favorable funding as a result.

## 2.5 Conclusion

Seed accelerator programs represent a relatively recent phenomenon. They, however, play an increasingly important vehicle to assist young firms with funding and development. Despite their growing importance, there is a lack of literature related to their impact on how a firm's financing evolves. This paper provides the first examination of the impact of accelerator participation on follow-on funding success and characteristics.

In this study I find a significant positive relationship between accelerator participation and whether a young firm raises follow-on funding in the three years following initial seed funding. Overall the evidence suggests that seed accelerator programs provide the benefit of an increased likelihood of obtaining follow-on funding.

Since this is a primary measure of start-up success, it seems that seed accelerator program participation leads to a higher likelihood of success for start-ups.

In the second component of my analysis, I examine the characteristics of follow-on funding with a focus on whether the firm participated in a seed accelerator program. I find that there is a significant positive relation between accelerator program participation and the total amount of follow-on funding raised, the average size of follow-on funding rounds, and the average time between such funding rounds. I find a negative relationship between accelerator program attendance and the number of follow-on funding rounds. Each of the findings with respect to the characteristics of follow-on funding rounds is consistent with the theory that accelerator programs reduce agency conflicts as well as information asymmetry.

This research makes a number of significant contributions to the literature. First, the study fills a gap in the research related to one of the newest funding vehicle, venture capital accelerators. Second, this study adds to the literature in a significant way in that it provides a foundation from which to examine the long-term effects of these new funding vehicles on both private and public companies.

# CHAPTER 3: THE PRECIPITOUS DECLINE OF IPOs: EVIDENCE FROM THE MARKET FOR REAL ESTATE INVESTMENT TRUSTS

## 3.1 Introduction

Over the past decade there has been a precipitous decline in the number of initial public offering (IPO) of equity securities. An average of only 99 firms had initial public offerings during the period of 2001-2012, compared to an average of 310 firms that went public each year from 1980-2000. Making this significant decline in IPOs even more striking is the fact that much of the trend has been concentrated in small firms. Comparing IPOs from 1980-2000 to 2001-2009, a decrease of more than 80%, from an average of 165 small-firm initial public offerings each year to only 30, is observable in the latter period (Gao, Ritter, and Zhu (2013); Jensen, Marshall, and Jahera (2012)). This downtrend can also be observed among IPOs related to Real Estate Investment Trusts (REIT). While small-firm IPOs made up 57% of the REIT initial public offerings in the decade from 1991 through 2000, these offerings made up only 21% of the offerings in the period from 2001 through 2010. The importance of this paradigm shift in how firms grow and raise capital cannot be overstated.

The recent trend in offerings represents a major shift in how small firms raise capital. The public equity markets represent a cornerstone of the U.S. financial system, and one that impacts the economy as a whole. In addition, whether government regulation is having a detrimental impact on small real estate-related firms is of importance to founders, investors and regulators. Real Estate Investment Trusts, which

were first created by Congress in 1960, have long served the dual purposes of providing access to capital for urban expansion and renewal, as well as allowing for investment in real estate without the double taxation that often plagues many corporations. As real estate investment trusts have grown to play a major role in real estate ownership, development, and management, they have become a central foundation of the U.S. real estate industry.

A number of explanations for the precipitous decline in initial public offerings have been suggested in the finance literature. First, some have suggested that the trend in the number of initial public offerings is due to dynamics in the regulatory environment (Weild and Kim (2008, 2009); Zweig (2010); Weild (2011)) and the IPO Task Force (2011)). Known as the *Regulatory Overreach Theory,* this explanation posits that government regulations, such as the repeal of the Glass-Steagall Act, the Sarbanes-Oxley Act, and Regulation FD have made it more costly for small public companies to operate, and therefore, fewer small businesses are going public. Those who have taken this position have cited both changes in the regulatory environment, as well as dynamics in how small companies are analyzed and covered within the securities industry, as a result of such regulatory changes, as the primary causes of the decline in small-firm initial public offerings.

Others, such as Gao, Ritter, and Zhu (2013), have presented a different theory to explain the decline in small-firm IPOs. They argue that there has been a fundamental change in the economy over the past decade resulting in a decrease in the profitability of small companies. The proponents of this *Economies of Scope Theory* contend that small companies increasingly have a difficult time earning profits in an economy that

increasingly rewards larger businesses. Therefore, as the theory states, rather than going public companies are choosing to merge with other firms, and take other steps to compete in their markets. The changes, they suggest, go beyond regulatory changes, and have been gradually impacting how firms grow for two decades.

This second theory suggests that small firms must grow quickly to compete, and due to technological changes are required to respond in a short period of time or lose profitable opportunities. In many instances, they can create higher profits by selling out to large firms who enjoy economies of scope and scale. Some have argued that this theory also suggests that small independent companies have evolved, and must be less focused on immediate profit-maximization, then their historical counterparts, even though they operate in what has been characterized as an "eat or be eaten" environment (Campbell, Lettau, Malkiel, and Xu (2001)).

The goal of this study is to examine the recent IPO trends in the market for real estate investment trusts, in an effort to determine if there is support for the primary theories related to the decline in initial public offerings. To my knowledge, no other study has examined the changes in the market for small-firm REIT initial public offerings. Real Estate Investment Trusts (REITs) provide a unique opportunity to study this issue. With respect to REITs, the overall number of initial offerings has not declined as dramatically as in the general market for securities. In fact, REITs have enjoyed increased popularity as an entity-structure for both private and public real estate firms over the past decade. However, despite the growing popularity of REITs in general, the decline in small-firm REIT initial public offerings[23] have seen a significant 77% decline, when comparing the decade from 1991 through 2000, to that of 2001 through 2010. In fact, small-company

[23] Small-Firm IPOs are defined as offerings of less than $150,000 million at the time of the offering,

REIT IPOs have become nearly extinct in today's securities markets. Since the end of 2004, there have been only 5 RIET offerings of less than $150 million. The same disappearance of small-firm REIT IPOs is observable when examining the dollar volume of initial public offerings.

In addition to the significant decline in small-firm IPOs, Real Estate Investment Trusts offer other benefits in terms of studying the decline in initial public offerings. These real estate companies are typically capital intensive, hold a large percentage of fixed assets, and because of the rules associated with how REITs distribute earnings, are uniquely transparent with respect to their performance and financial information. Finally, the real estate industry is largely isolated from the traditional venture capital market, which has been cited as a possible cause of the recent IPO trends. These characteristics provide fruitful ground to study the different theories that could explain the recent IPO phenomenon.

In this paper, I test the leading explanations for the decline in IPOs, from the perspective of real estate investment trusts, and present numerous results related to the validity of such theories, in this context. My regression equation specification tests both the gradual change in the economic climate for firms, as well as the impact of a number of key legislative changes that are thought to be the primary regulatory changes impacting IPOs, including the Gramm-Leach-Bliley Act, the Sarbanes-Oxley Act, the Global Settlement, and Regulation NMS.

I present findings that provide support for the *Economies of Scope Theory,* and are inconsistent with the *Regulatory Overreach Theory*, with respect to small-firm REIT initial public offerings. Specifically, I find that there is no relation between the number of

quarterly small-firm REIT IPOs, as well as the dollar volume of such IPOs, and the Sarbanes-Oxley Act, the Global Settlement, and Regulation NMS, after controlling for changes in the economic climate for small firms. In addition, my results support the *Economies of Scope Theory*, and suggest that, except with respect to the Gramm-Leach-Blilley Act, the decline in the number of small-firm REIT IPOs has been a gradual trend rather than one punctuated by discrete shocks. With respect to large-firm REIT IPOs I find that there does not appear to be a relationship between the number of large-firm REIT offerings, and the legislation thought to have impacted initial public offerings. The results provide limited support for the *Regulatory Overreach Theory*, with respect to the impact of regulations on the volume of large-firm real estate investment trust initial public offerings.

This paper offers a unique perspective on the declining initial public offering phenomenon. It provides an analysis of the different theories related to the decline in IPOs, and insights into the impact of government regulations, from the perspective of the market for real estate-related firms. The data and methodology examines specific, literature-based theories with respect to the decline in IPOs, and provides support for the *Economies of Scale/Scope Theory*, with respect to real estate investment trusts. To my knowledge, no other literature has examined the recent changes in initial public offerings in this context.

The paper proceeds as follows. In section 3.2, I present an overview of the literature related to the decline in initial public offerings and the theories that have been presented to explain the downtrend. Section 3.3 presents the Data and Sample Selection. Section 3.4 provides the Empirical Analysis. Section 3.5 concludes.

## 3.2 Literature Review

Initial public offerings in the United States have been on the decline over the past decade. It is well documented that, during the period of 1980-2000, an average of 310 firms went public each year. Over the past decade, however, the number of IPOs each year has decreased substantially. From 2001-2012, an average of only 99 firms engaged in initial public offerings (Gao, Ritter, and Zhu (2013); Jensen, Marshall, and Jahera (2012)). Figure 1 presents the number of initial public offerings, by year, for small and large firms in the U.S.

While this recent trend is surprising, the specific characteristics of the firms that have experienced the largest decline help shed light on the phenomenon. A large proportion of the decline in IPOs, has been concentrated in small firms. Figure 1 provides the yearly number of initial public offerings, based on small and large categories of firms. The number of yearly small-company IPOs has dropped by more than 80%, from an average of 165 IPOs each year during the period of 1980-2000, to just 30 per year from 2001-2009. (Gao, Ritter, and Zhu (2013) and Jensen, Marshall, and Jahera (2012)).

The same trend is observable when examining REIT offerings. Over the past decade, small IPOs have nearly disappeared from the REIT equity market. Just twenty years ago the majority of IPOs by real estate investment trusts were issued by small companies, those offering less than $150 million. Today, however, such offerings have become nearly nonexistent. Specifically, from 1991 through 2000 small company REIT

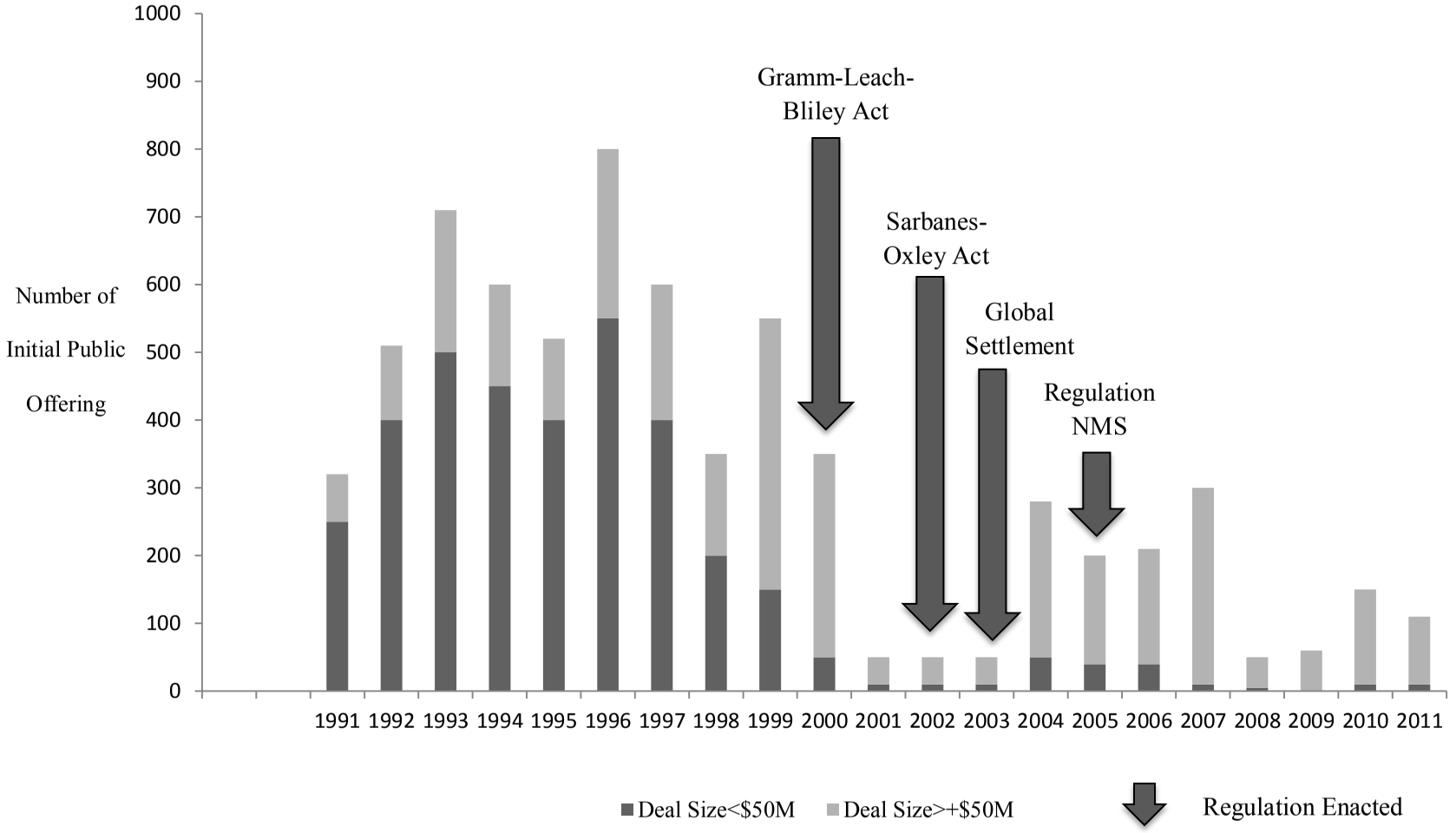


FIGURE 1: Number of U.S. initial public offerings of companies based on deal size, 1991 – 2011.
*Source: Thomson Reuters/National Venture Capital Association*.

IPOs made up 57% of all real estate-related IPOs, on average. For the period from 2001 through 2010, however, small company IPOs only accounted for only 21% of all REIT IPOs. With respect to the dollar volume of REIT IPOs one can observe the same downtrend, with a decrease for small-firm IPOs from 33% to just 6% of all IPOs when comparing the same two periods of time.

A number of theories have been presented in the finance literature to explain the dramatic decline in small-company IPOs. The preponderance of the research to date has focused on the possible impact of changes in the regulatory environment on initial public offerings. This premise, termed the *Regulatory Overreach Theory*, suggests that changes in government regulations have caused the overall reduction in the number of small-firm IPOs, due to increased costs associated with operating a public company.

The costs are the result of a litany of accounting and compliance laws and rules imposed by new legislation. Beginning in 1999 the Gramm-Leach-Bliley Act, which repealed the Glass Steagall Act, changed the equity markets by removing restrictions on affiliations between Commercial banks and securities firms. Other legislation that changed the equity landscape over the past decade were the Global Settlement and Regulation NMS. Some authors have also argued that due to regulatory changes, analyst coverage of initial public offerings has changed in recent years. These changes, they suggest, have had a large impact on small company offerings. (Weild and Kim (2010)). Figure 1 also presents the key legislation thought to have impacted initial public offerings, along with the number of IPOs by year. The primary legislation thought to have influenced initial public offerings are:

A. The Gramm-Leach-Bliley Act of 1999. The Gramm-Leach-Bliley Act

effectively repealed the Glass-Steagall Act, allowing commercial banks to engage in investment banking activities. Further, the legislation requires that companies that offer consumer financial products or services such as loans, financial or investment advice, and insurance explain their information sharing practices to their customers and safeguard sensitive data. Financial institutions must protect the consumer information they collect under the Safeguards rule. The act also implemented an interagency notice research project that developed privacy notices that consumers can understand. Financial institution must tell their customers about their information sharing practices and the consumers right to "opt-out."

B. The Sarbanes-Oxley Act of 2002. The Sarbanes-Oxley Act was enacted largely in response to corporate accounting scandals in the early 2000s, such as Enron, Tyco, and WorldCom. The regulation provided for new and severely enhanced standards for all U.S. public companies, as well as their managements, boards, and accounting firms. Among other requirements, SOX the management of public companies must certify the accuracy of financial information, as well as the company processes in place to guarantee its accuracy. The act also increased auditing and board of director oversight requirements, and imposed criminal penalties for its violation. Compliance with the Sarbanes-Oxley Act is mandatory for public companies.

C. The Global Settlement of 2003. The Global Settlement is a $1.4 billion settlement agreement reached between the SEC, NASD, NYSE and 10 Wall Street firms during an investigation into Wall Street conflicts. The 10 firms agreed to make major structural changes to separate their research departments from their investment banking departments. The departments must be physically separated, investment banking

revenues must have no impact on research budgets, compensation paid to research analysts cannot be tied to investment revenues and research analysts must not solicit investment banking business. In addition, contracts with independent research firms must be in place for customer's that wish to use them.

D. Regulation NMS of 2005. The National Market System is a set of rules developed by the SEC to improve the U.S. exchanges by improving fairness in price execution and the display of quotes and amount and access to market data. The rules ensure investors get the best price when their order is executed. It also includes the Sub-Penny Rule which sets the lowers quotation increment of all stocks over $1.00 per share to at least $0.01. Finally, it includes Market Data Rules to allocate revenue to self-regulator organizations that promote and improve market data access.

While all of the above regulations have been suggested as possible causes of the decline in initial public offering, the primary legislation often cited by proponents of the *Regulatory Overreach Theory,* is the Sarbanes-Oxley Act of 2002 (Weild and Kim (2008, 2009); Zweig (2010); Weild (2011); IPO Task Force (2011)). Many have debated the costs and benefits associated with the Sarbanes-Oxley Act (SOX). Some have argued that the wide-sweeping law has restored confidence in our public companies, and the in which their stocks trade. Others, however, have cited the legislation as reducing the United States' competitive edge in the global economy, and causing a decrease in both the number of public firms, and the initial public offering of equities. Due to the extensive compliance and auditing measures that SOX implemented, the legislation's opponents have argued that small companies cannot afford to operate as public firms in the current regulatory environment. In particular, Section 404 of SOX imposed large costs of

compliance with respect to reporting and auditing, on small public companies. At some point, it has been argued, these costs outweigh the benefits of becoming a public company, and the result is fewer small company initial public offerings. Figure 1 provides a view of the primary legislation thought to have had an impact on initial public offerings, together with the number of IPOs, by year.

In recent years, a number of pieces of legislation have been enacted reducing the burdens of the regulation on small public companies. In 2007, for example, the Securities Exchange Commission delayed some of the primary small-company compliance requirements associated with the Sarbanes-Oxley Act, ostensibly reducing the burdens on small firms. Going one step further, small businesses were permanently exempted from these requirements in September 2010. Despite these changes, however, small-company initial public offerings have not increased. In fact, small offerings for real estate firms have virtually disappeared, in spite of the regulatory changes relaxing the burdens on small firms. It is certainly plausible that government regulation, and the large burdens it imposes on small public firms, dampened the market for public offerings. The lack of small-firm REIT IPOs since the relaxation of regulatory compliance beginning in 2007, however, leads one to question whether the *regulatory overreach theory* is a primary cause of the downtrend associated with REIT IPOs.

In this regard, Gao, Ritter, and Zhu (2013) present the argument that regulatory overreach has not been the primary issue plaguing small-firm offerings. Rather, these authors suggest that fundamental changes in the economy over the past decade are the main cause of the alarming rate of decline in small company IPOs. These changes, they hypothesize, have resulted in a decrease in the profitability of small companies. This

decrease in profits, according to the authors, has led small firms to choose other means of growth, such a mergers. Figure 2 provides the percentage of initial public offerings compared to mergers & acquisitions from 1990 through 2011.

The *Economies of Scope Theory* suggests that changes in the economy, such as improvements in company efficiency and technology, make it difficult for small firms to compete in the marketplace. The circumstances related to this, more recent theory, are suggested to be a result of large-firm economies of scale and economies of scope. Small firms, it has been argued, must grow quickly, as well as bring new products to market in an expeditious manner, to survive. These changes, in turn, have led to fewer small-firm initial public offerings, and an increase in mergers as a primary method of raising funds and growing businesses.

Rather than taking the firms public, the theory holds, small companies either sell out to larger firms to survive, or are able to create higher profits through nonorganic growth, such as a merger. The theory suggests that these changes have resulted in a decrease in the profitability of small companies. Some have also suggested that small, independent companies have evolved, and today are less focused on short-term profit-maximization, then their historical counterparts. (Gao, Ritter, and Zhu (2013); Jensen, Marshall, and Jahera (2012)).

A number of authors have examined economies of scale and scope generally, in the context of real estate businesses. In fact, industry-wide consolidation has been predicted among real estate firms for nearly two decades. Linneman (1997, 2002) first argued that the real estate industry was following a path like most industrialized industries. This trend, the papers suggest, is one of consolidation where large, publically-

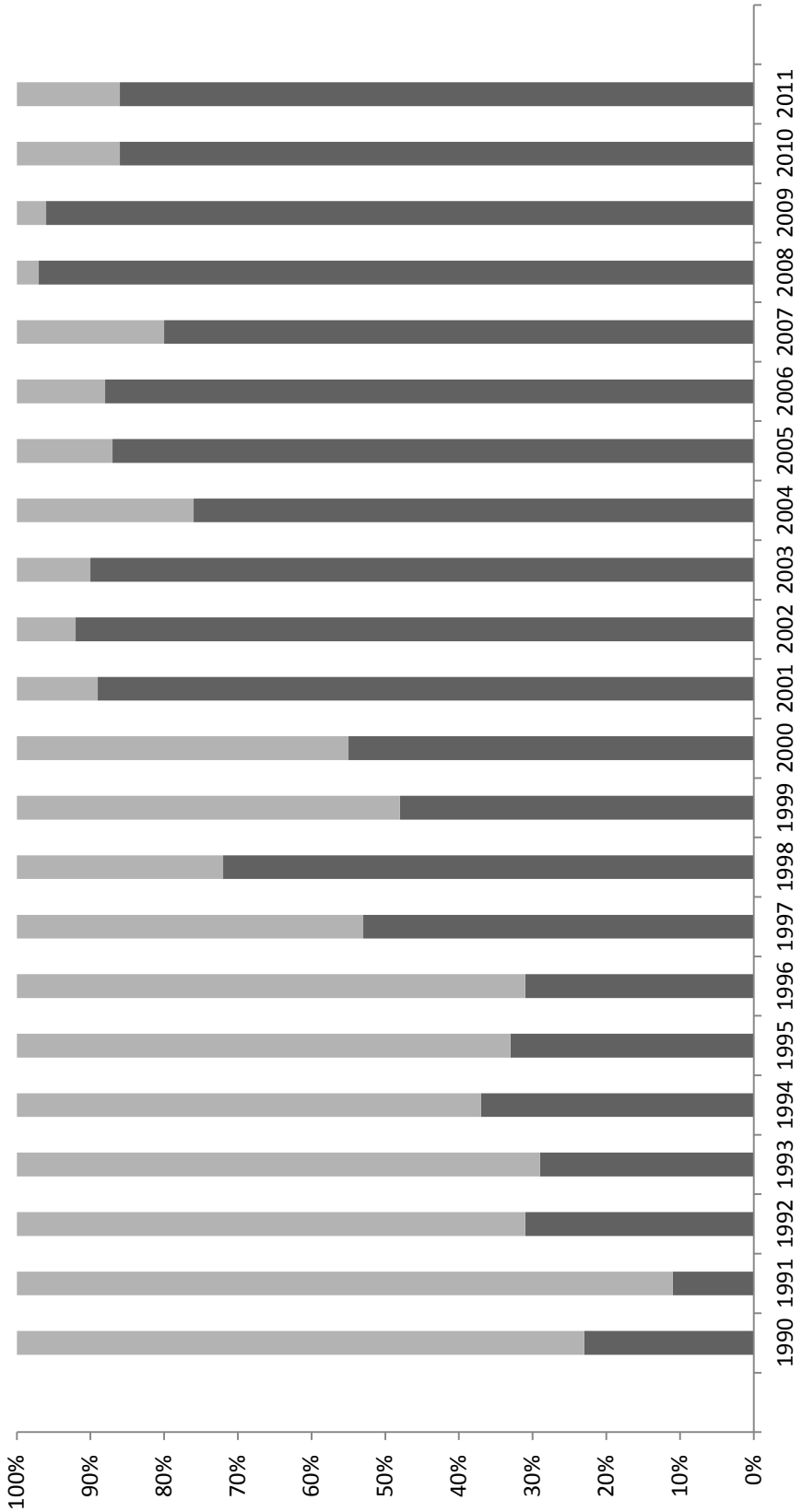


FIGURE 2: Percentage of U.S. initial public offerings compared to U.S. mergers & acquisitions, 1990 – 2011.
*Source: Thomson Reuters/National Venture Capital Association.*

traded companies take the lead, and small firms are forced to grow very quickly or merge with other businesses simply to survive.

Other literature has also found evidence of economies of scale within real estate investment trusts in particular. Anderson, Fok, Springer, and Webb (2002) examined whether economies of scale exist for real estate-related firms, using a sample of REITs from 1992 through 1996. They found that REITs are inefficient in terms of their input utilization and failure to operate at constant returns to scale. They also concluded that most REITs are operating at increasing returns to scale, which lends support to the premise that they can benefit from increased size. Bers and Springer (1997) also conclude that economies of scale plays a role among REIT firms. The authors further find that the economies of scale for REITs vary considerably over time.

Reflecting the importance of the recent changes in the market for initial public offering a number of groups have proposed changes that are designed to spur growth in small businesses and IPOs. The IPO Task Force, which grew from an Access to Capital Conference at the U.S. Treasury Department in 2011, published their findings and recommendations in October 2011. Their report, *Rebuilding the IPO On-Ramp: Putting Emerging Growth Companies and the Job Market Back on the Road to Growth*, makes a number of suggestions.

First, the task force recommended that there be reductions in the costs for small companies going public in the form of easing of legal regulations for firms with revenues of less than $1 billion. Second, the report calls for improved availability and flow of information for investors to increase the visibility for emerging-growth companies. The third suggestion made was to reduce the capital gains tax rate for investors that purchase

shares in an IPO and retain the shares for at least two years. Finally, it was recommended that there be an increase in education among issuing firms related to initial public offerings and their underwriting (IPO task Force (2011)). Without clear evidence as to the true causes of the decline in IPOs, and careful consideration as to the best approach to address them, however, such measures are unlikely to have a substantial impact on the IPO trend.

The literature with respect to this dynamic topic is still developing. Relevant historical observations of the IPO phenomenon have only recently grown to cover a full decade. Further, no studies have examined the changes occurring within the market for small real estate-related equities. Regardless of the cause of the paradigm shift in new-firm offerings, the changes represent forces that stand to have ripple effects through every aspect of the financial and real estate industries. Taking a firm public has been viewed as a primary means of raising capital, and providing for early investor exit, for many years. Additionally, the ability of real estate-related companies to raise public funds, and provide investors with an opportunity to invest in these companies, have been central goals of the REIT structure, since its advent by Congress in 1960.

If the trend has shifted away from IPOs as a primary method for small firms to raise capital, it represents a significant change in the traditional patterns of business growth. The impact of the recent changes in the development and financial structure of firms is also important to the overall economy. The small business and real estate markets enjoys a mutual dependence with the financial markets. Black and Gilson (1999) research the importance of an active stock market in the venture capital process. The authors argue that the small business industry in the United States flourishes in large part because of the

availability of the active stock market. They suggest that the United States stock market provides two benefits. First, it offers a readily available early investor exit in the form of initial public offerings. Second, they argue that, assuming the company is successful, the IPO possibility gives entrepreneurs a valuable option to reacquire control of their company from investors. If there have been fundamental changes in how founders view their capital and exit options, it stands to have an effect on numerous aspects of the financial markets and the economy as a whole.

While there have been a number of studies that explore the causes of the decline in the number of IPOs, and more particularly the changes related to small company offerings, the issue is far from resolved. Further, there is a surprising lack of literature related to how the apparent trend in initial equity offerings has affected offerings within specific industries. In particular, to my knowledge, no research has studied the primary theories related to the decline in initial public offerings within the real estate industry.

## 3.3 Data and Sample Selection

From the National Association of Real Estate Investment Trusts (NAREIT), I collect all of the real estate investment trust initial public offerings in the Industry Capital Offerings database during the period from 1991 through 2010, which yields a sample of 231 REIT initial public offerings. The data includes amount of offering, date of offering, number of shares, opening price, as well as firm-specific information. Related to the REIT IPOs, I also collect first day closing price, from SNL Financial. The IPOs are split into groups based on the quarter in which the offers took place. Then they are placed into two primary categories related to whether the offering was a small IPO or large IPO. Small-firm initial public offerings are defined as those that were less than $150 million,

at the time of offering. Large-firm offerings are defined as those that were $150 million or more. Consistent with the literature, approximately half of the sample is represented in each group over the period of 1991 through 2010. The quarterly average IPO initial returns are collected from Jay Ritter's website.[24] Real GDP Growth is computed using data from the St. Louis Federal Reserve.[25] Data related to the Consumer Price Index is collected from the Bureau of Labor Statistics.[26] I also collect the quarterly NAREIT Index data from the National Association of Real Estate Investment Trusts.

Table 17 provides an overview of the frequency of REIT initial public offerings, by year, during the sample period. Panel A reflects the number of small and large-firm initial public offerings, by year. In addition to the number of offerings, the relative percentage of the total number of initial public offerings by each group is also presented. Panel B reports yearly averages, for the entire sample, as well as each ten-year period. Table 18 presents statistics related to the proceeds of REIT initial public offerings between 1991 and 2010. The dollar proceeds for small-firm, as well as those of large firms, IPOs are reported, together with averages.

In addition to the information related to REIT initial public offerings, I collect information regarding monthly REIT performance from REIT Watch, published by the National Association of Real Estate Investment Trusts, for the period of 2000 through 2010 including firm capitalization, average Funds from Operations (FFO) per share, average Price/FFO ratio, firm returns. Finally, from SNL Financial I collect firm-specific Net Asset Value (NAV) information for seasoned REIT companies, during the period of

[24] Jay R. Ritter's website is: http://bear/warrington.ufl.edu/ritter/
[25] The St. Louis Federal Reserve website is: http://research.stlouisfed.org/
[26] The Bureau of Labor Statistics website is: http://bls.gov

TABLE 17: U.S. real estate investment trust initial public offerings by year

This table reports the number U.S. Real Estate Investment Trust (REIT) initial public offerings. Panel A reports the information by year, while Panel B reports annual averages. In addition, the table presents the number of small-firm REIT initial public offerings, and number of large-firm REIT initial public offerings for each year, as well as their respective percentage of the total number of REIT initial public offerings. Small-firm offerings are defined as initial public offerings of less than $150 million, while large-firm offerings are those $150 million or larger. The data is collected from the National Association of Real Estate Investment Trusts.

*Panel A: Number of IPOs by Year*

| | Total Number | Small-Firm IPOs | | Large-Firm IPOs | |
|---|---|---|---|---|---|
| Year | of IPOs | Number | % of Total Number of IPOs | Number | % of Total Number of IPOs |
| 1991 | 3 | 3 | 100% | 0 | 0% |
| 1992 | 6 | 4 | 67% | 2 | 33% |
| 1993 | 45 | 19 | 42% | 26 | 58% |
| 1994 | 43 | 23 | 53% | 20 | 47% |
| 1995 | 8 | 6 | 75% | 2 | 25% |
| 1996 | 6 | 4 | 67% | 2 | 33% |
| 1997 | 26 | 12 | 46% | 14 | 54% |
| 1998 | 17 | 12 | 71% | 5 | 29% |
| 1999 | 2 | 1 | 50% | 1 | 50% |
| 2000 | 0 | 0 | 0% | 0 | 0% |
| 2001 | 0 | 0 | 0% | 0 | 0% |
| 2002 | 3 | 2 | 67% | 1 | 33% |
| 2003 | 8 | 3 | 38% | 5 | 63% |
| 2004 | 28 | 9 | 32% | 19 | 68% |
| 2005 | 11 | 2 | 18% | 9 | 82% |
| 2006 | 5 | 1 | 20% | 4 | 80% |
| 2007 | 4 | 0 | 0% | 4 | 100% |
| 2008 | 2 | 0 | 0% | 2 | 100% |
| 2009 | 5 | 1 | 20% | 4 | 80% |
| 2010 | 9 | 1 | 11% | 8 | 89% |
| Total | 231 | 103 | | 128 | |

*Panel B: Annual Averages*

| | | | | | |
|---|---|---|---|---|---|
| 1991 - 2000 | 15.60 | 8.40 | 63.42% | 7.20 | 36.58% |
| 2001 - 2010 | 7.50 | 1.90 | 22.84% | 5.60 | 77.16% |
| 1991 - 2010 | 11.55 | 5.15 | 43.13% | 6.40 | 56.87% |

TABLE 18: U.S. real estate investment trust initial public offerings dollar volume by year

This table reports the dollar volume of U.S. Real Estate Investment Trust (REIT) initial public offerings. Panel A reports the information by year, while Panel B reports annual averages. In addition, the table presents the dollar volume of small-firm REIT initial public offerings, and dollar volume of large-firm REIT initial public offerings for each year, as well as their respective percentage of the total dollar volume of REIT initial public offerings. Small-firm offerings are defined as initial public offerings of less than $150 million, while large-firm offerings are those $150 million or larger. The data is collected from the National Association of Real Estate Investment Trusts.

*Panel A: Volume of IPOs by Year*

| Year | Total IPO Proceeds (Millions) | Small Firm IPO Proceeds (Millions) | % of Total IPO Volume | Large Firm IPO Proceeds (Millions) | % of Total IPO Volume |
|---|---|---|---|---|---|
| 1991 | $207.90 | $207.90 | 100.00% | $0.00 | 0.00% |
| 1992 | $842.90 | $398.10 | 47.23% | $444.80 | 52.77% |
| 1993 | $8,530.45 | $1,660.06 | 19.46% | $6,870.39 | 80.54% |
| 1994 | $6,714.13 | $1,761.73 | 26.24% | $4,952.40 | 73.76% |
| 1995 | $922.15 | $441.85 | 47.92% | $480.30 | 52.08% |
| 1996 | $1,107.84 | $242.53 | 21.89% | $865.31 | 78.11% |
| 1997 | $6,296.48 | $909.04 | 14.44% | $5,387.44 | 85.56% |
| 1998 | $2,129.30 | $941.20 | 44.20% | $1,188.10 | 55.80% |
| 1999 | $292.00 | $12.00 | 4.11% | $280.00 | 95.89% |
| 2000 | $0.00 | $0.00 | 0.00% | $0.00 | 0.00% |
| 2001 | $0.00 | $0.00 | 0.00% | $0.00 | 0.00% |
| 2002 | $608.20 | $158.20 | 26.01% | $450.00 | 73.99% |
| 2003 | $2,645.86 | $328.11 | 12.40% | $2,317.75 | 87.60% |
| 2004 | $7,980.44 | $482.48 | 6.05% | $7,497.96 | 93.95% |
| 2005 | $3,789.24 | $259.49 | 6.85% | $3,529.75 | 93.15% |
| 2006 | $2,271.43 | $69.00 | 3.04% | $2,202.43 | 96.96% |
| 2007 | $1,857.88 | $0.00 | 0.00% | $1,857.88 | 100.00% |
| 2008 | $491.00 | $0.00 | 0.00% | $491.00 | 100.00% |
| 2009 | $2,614.49 | $115.12 | 4.40% | $2,499.37 | 95.60% |
| 2010 | $1,986.70 | $30.36 | 1.53% | $1,956.34 | 98.47% |
| Total | $51,288.39 | $8,017.17 | | $43,271.22 | |

*Panel B: Annual Averages*

| | | | | | |
|---|---|---|---|---|---|
| 1991 - 2000 | $2,704.32 | $657.44 | 24.31% | $2,046.87 | 75.69% |
| 2001 - 2010 | $2,424.52 | $144.28 | 5.95% | $2,280.25 | 94.05% |
| 1991 - 2010 | $2,564.42 | $400.86 | 15.63% | $2,163.56 | 84.37% |

2000 through 2010. The NASDAQ Composite Index is used as a further macroeconomic-level control variable.

I collect information related to REIT mergers from SDC Platinum, including firm names, dates, type, offering amount, related to REIT mergers during the period from 1991 through 2010. Limited Partnerships, and firms for which offering characteristics are not available, are excluded from the sample. The resulting sample includes 230 real estate investment trust initial public offerings. Table 19 reports descriptive statistics related to the profitability of REITS. Finally, Table 20 reports statistics related to mergers during the sample period.

## 3.4 Empirical Analysis

### 3.4.1 The Decline in REIT Initial Public Offerings

Over the past decade, small IPOs have nearly disappeared from the REIT equity market. Table 17 reports the statistics related to real estate investment trust offerings. From 1991 through 2000 small company REIT IPOs made up 63% of all real estate-related IPOs, on average. For the period from 2001 through 2010, however, small company offerings only accounted for only 23% of all REIT IPOs. The same trend can be observed with respect to the dollar volume of REIT initial public offerings. Table 18 reports the dollar volume of initial public offerings during the sample period. During the period from 1991 through 2000, small-firm REIT offerings made up 24% of the total IPOs, based on offering proceeds. That figure drops dramatically to just 6% during the period of 2001 through 2010.

One possible explanation for where IPOs have gone over the past decades, states that there has been shift toward mergers as a primary method of growing small firms.

Figure 2 presents the number of mergers & acquisitions related to firms from all industries, along with initial public offerings over the past twenty years, by year. As can be seen, there has been a shift away from initial public offerings, and toward mergers & acquisitions as a means of growing and exiting firms. Table 19 presents descriptive statistics related to the 336 mergers in the sample. As is the case with the initial public offerings, there has been a significant change in the overall volume of mergers over the past two decades. For example, the volume of U.S. REIT mergers has increased from an annual average of $7 billion from 1991 through 2000, to an annual average of $40 billion in the period of 2001 through 2010. It is important to note that 2004 had an unusually large amount of REIT IPO volume. If you remove 2004 from the sample, however, the yearly average volume of mergers is $21 billion for the period of 2000-2010, which still represents a significant increase over the prior decade. The same trend holds true for the average size of the mergers, which grew from $333 million for the period of 1991-2000, compared to $3 billion during the period of 2001-2010.

Despite the clear evidence that initial public offerings are on the decline as a tool for growth and investor exit, the reasons for such decline are unclear. The characteristics of the downtrend may provide some explanations. As discussed above, small-firm REIT IPOs have experienced a significantly larger decline in initial public offerings. It has been suggested that the differential in the IPO trend may be a result of deteriorating profitability among small firms. Large firms, the theory suggests, enjoy financial benefits due to their relative size. Small businesses, on the other hand do not benefit from these

TABLE 19: U.S. real estate investment trust mergers by year

This table reports the frequency, total dollar volume, and average size in millions of dollars, of U.S. Real Estate Investment Trust (REIT) mergers during the sample period. Panel A reports the information by year, while Panel B reports annual averages. The data is collected from the National Association of Real Estate Investment Trusts.

*Panel A: Mergers by Year*

| Year | No. of Mergers | Total Volume (Millions) | Average Size (Millions) |
|---|---|---|---|
| 1991 | 2 | $167.80 | $83.90 |
| 1992 | 2 | $14.60 | $7.30 |
| 1993 | 7 | $1,334.73 | $190.68 |
| 1994 | 9 | $1,574.48 | $174.94 |
| 1995 | 12 | $939.78 | $78.32 |
| 1996 | 23 | $7,274.23 | $316.27 |
| 1997 | 35 | $12,946.14 | $369.89 |
| 1998 | 32 | $23,445.52 | $732.67 |
| 1999 | 21 | $11,767.54 | $560.36 |
| 2000 | 17 | $13,914.04 | $818.47 |
| 2001 | 17 | $16,691.39 | $981.85 |
| 2002 | 26 | $14,394.21 | $553.62 |
| 2003 | 22 | $10,703.77 | $486.54 |
| 2004 | 10 | $198,059.63 | $19,805.96 |
| 2005 | 18 | $13,101.70 | $727.87 |
| 2006 | 29 | $39,125.64 | $1,349.16 |
| 2007 | 33 | $97,870.59 | $2,965.78 |
| 2008 | 7 | $2,451.20 | $350.17 |
| 2009 | 9 | $502.68 | $55.85 |
| 2010 | 5 | $5,251.71 | $1,050.34 |
| Total | 336 | $471,531.38 | $31,659.94 |

*Panel B: Annual Averages*

| | | | |
|---|---|---|---|
| 1991 - 2000 | 16 | $7,337.89 | $333.28 |
| 2001 - 2010 | 17.6 | $39,815.25 | $2,832.71 |
| 1991 - 2010 | 16.8 | $23,576.57 | $1,583.00 |

types of economies of scope. This differential, it is suggested, puts small businesses at a financial disadvantage and they, therefore, are being forced to choose other means of growth than initial public offerings. Table 20 provides summary statistics related to real estate investment trust profitability during the period from 2000 through 2010[27]. The statistics are presented for both small and large U.S. REITs. Small firms are defined as those that have total capitalization of less than $250 million, while large REITs have capitalization of $250 million or more.[28] For each category of firm size, three primary metrics are used to access firm profitability in the sample: Average Funds From Operations (FFO) per share, Average Price/FFO ratio, and the percentage of firms with negative returns. FFO per share is used by real estate investment trusts, as an alternative to earnings per share, to define cash flow from their operations. Funds from Operations is defined as earnings, plus depreciation and amortization expenses. Because REITs are, by virtue of their Internal Revenue Code status, required to hold at least 75% of their assets in real estate-related assets, which often appreciate over time, FFO is considered a better measure than earnings per share, which can often impacted by depreciation and other accounting activities. FFO also adjusts for gains and losses from the sale of property since they are not recurring.

By examining firm profitability for small REITs compared to large REIT firms, striking differences are apparent. First, average FFO per share over the sample period is 1.08 for small firms, compared to 2.49 for the firms categorized as large REITs. This is a striking difference, and supports the premise that the market recognizes key differences

[27] Reliable data related to real estate investment trust profitability is not available prior to 2000.
[28] A differentiation point of $250 million is used for seasoned REIT firms since they typically have larger total capitalization than companies engaging in initial public offerings, and REITs are generally capital intensive.

TABLE 20: U.S. real estate investment trust summary statistics related to profitability of firms over time

This table reports summary statistics related to the profitability of U.S. Real Estate Investment Trusts over time. The data is collected from SNL Financial and the National Association of Real Estate Investment Trusts. This data is not available prior to 2000, and therefore, the sample includes 1,913 publically traded Real Estate Investment Trusts traded between 2000 and 2010. The sample is partitioned by capitalization of the firm, with those with less than $250 million in capitalization placed in the small-firm category, and companies with $250 million or more of capitalization placed in the large-firm category. Panel A reports the information by year, while Panel B reports annual averages. Funds from Operation is defined as earnings, plus depreciation and amortization expenses.

TABLE 20: Continued

*Panel A: REIT Profitability Statistics*

| | | Small Firms | | | | Large Firms | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Total Number Firms | Number | Average FFO ($) per Share | Average Price/FFO | % of Firms with Returns < 0 | Number | Average FFO ($) per Share | Average Price/FFO | % of Firms with Returns < 0 |
| 2000 | 190 | 87 | 1.59 | 6.37 | 51.72% | 103 | 2.57 | 7.94 | 57.28% |
| 2001 | 177 | 83 | 1.51 | 6.05 | 36.14% | 94 | 2.79 | 8.87 | 5.32% |
| 2002 | 192 | 76 | 1.61 | 10.72 | 27.63% | 116 | 2.63 | 10.16 | 14.66% |
| 2003 | 177 | 55 | 1.22 | 9.02 | 30.91% | 122 | 2.59 | 9.82 | 21.31% |
| 2004 | 172 | 48 | 1.01 | 11.31 | 4.17% | 124 | 2.42 | 13.52 | 1.61% |
| 2005 | 193 | 43 | 1.05 | 12.94 | 23.26% | 150 | 2.27 | 16.72 | 1.33% |
| 2006 | 200 | 44 | 0.93 | 14.85 | 56.82% | 156 | 2.17 | 15.59 | 29.49% |
| 2007 | 182 | 33 | 1.01 | 13.48 | 24.24% | 149 | 2.35 | 17.56 | 2.01% |
| 2008 | 152 | 31 | 1.00 | 11.62 | 87.10% | 121 | 2.55 | 12.89 | 81.82% |
| 2009 | 136 | 40 | 1.12 | 9.04 | 95.00% | 96 | 2.64 | 9.16 | 88.54% |
| 2010 | 142 | 34 | -0.16 | 5.47 | 23.53% | 108 | 2.46 | 11.20 | 12.04% |
| Total | 1913 | 574 | | | | 1339 | | | |
| *Panel B: Annual Averages* | | | | | | | | | |
| 2000-2010 | | 52.18 | 1.08 | 10.08 | 41.87% | 121.73 | 2.49 | 12.13 | 28.67% |
| 2000-2005 | | 65.33 | 1.33 | 9.40 | 28.97% | 118.17 | 2.55 | 11.17 | 16.92% |
| 2006-2010 | | 36.40 | 0.78 | 10.89 | 57.34% | 126.00 | 2.43 | 13.28 | 42.78% |

in the profitability of small firms as compared to their larger counterparts. Moreover, when comparing the first six years of the sample period to the last five years, the statistics indicate that the average FFO, per share has declined more than 41%. For large firms, however, the decline has been only 4.7%. The average Price/FFO ratio also provides insight into the fact that small REITs differ from larger companies in important ways. The average Price/FFO ratios for small and large companies are 10.08 and 12.13, respectively.

This difference in Price/FFO ratio for small versus large companies is consistent with the *Economies of Scope Theory*. As a third measure of the market's perception of firm value, Table 4 also reports the percentage of public REIT firms that have negative returns, by year. As can be seen, here too there are stark difference when comparing small to large REITs. Specifically, on average, 42% of the small-firm REITs have negative returns each year, while only 29% of the large firms experienced negative returns, during the sample period.

### 3.4.2 Explaining the Decline in IPOs: Regulatory Overreach and Economies of Scope

According to the literature, two primary theories exist related to the decline in the volume of initial public offerings over the past decade, particularly with respect to small firms. The *Regulatory Overreach Theory* suggests that the government has decreased the ability of small firms to afford to be public companies, and this has resulted in few initial public offerings. The *Economies of Scope Theory,* on the other hand, holds that gradual changes in the economy, and how firms operate, have resulted in the precipitous decline in IPOs.

The goal of this paper is to examine these two theories, from the context of the market for real estate investment trusts, which offers a unique opportunity to explore the possible causes of the downturn in IPOs. When compared to public firms in general, these real estate companies are typically capital intensive and hold a large percentage of fixed assets. The Internal Revenue Service rules associated with REIT qualification, that require that 75% of these entities' total assets be held in real estate. In addition, 90% of a REIT's income must be distributed each year. This distribution requirement results in these companies being relatively transparent with respect to their performance and financial information, when compared to non-real estate-related public companies. These characteristics make REITs an excellent candidate to study the different theories that could explain the recent IPO phenomenon.

Another important aspect of the market for REIT IPOs in this study is its relative independence from the venture capital industry. It has been argued that the decline in IPOs over the past decade is, at least in part, a result of changes in venture capital. Since real estate investment trusts rarely raise funding through venture capital, they offer a subset of the IPO market that can be analyzed separate from any possible effects of changes in venture capital structure.

In this paper I test the two primary explanations for the IPO downtrend, by examining the relationship between quarterly initial public offering volume for U.S. REITs and a number of factors thought to have drastically impacted such volume over the past twenty years. Thus far I have presented a numerous summary statistics that support the fact that initial public offerings related to real estate investment trusts have declined significantly over the past twenty years, particularly with respect to small-firm offerings.

To further test the predictions of these two theories, with respect to the initial public offerings of real estate investment trusts, I use time-series regression analysis to ascertain if there is support for either of the primary theories related to the downtrend in small-firm IPOs. At the core of the study, I examine the relationships between the primary legislation thought to impact IPOs, as well as economies of scope, and quarterly REIT initial public offering volume. To study these relationships I use two different dependent variables in separate models: The quarterly number of REIT initial public offerings, and the quarterly dollar volume of REIT IPOs. I use the following regression specification:

$$\begin{aligned}\text{Quarterly IPO Activity}_t = {} & \alpha + \beta_1 \text{ x Time Trend}_t \\ & + \beta_2 \text{ x Gramm-Leach-Bliley Dummy} \\ & + \beta_3 \text{ x Sarbanes-Oxley Act Dummy} \\ & + \beta_4 \text{ x Global Settlement Dummy} \\ & + \beta_5 \text{ x Regulation NMS Dummy} \\ & + \beta_6 \text{ x Small Firms with Negative Returns}_{t-1} \\ & + \beta_7 \text{ x IPO Initial Return}_{t-1} + \beta_8 \text{ x Real GDP Growth}_{t-1} \\ & + \beta_9 \text{ x NAREIT Index}_{t-1} + \beta_{10} \text{ x NASDAQ Index}_{t-1} + \varepsilon\end{aligned} \quad (1)$$

where, *Quarterly IPO Activity*$_t$ denotes either the quarterly number of initial public offerings, or the natural log of the quarterly dollar volume of initial public offerings, depending on the model. Quarterly dollar volume of IPOs is scaled by the Consumer Price Index, with the base year of 2010. *Time Trend*$_t$ denotes the quarterly time trend variable used to measure a gradual change in the volume of IPOs over time, as

a proxy for changes in economies of scale/scope during the sample period, following Gao, Ritter, and Zhu (2013), and Campbell, Lettau, Malkiel, and Xu (2001). The time trend equals 0.10 for the first quarter of 1991, and increases by 0.10 for each quarter thereafter, until the fourth quarter of 2010. *Gramm-Leach-Bliley Dummy* denotes whether the quarter was before or after passing of the Gramm-Leach-Bliley Act of 1999, which repealed the Glass-Steagall Act. The variable equals zero for all quarters prior to the new rules, and one after. *Sarbanes-Oxley Dummy* represents a dummy explanatory variable used to capture the importance of the Sarbanes-Oxley Act of 2002 on quarterly IPO volume. The dummy variable equals zero in quarters prior to July 2002, when the Sarbanes-Oxley Act was enacted, and is equal to one until after the fourth quarter of 2007, when the Securities Exchange Commission relaxed the compliance requirements on small firms. For all periods after the fourth quarter of 2007, the dummy variable equals zero. *Global Settlement Dummy,* denotes whether the quarter was before or after the Global Settlement of 2003, and equals one for all quarters prior to the settlement, and one for all quarters after. *Regulation NMS Dummy*, represents whether the quarter was before or after the enactment of Regulation NMS in 2005. The variable equals zero for all quarters prior to the legislation, and one after. *Percentage of Small Firms with Negative Returns*$_{t-1}$ represents the percentage of small firms that had negative returns from the prior quarter. *Initial Returns*$_{t-1}$ denotes the average initial return in the quarter prior to the instant quarter. *Real GDP Growth*$_{t-1}$ Is the percentage of Real GDP Growth in the quarter prior to the instant quarter. *NAREIT Index*$_{t-1}$ denotes the National Association of Real Estate Investment Trusts Index for the quarter prior to the instant quarter. *NASDAQ Index*$_{t-1}$ represents the NASDAQ Composite Index in the quarter prior to the instant

quarter. The model specification also includes an AR(1) Coefficient.

The regression analysis is performed with two different models, each used to measure REIT initial public offerings activity. First, following the literature, I use the quarterly number of REIT initial public offerings. As a second analysis, I use the quarterly dollar volume of REIT IPOs as the dependent variable. In both instances, the sample is divided into two categories, one related to small-firm REIT IPOs, and a second group of large-firm REIT IPOs. I define small-firm IPOs offerings of less than $150 million, at the time of the offering. Approximately 50% of IPOs fit into the categories of small-firm and large-firm IPOs, based on this cut off.

Each primary regression model includes two variables of interest. First, following Gao, Ritter, and Zhu (2013), I include a time trend to proxy for the gradual change in the impact of economies of scale and scope on quarterly IPO volume. The *Economies of Scope Theory* suggests that the decline in small-firm IPOs has been primarily due to a gradual change in the economy, which benefits large companies. Following Gao, Ritter, and Zhu (2013) and Campbell, Lettau, Malkiel, and Xu (2001),[29] I use a time trend explanatory variable to capture the effect of economies of scope/scale and the importance of a gradual change in the overall environment related to small real estate investment trusts.[30] Consistent with the literature, I begin the time trend in the first quarter of 1991, and increase the variable quarterly until the end of our sample in the fourth quarter of 2010. If economies of scale and scope have played a primary role in the decline in small-

[29] Gao, Ritter, and Zhu (2013) use a time trend to test the impact of economies of scope on IPO volume in the general IPO market. Campbell, Lettau, Malkiel, and Xu (2001) use a time trend to test for a gradual increase in idiosyncratic stock volatility.

[30] The use of the time trend serves the primary purposes often cited as appropriate for use of a time trend in regression equations. The time trend captures trajectory of the variable over time, as well as the effect of relevant variables in the regression equation that change over time and are not directly measurable.

firm REIT IPOs, one would expect to observe this fact through this explanatory variable. A statistically significant result related to the coefficient on the time trend in the regressions would indicate that there is a gradual, linear relationship between quarterly IPO volume and an increase in time through the sample. Further, a positive/negative coefficient on the time trend would suggest that there is a continuous increase/decline in REIT IPO volume over time. A negative coefficient would support the *Economies of Scope Theory*.

The second primary variable of interest in each model is used to measure the impact of regulation on the number and volume of REIT initial public offerings. According to the *Regulatory Overreach Theory,* overly excessive government regulations imposed costs on small firms, and the result has been a significant decline in small-firm initial public offerings. If government regulations played a significant role in the decline in small-firm REIT IPOs, one would expect to see this fact through a time-series study of REIT IPO activity.

Each model specification includes an explanatory variable corresponding with one of the major pieces of legislation that has been cited as a possible cause of the significant decline in initial public offerings over the past decade. While the Sarbanes-Oxley Act is considered the primary legislation that increased the compliance costs of public firms, regulations enacted both before and after have also been suggested as having imposed burdens that impacted IPOs. If the regulations played a significant role in curbing the volume of small-firm IPO activity, one would expect this effect to be observable in regressions of IPO volume. The regulatory variables were chosen to reflect the possible legislative burdens outlined under the *Regulatory Overreach Theory,* and

include:

A. *The Gramm-Leach-Bliley Act of 1999*.

B. *The Sarbanes-Oxley Act of 2002*.

C. *The Global Settlement of 2003*.

D. *Regulation NMS of 2005*.

I use dummy variables to indicate whether the specific quarter was during the influence of such legislation. For each regulatory variable the dummy flag is zero prior to the enactment of the legislation, and one after its passing into law. It is important to note that the Sarbanes-Oxley Act became law in 2002. The compliance requirements, however, were relaxed for small firms in the fourth quarter of 2007. Therefore, the SOX dummy variable is zero prior to the enactment of the law, and one from the time it was passed until the fourth quarter of 2007, when it again becomes zero. Each regulation is tested individually, together with control variables, as well as with the time trend, and control variables, to ascertain the impact of the legislation. A negative coefficient related specific legislation would suggest that such laws contributed to the decline in IPO volume.

Table 21 reports the time-series regression results with quarterly number of small-firm REIT IPOs as the dependent variable, and estimated over the 1991 through 2010 period. Models 1 through 8 test the number of quarterly small-firm IPOs, each with a different regulatory variable alone, as well as with the time trend. At the core of my empirical findings is the result that, with respect to the number of small-firm REIT IPOs, the coefficients on the Sarbanes-Oxley Act, the Global Settlement, and Regulation NMS variables are not significant, in the presence of the time trend variable.

TABLE 21: Quarterly time-series regressions of number of small-firm REIT IPOs

This table reports the results from the regressions of quarterly number of small-firm initial public offerings on the time trend variable, as well as the regulatory variables, and control variables, during the sample period of 1991 through 2010. Small-firm offerings are defined as initial public offerings of less than $150 million, while large-firm offerings are those $150 million or larger. The data is collected from the National Association of Real Estate Investment Trusts. *Quarterly IPO Activity* denotes the quarterly number of initial public offerings. *Time Trend* denotes the quarterly time trend variable used to measure a gradual change in the volume of IPOs over time, as a proxy for changes in economies of scale/scope during the sample period, following Gao, Ritter, and Zhu (2013), and Campbell, Lettau, Malkiel, and Xu (2001). The time trend equals 0.10 for the first quarter of 1991, and increases by 0.10 for each quarter thereafter, until the fourth quarter of 2010. *Gramm-Leach-Bliley Dummy* denotes whether the quarter was before or after passing of the Gramm-Leach-Bliley Act of 1999, which repealed the Glass-Steagall Act. The variable equals zero for all quarters prior to the new rules, and one after. *Sarbanes-Oxley Dummy* represents a dummy explanatory variable used to capture the importance of the Sarbanes-Oxley Act of 2002 on quarterly IPO volume. The dummy variable equals zero in quarters prior to July 2002, when the Sarbanes-Oxley Act was enacted, and is equal to one until after the fourth quarter of 2007, when the Securities Exchange Commission relaxed the compliance requirements on small firms. For all periods after the fourth quarter of 2007, the dummy variable equals zero. *Global Settlement Dummy* denotes whether the quarter was before or after the Global Settlement of 2003, and equals one for all quarters prior to the settlement, and one for all quarters after. *Regulation NMS Dummy* represents whether the quarter was before or after the enactment of Regulation NMS in 2005. The variable equals zero for all quarters prior to the legislation, and one after. *Percentage of Small Firms with Negative Returns* denotes the percentage of small firms that had negative returns from the prior quarter. *Initial Returns* denotes the average initial return in the quarter prior to the instant quarter. *Real GDP Growth* Is the percentage of Real GDP Growth in the quarter prior to the instant quarter. *NAREIT Index* denotes the National Association of Real Estate Investment Trusts Index for the quarter prior to the instant quarter. *NASDAQ Index* represents the NASDAQ Composite Index in the quarter prior to the instant quarter. The model specification also includes an AR(1) Coefficient. Year dummies are included in the specification, but not reported. T-statistics are reported in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

TABLE 21: Continued

| | Number of Small-Firm REIT IPOs | | | | | | | | | Small IPOs/All IPOs |
|---|---|---|---|---|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
| Time trend | | -.0944 | | -.3188*** | | -.3995** | | -.3924*** | -.3510*** | -.0491*** |
| | | (-0.57) | | (-3.12) | | (-2.28) | | (-2.88) | (-3.98) | (-2.88) |
| Gramm-Leach-Bliley Dummy | -1.8110*** | -1.4316* | | | | | | | | |
| | (-4.42) | (-1.84) | | | | | | | | |
| Sarbanes-Oxley Dummy | | | -1.1237** | -.3266 | | | | | | |
| | | | (-2.38) | (-0.64) | | | | | | |
| Global Settlement Dummy | | | | | -1.3853*** | .2702 | | | | |
| | | | | | (-3.16) | (0.32) | | | | |
| Regulation NMS Dummy | | | | | | | -1.3122*** | .2945 | | |
| | | | | | | | (-2.61) | (0.40) | | |
| IPO initial return in (t-1) | -2.1531** | -2.2603** | -3.2480*** | -2.8340** | -3.5921*** | -2.4770** | -3.1761*** | -2.5421** | -2.6598** | -.3021 |
| | (-1.96) | (-2.02) | (-2.69) | (-2.46) | (-3.02) | (-1.97) | (-2.67) | (-2.20) | (-2.39) | (-1.40) |
| NAREIT Index (t-1) | -1.0758 | -1.2491 | -2.1454 | -1.9737 | -2.2782 | -1.9526 | -2.4297 | -1.9256 | -1.9909 | -.4254 |
| | (-0.50) | (-0.57) | (-0.93) | (-0.90) | (-1.01) | (-0.89) | (-1.06) | (-0.88) | (-0.91) | (-1.01) |
| Real GDP Growth (%) (t-1) | 60.6975* | 60.2620* | 114.9783*** | 75.0743** | 86.1514** | 68.1311** | 74.6609** | 72.0891** | 69.2822** | 10.6681 |
| | (1.79) | (1.77) | (3.28) | ( 2.12) | (2.49) | (1.97) | (2.03) | ( 2.06) | (2.03) | (1.61) |
| NASDAQ Index (t-1) | -.1787 | -.0376 | 1.13248 | .6811 | 1.6526 | .4682 | 1.5050 | .4966 | .6376 | .0833 |
| | (-0.10) | (-0.02) | (0.62) | (0.40) | (0.93) | (0.26) | (0.83) | ( 0.28) | (0.37) | (0.25) |
| Constant | 2.2896*** | 2.4820*** | 1.4205*** | 2.6850*** | 1.8873*** | 2.8027*** | 1.7186*** | 2.7820*** | 2.7330*** | .4643*** |
| | (5.54) | (4.65) | (3.90) | (5.05) | (4.54) | (4.91) | (4.14) | (5.14) | (5.21) | (4.58) |
| Observations | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Adjusted R-squared | 0.26 | 0.26 | 0.14 | 0.23 | 0.18 | 0.22 | 0.15 | 0.22 | 0.23 | 0.12 |

The results indicate that there is no relation between this legislation and small-firm REIT IPOs, after accounting for the gradual change in the overall economic environment for small firms, and is inconsistent with the *Regulatory Overreach* Theory. The result is also consistent with Gao, Ritter, and Zhu (2013), which tested the *Regulatory Overreach Theory* on a sample of all U.S. IPOs, and found no support for the premise that government regulations have caused the decline in initial public offerings. In Models 1 The Gramm-Leach-Blilly Act variables are negative and significant. Although the coefficient is smaller in Model 2, this result holds even in the presence of the time trend variable, which indicates that this legislation is inversely related to quarterly small-firm REIT IPO volume during the sample period, after accounting for other factors. The coefficient of -1.8110 suggests that the legislation is related to approximately 2 fewer small-firm REIT IPOs per quarter.

The results in Table 21 also indicate that the time trend variable is related to the decline quarterly in small-firm REIT IPO activity. A primary result of the regression analysis is the negative, significant coefficient on the time trend variable in Models 4, 6, 8, and 9. In Model 4, for example, the coefficient is -.3188 (significant at the 5% level), which implies that by the end of the sample period, the quarterly volume of small-firm IPOs declines by 2.8736 (-.3592 x 0.10 trend per quarter x 80 quarters), or 11.4944 yearly, from the beginning of 1991. Compared to the yearly sample average of 5.15 small-firm REIT IPOs over the sample period, the time trend is economically significant. The results indicate that there is a significant, inverse relationship between quarterly small-firm offering volume and the time trend, and support the *Economies of Scope Theory*. The results are also consistent with the results in Gao, Ritter, and Zhu (2013),

which also found a statistically significant inverse relation between the time trend used to account of economies of scope and the quarterly IPO volume of small firms.

To further examine the possible impact of government regulation on small-firm REIT IPO activity, I also regress quarterly dollar volume of REIT initial public offerings on the explanatory variables discussed above. Table 22 reports the regression results related to this analysis. The model specification again tests the four primary regulatory variables, as well as the time trend and control variables. The results with the dependent variable of quarterly dollar volume of IPOs are similar to those found with respect to the number of quarterly offerings. In the presence of the time trend, only the Gramm-Leach-Bliley regulatory variable is statistically significant. In all of the other models testing the regulatory variable coefficients are insignificant, in the presence of the time trend variable. After accounting for the gradual decline in quarterly IPO volume, as suggested by the *Economies of Scope Theory,* none of the other regulations appear to have a relationship with the decline in the volume of small-firm REIT initial public offerings, except the Gramm-Leach-Bliley Act. The results add further support that, other than the Gramm-Leach-Bliley Act, government regulations are not related to the decline in small-firm REIT IPOs, and are inconsistent with the *Regulatory Overreach Theory*.

Specifically, with respect to the test of the *Economies of Scope Theory,* the time trend in the regressions of quarterly small-firm REIT IPO volume on the explanatory and control variables, the results indicate that there is a negative, significant relationship between the time trend and the volume of small-firm offerings during the sample period. The results with respect to the time trend are significant in all of the models, except the Gramm-Leach-Bliley model.

TABLE 22: Quarterly time-series regressions of volume of small-firm REIT IPOs

This table reports the results from the regressions of quarterly volume of small-firm initial public offerings on the time trend variable, as well as the regulatory variables, and control variables, during the sample period of 1991 through 2010. The data is collected from the National Association of Real Estate Investment Trusts. *Quarterly IPO Activity* denotes the natural log of the quarterly dollar volume of small-firm initial public offerings. Small-firm offerings are defined as initial public offerings of less than $150 million, while large-firm offerings are those $150 million or larger. Quarterly dollar volume of IPOs is scaled by the Consumer Price Index, with the base year of 2010. The other variables are defined as in Table 5. The model specification also includes an AR(1) Coefficient. Year dummies are included in the specification, but not reported. T-statistics are reported in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

TABLE 22: Continued

| | Volume of Small-Firm IPOs | | | | | | | | | Small IPOs/All IPOs |
|---|---|---|---|---|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
| Time trend | | -.1190 | | -.5294*** | | -.5675** | | -.4871*** | -.4843*** | -.0468*** |
| | | (-0.53) | | (-3.82) | | (-2.38) | | ( -2.63) | (-4.04) | (-2.83) |
| Gramm-Leach-Bliley Dummy | -2.516*** | -2.0380* | | | | | | | | |
| | (-4.54) | (-1.93) | | | | | | | | |
| Sarbanes-Oxley Dummy | | | -.8670 | .4567 | | | | | | |
| | | | (-1.32) | (0.65) | | | | | | |
| Global Settlement Dummy | | | | | -1.8881*** | .4636 | | | | |
| | | | | | (-3.16) | (0.41) | | | | |
| Regulation NMS Dummy | | | | | | | -1.9743*** | .02035 | | |
| | | | | | | | (-2.92) | (0.02) | | |
| IPO initial return in (t-1) | -3.765** | -3.8999*** | -4.9123*** | -4.2250*** | -5.7391*** | -4.1551** | -5.2477*** | -4.4606*** | -4.4687*** | -.1934 |
| | (-2.54) | (-2.58) | (-2.91) | (-2.71) | (-3.54) | (-2.44) | (-3.27) | (-2.84) | (-2.96) | (-0.93) |
| NAREIT Index | -2.8726 | -3.0910 | -4.4561 | -4.1710 | -4.5439 | -4.0813 | -4.7682 | -4.1425 | -4.1470 | -.3499 |
| | (-0.99) | (-1.05) | (-1.38) | (-1.41) | (-1.48) | (-1.37) | (-1.54) | (-1.39) | (-1.40) | (-0.86) |
| Real GDP Growth (%) | 100.9813** | 100.4324*** | 171.4390 | 105.1723** | 136.8972*** | 111.2987** | 116.6605** | 113.4676** | 113.2736** | 6.2432 |
| | ( 2.20) | (2.18) | (3.51) | (2.18) | (2.91) | (2.37) | (2.36) | (2.38) | (2.44) | (0.97) |
| NASDAQ Index (t-1) | .4627 | .6406 | 2.2905 | 1.5408 | 2.9937 | 1.3112 | 2.8439 | 1.5920 | 1.6017 | -.1224 |
| | (0.20) | ( 0.27) | (0.90) | (0.66) | (1.24) | (0.54) | (1.17) | (0.67) | (0.69) | (-0.38) |
| Constant | 3.8815*** | 4.1240*** | 2.4487*** | 4.5486*** | 3.3006*** | 4.6010*** | 3.1646 | 4.4848*** | 4.4814 | .4066 |
| | (6.93) | (5.70) | (4.81) | (6.30) | (5.83) | ( 5.94) | (5.66) | (6.10) | ( 6.30) | (4.13) |
| Observations | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Adjusted R-squared | 0.30 | 0.30 | 0.13 | 0.27 | 0.22 | 0.26 | 0.20 | 0.26 | 0.27 | 0.08 |

Table 23 presents the regression results using the number of quarterly large-firm IPOs during the sample period as the dependent variable. As can be seen, none of the variables corresponding to the Gramm-Leach-Bliley Act, Sarbanes-Oxley Act, the Global Settlement, or Regulation NMS are significant. Table 24 reports similar results with respect to quarterly large-firm real estate investment trust IPO volume. Overall, the results suggest that this legislation is not significantly related to the decrease in the number of large-firm IPOs, and are inconsistent with the *Regulatory Overreach Theory,* as well as Gao, Ritter, and Zhu (2013).

The finding that there does not appear to be a relationship between the regulations tested and the number of large-firm IPOs also holds when including the time trend in the specification. Note, however, that the time trend is not statistically significant in any of the models when testing REIT large-firm IPOs (Models 14, 16, 18, and 19). The coefficient on the time trend is statistically signification when regression the number of large-firm IPOs, scaled by the total number of IPOs (Model 20).

Interestingly, the results related to REIT large-firm IPO volume are somewhat different. As can be seen in Table 24, the variables with respect to the Sarbanes-Oxley Act and the Global Settlement are both statistically significant, even after controlling for the gradual change in the economic climate. Only under Model 16, however, is the time trend significant itself. The results related to the impact of regulations and the changes in the economic environment on the number and volume of large-firm REIT initial public offerings are not consistent, and indicate that the decline in these types of offerings is possibly related to other factors.

TABLE 23: Quarterly time-series regressions of number of large-firm REIT IPOs

This table reports the results from the regressions of quarterly number of large-firm initial public offerings on the time trend variable, as well as the regulatory variables, and control variables, during the sample period of 1991 through 2010. Small-firm offerings are defined as initial public offerings of less than $150 million, while large-firm offerings are those $150 million or larger. The data is collected from the National Association of Real Estate Investment Trusts. *Quarterly IPO Activity* denotes the quarterly number of initial public offerings. The other variables are defined as in Table 5. The model specification also includes an AR(1) Coefficient. Year dummies are included in the specification, but not reported. T-statistics are reported in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

TABLE 23: Continued

| | Number of Large-Firm IPOs | | | | | | | | | Large IPOs/All IPOs |
|---|---|---|---|---|---|---|---|---|---|---|
| | Model 11 | Model 12 | Model 13 | Model 14 | Model 15 | Model 16 | Model 17 | Model 18 | Model 19 | Model 20 |
| Time trend | | .0830 | | -.0739 | | -.3975 | | .1143 | -.0378 | .0795*** |
| | | (0.35) | | (-0.51) | | (-1.62) | | (0.59) | (-0.30) | (4.56) |
| Gramm-Leach-Bliley Dummy | -.3404 | -.6743 | | | | | | | | |
| | (-0.57) | (-0.59) | | | | | | | | |
| Sarbanes-Oxley Dummy | | | .1805 | .3653 | | | | | | |
| | | | (0.28) | (0.50) | | | | | | |
| Global Settlement Dummy | | | | | .3554 | 2.0023 | | | | |
| | | | | | ( 0.59) | ( 1.70) | | | | |
| Regulation NMS Dummy | | | | | | | -.6148 | -1.0827 | | |
| | | | | | | | (-0.91) | (-1.04) | | |
| IPO initial return in (t-1) | -3.9378** | -3.8435** | -3.9327** | -3.8368** | -3.7864** | -2.6771 | -4.2797*** | -4.4643*** | -4.0317** | -.6630*** |
| | (-2.47) | ( -2.36) | (-2.42) | (-2.33) | (-2.31) | (-1.52) | (-2.67) | (-2.72) | (-2.54) | (-3.01) |
| NAREIT Index | -1.3549 | -1.2025 | -1.6109 | -1.5711 | -1.5920 | -1.2680 | -1.6449 | -1.7917 | -1.5519 | .2670 |
| | (-0.43) | (-0.38) | (-0.52) | (-0.50) | (-0.51) | (-0.41) | (-0.53) | (-0.58) | (-0.50) | ( 0.62) |
| Real GDP Growth (%) | 115.7521** | 116.1353** | 123.1552*** | 113.9052** | 129.7799*** | 111.8533** | 109.3162** | 110.0651** | 120.3838** | 19.1571*** |
| | (2.35) | (2.35) | ( 2.62) | ( 2.25) | (2.72) | ( 2.31) | (2.21) | ( 2.21) | (2.47) | (2.84) |
| NASDAQ Index (t-1) | .4971 | .3729 | .7469 | .6422 | .6144 | -.5639 | .9153 | 1.2090 | .6909 | .1859 |
| | (0.20) | (0.15) | (0.31) | (0.26) | (0.25) | (-0.22) | (0.38) | (0.48) | (0.28) | (0.55) |
| Constant | 1.8722*** | 1.7029** | 1.5818*** | 1.8749** | 1.4271** | 2.3377*** | 1.9508*** | 1.6412** | 1.8211** | .0353 |
| | (3.11) | ( 2.19) | (3.23) | (2.47) | ( 2.49) | (2.93) | (3.49) | (2.14) | (2.43) | (0.34) |
| Observations | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Adjusted R-squared | 0.07 | 0.06 | 0.07 | 0.06 | 0.07 | 0.09 | 0.08 | 0.07 | 0.07 | 0.27 |

TABLE 24: Quarterly time-series regressions of volume of large-firm REIT IPOs

This table reports the results from the regressions of quarterly volume of large-firm initial public offerings on the time trend variable, as well as the regulatory variables, and control variables, during the sample period of 1991 through 2010. The data is collected from the National Association of Real Estate Investment Trusts. *Quarterly IPO Activity* denotes the natural log of the quarterly dollar volume of large-firm initial public offerings. Small-firm offerings are defined as initial public offerings of less than $150 million, while large-firm offerings are those $150 million or larger. Quarterly dollar volume of IPOs is scaled by the Consumer Price Index, with the base year of 2010. The other variables are defined as in Table 5. The model specification also includes an AR(1) Coefficient. Year dummies are included in the specification, but not reported. T-statistics are reported in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

TABLE 24: Continued

| | Volume Large-Firm IPO | | | | | | | | | Large IPOs/All IPOs |
|---|---|---|---|---|---|---|---|---|---|---|
| | Model 11 | Model 12 | Model 13 | Model 14 | Model 15 | Model 16 | Model 17 | Model 18 | Model 19 | Model 20 |
| Time trend | | .2119 | | -.1626 | | -.7440** | | .2332 | .0510 | .0326 |
| | | (0.66) | | (-0.86) | | (-2.33) | | (0.90) | (0.30) | (1.51) |
| Gramm-Leach-Bliley Dummy | -.0456 | -.8978 | | | | | | | | |
| | (-0.06) | (-0.59) | | | | | | | | |
| Sarbanes-Oxley Dummy | | | 1.7570** | 2.1636** | | | | | | |
| | | | (2.12) | (2.26) | | | | | | |
| Global Settlement Dummy | | | | | 1.3434* | 4.4261*** | | | | |
| | | | | | (1.68) | (2.88) | | | | |
| Regulation NMS Dummy | | | | | | | -.3423 | -1.2972 | | |
| | | | | | | | (-0.37) | (-0.92) | | |
| IPO initial return in (t-1) | -6.1140*** | -5.8734*** | -5.1804** | -4.9693** | -5.2060** | -3.1296 | -6.2654*** | -6.6423*** | -6.1239*** | -.6241** |
| | (-2.84) | (-2.68) | (-2.44) | ( -2.32) | (-2.40) | (-1.37) | (-2.89) | (-3.00) | (-2.86) | (-2.29) |
| NAREIT Index | -.5714 | -.1824 | -.8488 | -.7612 | -.6263 | -.01988 | -.6353 | -.9348 | -.6476 | .0950 |
| | (-0.14) | ( -0.04) | ( -0.21) | ( -0.19) | (-0.15) | (-0.00) | (-0.15) | (-0.22) | (-0.15) | (0.18) |
| Real GDP Growth (%) | 158.2265** | 159.2043** | 146.8373** | 126.4849* | 179.5597** | 146.0036** | 150.9685** | 152.4971** | 164.8610** | 18.2312** |
| | ( 2.38) | ( 2.39) | ( 2.39) | (1.91) | (2.85) | (2.32) | (2.26) | (2.27) | (2.51) | (2.18) |
| NASDAQ Index (t-1) | 2.7665 | 2.4496 | 2.8148 | 2.5846 | 2.3047 | .0992 | 2.8944 | 3.4937 | 2.8730 | .3046 |
| | ( 0.83) | ( 0.72) | ( 0.88) | ( 0.81) | (0.71) | (0.03) | (0.88) | (1.04) | (0.87) | (0.73) |
| Constant | 3.2817*** | 2.8497*** | 2.6806*** | 3.3255*** | 2.4443*** | 4.1489*** | 3.4236*** | 2.7915*** | 3.0071*** | .2459* |
| | (4.04) | ( 2.72) | (4.18) | ( 3.36) | (3.22) | (3.99) | (4.53) | (2.70) | (2.99) | (1.92) |
| Observations | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| Adjusted R-squared | 0.09 | 0.08 | 0.14 | 0.14 | 0.12 | 0.17 | 0.09 | 0.09 | 0.09 | 0.06 |

## 3.5 Conclusion

It is well-documented in the financial literature that there has been a precipitous decline in the number of initial public offerings since 2000. This decline in the primary capital raising and exit strategy for companies has been particularly significant for small companies. With respect to real estate investment companies, the trend has been so significant that small-firm REIT IPOs have virtually disappeared from the financial landscape.

A number of theories have been suggested in the literature to explain this phenomenon. This paper examines the two explanations cited most frequently, the *Regulatory Overreach Theory* and *Economies of Scope Theory,* from the unique perspective of Real Estate Investment Trusts. I present findings that are inconsistent with the *Regulatory Overreach Theory,* and provide support for the *Economies of Scope Theory* with respect to small-firm initial public offerings. Specifically, I find that there is no relation between the number of quarterly small-firm REIT IPOs, as well as the dollar volume of such IPOs, and the Sarbanes-Oxley Act, the Global Settlement, and Regulation NMS, after controlling for changes in the economic climate for small firms. In addition, my results support the *Economies of Scope Theory*, and suggest that the decline in the number of small-firm REIT IPOs has been a gradual trend rather than one punctuated by discrete shocks.

With respect to large-firm REIT IPOs I find that there does not appear to be a relationship between the number of large-firm REIT offerings, and major legislation thought to have impacted initial public offerings. The results provide limited support for

the theory that government regulations have had an impact large-firm REIT initial public offering volume over the past decade.

This paper offers a unique perspective on the declining initial public offering phenomenon. To our knowledge, no other literature has examined the recent changes in the initial offering of equities, from the perspective of real estate-related firms. I provide an examination of the current theories found in the general finance literature, to ascertain their applicability to REIT IPOs.

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# APPENDIX: TABLES

TABLE A: Venture capital commitments index.

This table presents the dollar amount committed to venture capital firms by investors per quarter during the sample period. The table also presents the Venture Capital Commitments Index, calculated using 2005 as the base year. Data is collected from the National Venture Capital Association.

TABLE A: Continued

| Year | Quarter | Commitments ($) | Index |
|---|---|---|---|
| 2005 | Q1 | $5,489,500,000 | 1.00 |
| | Q2 | $6,491,200,000 | 1.18 |
| | Q3 | $5,389,500,000 | 0.83 |
| | Q4 | $9,276,200,000 | 1.72 |
| 2006 | Q1 | $6,544,500,000 | 0.71 |
| | Q2 | $14,185,500,000 | 2.17 |
| | Q3 | $5,375,300,000 | 0.38 |
| | Q4 | $5,592,800,000 | 1.04 |
| 2007 | Q1 | $5,754,200,000 | 1.03 |
| | Q2 | $9,141,800,000 | 1.59 |
| | Q3 | $8,763,700,000 | 0.96 |
| | Q4 | $11,016,200,000 | 1.26 |
| 2008 | Q1 | $6,959,200,000 | 0.63 |
| | Q2 | $9,247,700,000 | 1.33 |
| | Q3 | $8,449,900,000 | 0.91 |
| | Q4 | $3,620,400,000 | 0.43 |
| 2009 | Q1 | $5,373,900,000 | 1.48 |
| | Q2 | $4,718,000,000 | 0.88 |
| | Q3 | $2,310,300,000 | 0.49 |
| | Q4 | $4,053,100,000 | 1.75 |
| 2010 | Q1 | $3,968,800,000 | 0.98 |
| | Q2 | $2,142,800,000 | 0.54 |
| | Q3 | $2,991,600,000 | 1.40 |
| | Q4 | $2,989,900,000 | 1.00 |
| 2011 | Q1 | $7,604,200,000 | 2.54 |
| | Q2 | $2,650,400,000 | 0.35 |
| | Q3 | $2,116,000,000 | 0.80 |
| | Q4 | $6,105,000,000 | 2.89 |
| 2012 | Q1 | $4,801,300,000 | 0.79 |
| | Q2 | $6,319,300,000 | 1.32 |
| | Q3 | $5,223,900,000 | 0.83 |
| | Q4 | $3,354,600,000 | 0.64 |
| 2013 | Q1 | $4,386,200,000 | 1.31 |
| | Q2 | $3,260,100,000 | 0.74 |
| | Q3 | $4,357,500,000 | 1.34 |
| | Q4 | $4,913,000,000 | 1.13 |
| | Total | $204,937,500,000 | |

TABLE B: Venture capital investments index.

This table presents the dollar amount invested by venture capital organizations in firms, per quarter during the sample period. The table also presents the Venture Capital Investments Index, calculated using 2005 as the base year. Data is collected from the National Venture Capital Association.

TABLE B: Continued

| Year | Quarter | Investments ($) | Index | # of Deals | Index |
|---|---|---|---|---|---|
| 2005 | Q1 | $5,222,131,500 | 1.00 | 761 | 1.00 |
| | Q2 | $6,437,135,600 | 1.23 | 860 | 1.13 |
| | Q3 | $6,063,227,100 | 1.16 | 809 | 1.06 |
| | Q4 | $5,801,971,800 | 1.11 | 863 | 1.13 |
| 2006 | Q1 | $6,606,487,600 | 1.27 | 904 | 1.19 |
| | Q2 | $7,386,288,200 | 1.41 | 1007 | 1.32 |
| | Q3 | $6,852,042,400 | 1.31 | 955 | 1.25 |
| | Q4 | $6,669,683,200 | 1.28 | 1016 | 1.34 |
| 2007 | Q1 | $7,450,067,000 | 1.43 | 907 | 1.19 |
| | Q2 | $7,839,808,500 | 1.50 | 1115 | 1.47 |
| | Q3 | $8,211,663,500 | 1.57 | 1049 | 1.38 |
| | Q4 | $8,450,874,600 | 1.62 | 1156 | 1.52 |
| 2008 | Q1 | $8,109,060,700 | 1.55 | 1060 | 1.39 |
| | Q2 | $8,032,363,000 | 1.54 | 1107 | 1.45 |
| | Q3 | $7,616,451,300 | 1.46 | 1047 | 1.38 |
| | Q4 | $6,190,988,900 | 1.19 | 964 | 1.27 |
| 2009 | Q1 | $3,847,950,100 | 0.74 | 680 | 0.89 |
| | Q2 | $5,094,191,200 | 0.98 | 761 | 1.00 |
| | Q3 | $5,425,461,800 | 1.04 | 766 | 1.01 |
| | Q4 | $5,897,606,000 | 1.13 | 939 | 1.23 |
| 2010 | Q1 | $5,088,759,400 | 0.97 | 823 | 1.08 |
| | Q2 | $7,125,033,700 | 1.36 | 1025 | 1.35 |
| | Q3 | $5,451,651,900 | 1.04 | 888 | 1.17 |
| | Q4 | $5,694,433,200 | 1.09 | 910 | 1.20 |
| 2011 | Q1 | $6,509,901,100 | 1.25 | 905 | 1.19 |
| | Q2 | $8,196,010,900 | 1.57 | 1084 | 1.42 |
| | Q3 | $7,557,191,500 | 1.45 | 1018 | 1.34 |
| | Q4 | $7,446,918,300 | 1.43 | 994 | 1.31 |
| 2012 | Q1 | $6,304,123,300 | 1.21 | 880 | 1.16 |
| | Q2 | $7,396,341,300 | 1.42 | 982 | 1.29 |
| | Q3 | $6,677,519,500 | 1.28 | 946 | 1.24 |
| | Q4 | $6,945,409,200 | 1.33 | 1050 | 1.38 |
| 2013 | Q1 | $6,000,373,700 | 1.15 | 909 | 1.19 |
| | Q2 | $7,073,786,900 | 1.35 | 977 | 1.28 |
| | Q3 | $7,921,604,700 | 1.52 | 1032 | 1.36 |
| | Q4 | $8,369,192,800 | 1.60 | 1077 | 1.42 |
| | Total | $242,963,705,400 | | 34,226 | |