

BEHAVIORAL FINANCE:
FACTORS INFLUENCING ANGEL INVESTOR DECISIONS

by
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A Dissertation

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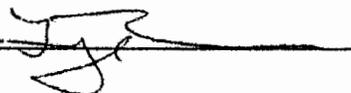
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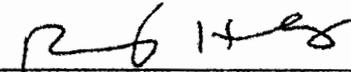
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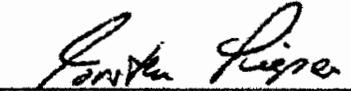
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ABSTRACT

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Angel investors are individual investors who invest in high-risk projects without the assistance of professional portfolio advisors and are an important source of early-stage entrepreneurial financing. When providing financing, an angel must decide how much time to spend on due diligence, the amount of wealth invested, and the degree of post-investment interaction with entrepreneurs. As they are individual investors, angels may be particularly influenced by behavioral factors. In order to provide insight into the investment decisions of angel investors this dissertation examines angel investor and deal characteristics including demographics, experience, perception of the management team, the source that led the entrepreneur to the angel investor, and syndication status. The dissertation finds that angels' decisions are influenced by rational and behavioral factors, such as cognitive biases and social influences. While there is strong evidence that experienced angel investors spend more time on due diligence, older investors spend less time on due diligence after controlling for investor experience. These results suggest that experienced angels invest in due diligence because they understand its importance. Gender, risk perception, venture stage, and source of deal identification also influence due diligence. In addition, older angels are found to invest a smaller percentage of their wealth in a deal, perhaps because they seek

to diversify holdings. More experienced angels, however, are found to invest a larger percentage of their wealth perhaps because experienced angels are more susceptible to cognitive biases such as overconfidence, or because they are able to identify ventures that will do well and choose to invest more in such ventures. Deal syndication also influences the percent of wealth invested in a deal. Other results suggest that after making an investment, angels continue to interact with the companies they invest in. There is strong evidence that more experienced angels are associated with greater post-investment interaction. Gender and risk perception also influence the degree of post-investment interaction.

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CHAPTER 1

In traditional finance theory, the predominant view is that people behave rationally, making unbiased decisions based on relevant information (Statman, 1995; von Neumann & Morgenstern, 1944). However, individual investors' decisions that violate principles of traditional finance have bedeviled researchers for years (Baker & Nofsinger, 2010; Barberis & Thaler, 2003; Fama, 1998; Miller, 1986; Shefrin, 2000; Statman, 1995; Statman, 1999; Shiller, 2003; von Neumann & Morgenstern, 1944). Indeed, scholars have concluded that behavioral elements in decision making are likely to be more influential on individual investors compared with large investors or institutional investors who rely on professional portfolio advisors and that knowledge of factors which influence individual investors is incomplete (Barberis & Thaler, 2003; Fama, 1998; Schleifer 2000; Shefrin, 2000; Thaler, 1999). This dissertation provides insight into factors that influence the observed decisions of angel investors which appear to violate the principles of traditional finance, such as investing in high risk projects that contain high information asymmetry while performing relatively little due diligence. Moreover, it explores variables that lead angel investors to invest time in due diligence, as well as to invest capital in projects. An underpinning of this research is *behavioral finance*.

Angel investors are an important source of early-stage financing. Typically, angel investors are individual investors who invest in high-risk, entrepreneurial projects without the assistance of professional portfolio advisors. Angel investors invest billions of dollars in thousands of startup companies and entrepreneurial projects annually

(DeGennaro & Dwyer, 2013; Mason & Harrison, 2000; Sohl, 1999). Despite significant financial commitment, angel investor decisions sometimes appear to violate the principles of traditional finance. For example, rational investors have been shown to spend time on due diligence to reduce information asymmetry and increase return on investments. Indeed, time spent on due diligence has been shown to be positively related to angel investor returns on investment. Some angels, though, spend no time on due diligence (Morrissette, 2007; Sohl, 2003a; Wiltbank & Boeker, 2007b). Wiltbank and Boeker (2007b) report that amount of time angel investors spend on due diligence ranges between zero and 5,000 hours per investment. Despite angel investors' growth and significance, very little research has examined factors that lead angel investors to expend time on due diligence as well as to invest in projects. They are one of the most common and least studied sources for financing new ventures (Wong, Bhatia & Freeman, 2009). Data used to examine individual investors not using professional portfolio advisors has been difficult to obtain. Moreover, studies examining the choices made by individual investors have been limited. Increasing availability of data on angel investors, however, provides an ideal opportunity to examine factors influencing individual investor decision making (Gompers & Lerner, 2010; Kaplan & Stromberg, 2003; Kerr, Lerner & Schoar, 2011; Prowse, 1998; Van Osnabrugge & Robinson, 2000). Understanding factors that guide angel decisions should assist in increasing their returns and help ensure their continued contribution to national economic growth.

Behavioral finance is a relatively new field that combines behavioral and cognitive psychology with traditional finance to provide explanations for why investors make decisions that appear to be irrational (Ackert & Deaves, 2009; Baker & Nofsinger,

2010; Hirshleifer, 2001; Pompian, 2011; Statman, 1999). Although traditional finance assumes that individual investors make decisions that are rational, empirical evidence suggests that deviations from the traditional model are persistent and predictable (Ackert & Deaves, 2009; Fama, 1998; Shleifer, 2000). Behavioral finance researchers have made significant contributions to understanding the factors that influence *individual* investors, yet the picture is incomplete (Barberis & Thaler, 2003; Fama, 1998; Shleifer, 2000; Shefrin, 2000; Thaler, 1999).

Behavioral finance guides the present research by providing enhanced understanding of individual investors and factors that motivate their decisions under conditions of risk. Angel investors have to make decisions on many important issues, including time spent on due diligence, percent of wealth to be invested, and post-investment interaction with entrepreneurs (Jensen & Meckling, 1976; Maxwell, Jeffrey & Lévesque, 2011; Sohl, 2003b; DeGennaro & Dwyer, 2013). To better understand investors' decisions, demographics such as age, gender, and education (Becker-Blease & Sohl, 2011; Dwyer, Gilkeson & List, 2002; Fünfgeld & Wang, 2009; Harrison & Mason, 2007) are analyzed. The influence of prior experience (Dimov, Shepherd, & Sutcliffe, 2007; Gustaffson, 2006; Mitteness, Baucus & Sudek, 2012), risk tolerance (Eisenhardt & Schoonhoven, 1990; Gompers, 1995; Hambrick & Mason, 1984; Michel & Hambrick, 1992; Murray, 1989; Wiltbank & Boeker, 2007b; Wright & Robbie, 1996), and syndication (Admati & Pfleiderer, 1994; Gompers & Lerner, 2001) are also utilized. These variables have been utilized in prior finance research, but have not been used *collectively* to understand angel investor behavior.

Prior research related to factors that shape angel investor behavior has included angel investor due diligence analysis and its impact on returns (Wiltbank & Boeker, 2007b), differences in due diligence between angel investors and venture capital (Van Osnabrugge, 2000), due diligence analysis and impact on expected returns (DeGennaro, 2011), as well as angel investor experience effects on learning (Smith, Harrison & Mason, 2010). However, little prior research has examined factors that influence angel investor *decisions* of time on due diligence, amount of wealth to be invested, and post-investment interactions.

This dissertation contributes to the knowledge base of entrepreneurial finance, angel investors, and factors that affect *individual* investor decisions. This dissertation is important for several reasons. First, using the context of angel investors enhances understanding of alternative investor situations where investors make decisions without the benefit of professional portfolio advisors. Second, understanding angel investor decisions regarding the amount of time spent on due diligence leads to further insight into antecedent factors to consider when assessing effectiveness of angel investor pre-investment decision behavior and processes. Also, investigating due diligence offers increased knowledge about information asymmetry in entrepreneurial finance.

CHAPTER 2 - LITERATURE REVIEW AND HYPOTHESES

Although angel investing has grown significantly, little is known about factors that influence decisions of angel investors and drive their returns on investment. Angel investors invest billions in new ventures each year, and the number of angel investor groups has grown 67 percent since 1969, so both their size and importance are growing (DeGennaro & Dwyer, 2013; Mason & Harrison, 2000; Sohl, 1999; Wiltbank & Boeker, 2007a).

Angel Investing

An angel investor is a person who provides capital, in the form of debt or equity, from his/her own funds to a private business (Shane, 2012). Angels are typically high net-worth individuals who provide investment capital during the risky early-stage of new ventures (Acs & Tarpley, 1998; Benjamin & Margulis, 2001; Morrissette, 2007; Wong, Bhatia & Freeman, 2009). These investors can be characterized as a source of informal risk capital, i.e. capital that is invested by private individuals directly (informally) for an entrepreneur's use without formal intermediation by an institution, such as a bank (Berger & Udell, 1998; Diamond, 1984).

Angel investors fall into the category of private equity investors (Benjamin & Margulis, 2001; Berger & Udell, 1998; Fenn & Liang; 1998; Prowse, 1998). Private equity is equity capital financing in equity securities that are not quoted or traded on a

public exchange. Whereas public stock and bond markets that fund large businesses are relatively transparent owing to oversight (e.g., reported financials, analysts' reports), private markets that finance small businesses are often opaque, which makes investing in them more risky (Berger & Udell, 1998; Kerr, Lerner & Schoar, 2011). Although the quantity of external private equity investments is less than that of public investments, the quality (as measured by the success of the businesses) of the investments has positively influenced entrepreneurs and communities (Berger & Udell, 1998). The critical private equity needed to fund these firms can be from private equity firms, angel investors, or venture capital firms. Angel investors are similar to venture capitalists in several ways, including that both have similar expectations for required returns, exit horizons, and working relationships to assist the firms in which they invest (Freear, Sohl, & Wetzel, 1995).

Angel investors invest in deals having various characteristics, including investment size, management experience, industry, and proposed exit strategies (Van Osnabrugge & Robinson, 2000). For example, Van Osnabrugge and Robinson (2000) find that the average deal size ranges from \$50,000 to \$150,000 for each angel investor. Several researchers find that, although angels will invest during different stages of an investment, seed and start-up stage companies are more than three-quarters of all angel projects (DeGennaro & Dwyer, 2013; Freear, Sohl, & Wetzel, 2000; Freear & Wetzel, 1989; Sohl, 2003a).

The early stage is crucial in fostering new venture growth. Early-stage investments are considered high-risk and often result in a wide array of investment returns (Van Osnabrugge, 2000; Wong, Bhatia & Freeman, 2009). As an example of the

risk involved in early stage investing, angel returns can range from total losses of an entire investment to yields of 50% or more (Collewaert, 2012; Mason & Harrison, 2002; Preston, 2011). The limited financial history of new start-ups contributes to their reduced access to capital markets, including bond markets, banks, and even vendor debt capital opportunities, resulting in decreased available financing opportunities for early-stage entrepreneurs. This early-stage investing increases the importance of angel investors, because entrepreneurs at this juncture often need a bridge of capital between family and friends and capital markets (Ibrahim, 2008). Additionally, the amount of time before realizing a return can be much longer than a typical investment--often taking several years relative to other types of investments where returns may be more immediate (DeGennaro & Dwyer, 2013; Ibrahim, 2008; Mason & Harrison, 2002).

Angel investors may be driven by financial or non-financial benefits, such as greed and fear (Morrisette, 2007; Sullivan & Miller, 1996). Some angels are clear about their greed motivations, such as the desire to make “10 times their money and selling out” (Hill & Power, 2002, p.36). Considering that around one-third of investments end in bankruptcy, the fear of failure may well be a valid concern (Mason & Harrison, 2002).

Behavioral Finance

Development of behavioral finance.

Traditional finance.

A brief review of traditional finance is helpful in understanding the contribution of behavioral finance. Modern portfolio theory (MPT) is a traditional finance theory developed by Markowitz (1952a) to describe optimal portfolio formation by maximizing

return for a given level of risk. MPT is important for several reasons. It provides us with enhanced understanding of investors and their motivations, as well as firm measures that drive portfolio selection (Elton, Gruber, Brown & Goetzman, 2009; Fama, 1980). It also offers direction for improving firm information to achieve efficient selection, thus fostering maximized portfolio expected returns for a given amount of risk (Markowitz, 1952a). In the Markowitz (1952a) algorithm, a person would identify a number of outcomes and assign a probability of occurrence for a given outcome as well as a return for the outcome. The expected return represents the average of the possible returns for each asset, and uncertainty is represented by the standard deviation. Under this mean-variance framework, people are risk averse in all their choices. By the late 20th and early 21st century, the application of MPT gained ground in the investment and academic communities. MPT appears to occupy a permanent place in the theory and practice of finance.

However, in recent years MPT has been challenged by academics in the field of *behavioral* economics and finance who contend that the effects of *social, cognitive, and emotional* factors also influence individual decisions. For example, Sullivan (1991) finds that return on investment is not the primary motivation of one-third of angel investors. Primary motivations of these angels included the fun of an interesting investment and the enjoyment of an active role in starting a company. Other non-financial benefits include creation of jobs within a community, networking, or being a part of a group that is making local investments (Freear, Sohl, & Wetzell, 1995; Linde, Prasad, Morse, Utterback, Stevenson & Roberts, 2000). Other angel investor non-financial motivations include enjoyment of helping start a new firm or assisting entrepreneurs (Leonard &

Swap, 2000). Leonard and Swap (2000) refer to angels as “mentor capitalists,” a reference to their enjoyment and participation in helping entrepreneurs with their new ventures.

The efficient market hypothesis (EMH) is a classic theory in traditional finance. It describes market prices of stocks based on the rationality of the market and market participants rapidly using available information, providing unbiased estimates of their values. The emerging discipline of behavioral finance has challenged the EMH on the basis that markets are not rational and are driven by other factors, such as fear and greed (Lo, 2004; Malkiel & Fama, 1970; Samuelson, 1965). Lo (2004) introduces the adaptive market hypothesis (AMH), which builds on psychology of human behavior characteristics (e.g., altruism, fairness, morality, ethics) that create human biases and help explain market dynamics. This evolutionary perspective suggests that individuals make choices based on past experiences and receipt of positive or negative reinforcement. Individuals thus develop heuristics, or rules of thumb, that enable them to adapt to economic challenges and achieve optimal solutions (Lo, 2004; Reuber & Fischer, 1994).

Under traditional finance, a rational person is assumed to have consistent preferences, or utilities, among different things. Expected utility theory has been the dominant theory for analysis of decision making under risk and is widely accepted as the normative model of rational choice. Expected utility theory assumes that all reasonable people will follow the principles of the theory (Kahneman & Tversky, 1979).

A utility function is a tool aimed at helping a rational person make decisions among choices when risk is involved. In expected utility theory, the utility function assigns weight rankings to an individual’s preferences, with higher numbers given to

more preferred outcomes. Therefore, the weighted average of all possible levels of utility will best represent the utility at any given point of time for an individual. Although expected utility theory has been a dominant theory in the examination of decision making under conditions of risk, an individual's choices among risky prospects often exhibit effects that are inconsistent with utility theory (Kahneman & Tversky, 1979). An example of individual behavior that contradicts expected utility theory is the *certainty effect*. The certainty effect is a phenomenon that occurs when people overweight outcomes that are considered certain relative to outcomes that are merely probable and is inconsistent with expected utility theory (Allais, 1953). Several variations of the Allais example assist in explaining the phenomenon. Below is an example of the Allais paradox as depicted in Kahneman & Tversky (1979):

Problem 1: Choose between

A: 2,500 with probability .33	B: 2,400 with certainty
2,400 with probability .66	
0 with probability .01	

Problem 2: Choose between

C: 2,500 with probability .33	D: 2,400 with probability .34
0 with probability .67	0 with probability .66

In Problem 1, the majority of people (over 80%) prefer option B; thus, they are choosing certainty over risk and are willing to trade away the potential for an additional 100 for the guarantee of 2,400. In Problem 2, most people choose option C; thus suggesting that $.33u(2,500) > .34u(2,400)$. The choice selected in either Problem 1 or Problem 2 did not represent irrational behavior. However, the combination of selections in Problems 1 and 2 - which were made by most people - represented inconsistency in the linear probability

decision making and the independence axiom described in expected utility theory. The results of the Allais examples suggest that individuals value certainty an inordinate amount and this influences decisions. These results exemplify that attitudes towards risk or chance cannot be captured by the expected utility model (Kahneman & Tversky, 1979).

The analysis of the Allais paradox by Kahneman and Tversky (1979) resulted in the conclusion that individuals do not always make decisions upon complete information. Their research suggests that people make decisions based on gains and losses and not in terms of their state of wealth. Thus, they suggest that people dislike losses and dislike risk in general and they feel the disadvantages of losses more than they feel the advantages of gains. Kahneman and Tversky (1979) reveal the bias built into most individuals and offered prospect theory as a critique and alternative to expected utility theory.

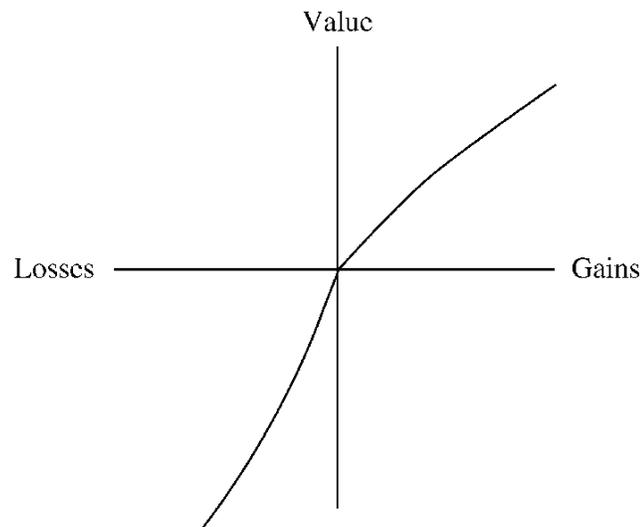
Prospect theory and behavioral finance.

Prospect theory is a behavioral theory that suggests individuals make decisions based on potential losses and gains relative to a reference point rather than the final outcome of the decisions. The theory is developed to model real-life choices and incorporate an explanation of the inconsistencies and seeming irrationality that more accurately describe human decision making under risk as compared to expected utility theory.

The decision weight associated with an event depends primarily on the perceived likelihood of that event and could be subject to major biases and heuristics (Kahneman &

Tversky, 1979). Thus, individuals will decide which outcomes are considered equivalent and utilize these as a reference point; then the outcomes that are greater are considered as gains and those which are less are considered as losses as shown in the figure below. The value of the reference point can be determined by the perception of the individual (Tversky & Kahneman, 1981). The dependence on the individual's perception or preferences on the decision problem is a significant concern (Tversky & Kahneman, 1981). The preferences may be influenced when a problem is framed in different ways. For example, our perception is attuned to the evaluation of changes rather than absolute magnitude. Thus, the gain in value between 100 and 200 appears to be greater than the difference between 1,100 and 1,200 and the loss of 100 to 200 may appear larger than the loss of 1,100 and a loss of 1,200 (Kahneman & Tversky, 1979).

The reference point used to evaluate utility in expected utility theory is the amount of wealth, whereas in prospect theory the value of an outcome is measured based on changes in wealth. The same level of wealth may imply poverty for one person and great riches for another depending on their current assets (Kahneman & Tversky, 1979). Note that the prospect theory value function is defined on the reference point, concave for gains and convex for losses and steeper for losses than gains and steepest at the reference point.



Source: Kahneman and Tversky (1979, p. 279)

Figure 1. Prospect theory value function.

Under prospect theory, individuals can determine their own risk preferences based on certain heuristics and biases. Kahneman and Tversky (1979) argue that the use of probabilistic alternatives involving risk addresses some of the weaknesses in expected utility theory, including that people value and apply more weight to what is *certain* than what is merely probable. A person is considered risk averse if he prefers the *certain* prospect over the risky prospect and the risk aversion is equivalent to the concavity of the utility function (Kahneman & Tversky, 1979). With the certainty effect, it appears that certainty increases the aversiveness of losses and the desirability of gains. In contrast, in expected utility theory changes in risk preference would be considered as a violation of the principles of the theory. Additionally, an individual's simplification of prospects can lead him to discard events of low probability and treat events of high probability as if they were certain or overweight low probability events. This concept that individuals may either ignore or overweight highly unlikely events through their inability to

comprehend and evaluate extreme probabilities suggests that the difference between certainty and high probability is either neglected or exaggerated (Shefrin & Statman, 2003).

Common examples of overweighting outcomes based on the probability and size of the loss are the purchase of insurance and the practice of gambling. Individuals will purchase insurance to cover against large and small losses, even when the price of the policies exceeds the actuarial costs, an example of risk aversion. Another example of overweighting low probability outcomes is when individuals purchase lottery tickets. Because the odds of winning the lottery are extremely slim, purchasing lottery tickets is considered risk-seeking behavior. However, the preference for the low potential of a large gain (lottery winning) over the preference of the small loss of the cost of the lottery ticket suggests that the value function for losses is convex. Interestingly, the same person who exhibits the risk-seeking behavior of purchasing a lottery ticket may also exhibit risk averse behavior, such as purchasing insurance to reduce risk or avoid a loss (Markowitz, 1952b), which is another example of a violation of the expected utility theory.

The reference, or value point, in prospect theory becomes more relevant when considering attitudes towards risk (Fiegenbaum & Thomas, 1988). Although the relationship between risk and return is commonly considered to be positively correlated, some studies have found that there is a negative correlation (Armour & Teece, 1978; Bowman, 1980, 1982; Treacy, 1980). Kahneman and Tversky (1979) suggest that individuals use value or reference points in evaluating risky choices.

Tversky and Kahneman (1991) developed a theoretical framework based on an individual's choice that depends on a reference level or the status quo. This reference-

dependent theory includes assumptions that alternatives are evaluated relative to a reference point and each choice can be decomposed into its own set of attributes and those attributes also have their own value function. Prospect theory was originally developed to describe choices between simple risky prospects with single attributes (money) and few outcomes. Tversky and Kahneman (1991) suggest that prospect theory should be expanded to include multiple attributes. Reference dependence and loss aversion with multiple attributes were studied by Hardie, Johnson and Fader (1993). The authors examined brand choice in loss aversion and reference dependence. Their findings suggest that multiple attributes can influence evaluation and can be seen as gains or losses relative to a reference point in the attribute space.

Behavioral finance is useful in examining angel investor economic and financial inconsistencies. Behavioral finance combines behavioral and cognitive psychological theory with conventional economics and finance to understand decisions investors make (Ackert & Deaves, 2009; Ritter, 2003; Shiller, 2003). Psychologists have been studying decision heuristics for decades (Debondt & Thaler, 1985; Slovic, 1969, Tversky & Kahneman, 1975; Kahneman & Tversky, 1979; Shefrin & Statman, 1985). These studies examine how and why decision makers reach outcomes focusing on the actual outcome itself. Human behavior is a result of investors processing information using shortcuts and emotional filters (Baker & Nofsinger, 2010). These shortcuts and emotional filters can result in suboptimal investor decisions. These decisions may seem to be irrational and violate the traditional assumption of risk aversion. Behavioral finance attempts to better understand what seems to be the suboptimal investor decisions, particularly those that impact markets and personal wealth.

This dissertation examines behavioral factors that lead angel investors to invest in projects, to invest time in due diligence, as well as the role due diligence and information asymmetry have on angel investor probability of success. Another difference in this study and other angel investor studies is the consideration of the behavioral factors that influence angel investor decisions and the angel investor's assessment of deal characteristics that influence his/her behavior. Angel investor decisions are examined based on traditional finance theory and behavioral finance. Modern portfolio theory, expected utility theory, and prospect theory are utilized to examine angel investing and information asymmetry.

The assessment of risk.

The level of risk is clearly an important factor when an investor is assessing opportunities. Friedman and Savage (1948) note that individuals frequently choose among alternatives that differ based on degree of risk. For example, in prospect theory, the decision weight associated with an event will depend primarily on the perceived likelihood of that event, which could be subject to major biases (Kahneman & Tversky, 1979). In contrast, under the traditional approach, the rational decision maker is assumed to be risk averse and, therefore, would require additional reward to accept increased risk (Tversky & Kahneman, 1981). However, assessing the probabilities of all outcomes can be difficult, as people cannot be aware of all possible outcomes.

Risk assessments and considerations in traditional angel investments include investment stage, top management experience, number of co-investors, and overall risk perceptions (Wiltbank, 2005). However, biases and heuristics influence people's

decisions that are not explained by traditional finance. Therefore, behavioral finance provides key insights to assist in understanding these decisions (Ackert & Deaves, 2009; Baker & Nofsinger, 2010; Statman, 1999).

Biases and heuristics.

Factors that influence decisions, including biases and heuristics, have received significant attention from behavioral finance researchers. Bias refers to people's tendency to make decisions based on cognitive factors, such as memory, attention, learning, problem solving, and heuristics, rather than evidence—and thus can include errors in judgment (Barberis, Shleifer & Vishny, 1998; Bem, 1965; Daniel, Hirshleifer & Subrahmanyam, 1998; Fama, 1998). Heuristics refers to experience-based techniques for problem solving and learning, such as rules of thumb, to reduce the search necessary to find the solution to a problem (Shefrin, 2000; Tversky & Kahneman, 1975). Biases and heuristics often influence people's decisions. Shefrin (2000, p. x) notes: "People are not good processors of information and are frequently subject to bias, error, and perceptual illusions."

Bias factors that may influence investor decisions include risk perception, framing, and overconfidence (Dimov, Shepherd & Sutcliffe, 2007; Mitteneß, Sudek & Cardon, 2012; Peters, Burraston & Mertz, 2004). Even if entrepreneurs provide the same information to all angel investors, the information may be perceived differently based on the angels' biases and past experiences. The angel investor's previous experience and expertise allows them to focus on key areas while ignoring other areas, thus influencing

their biases and heuristics and helping them be more efficient (Dimov, Shepherd & Sutcliffe, 2007).

Cognitive bias.

Whereas traditional finance represents rational people who want more wealth over less and are never confused over the forms of wealth, behavioral finance is populated by “normal” people who are affected by cognitive biases and emotions, confused by the forms of wealth, and are not always motivated by the desire to have more wealth (Statman, 2008). Sometimes, the so-called “normal” people want other things, such as more status or social responsibility and are willing to accept less wealth to achieve such goals (Statman, 2008).

Prior studies suggest that a dramatic influence on investments is the most recent investment an investor has participated in (Previtero, 2012). The most recent investment influence may be due to recall. Ebbinghaus (1902) examined recall accuracy as a function of cognitive bias. Recall or memory can create a bias based on primacy or recency. Primacy is recalling information that is presented earlier or in a better manner than information that is presented later on. Recency refers to items or events that are most recently examined having a memory advantage over items retrieved from long-term memory. The primacy and recency effects and whether or not an investor has invested in a project in the past may influence investor behavior. The influence of investor past success can lead to overconfidence, less diversification, and more risk taking (Merkle, 2012).

Loss aversion, risk aversion and level of wealth

Another key feature of the major biases addressed in prospect theory is loss aversion. Loss aversion is the tendency, for most people, to weigh losses larger than gains. Whereas people in a mean-variance framework are risk averse in all choices, under prospect theory people are risk averse in the gains domain and risk seeking relative to losses. Furthermore, the influence of the certainty effect causes people to prefer a smaller sure gain over a larger gain that is only probable, and the same effect leads to a preference for a smaller loss that is only probable over a sure loss that is certain. The concept of loss aversion is a psychological consideration that drives an individual's choice behavior in financial markets (Benartzi & Thaler, 1995). It can be impacted by how long one holds an investment or the extent of one's loss aversion (Benartzi & Thaler, 1995). Olsen (1997) examines loss aversion and prospect theory and finds that both individual investors as well as groups of professionals have similar risk perspectives. Olsen identifies four main characteristics in investor perception of risk that influence their loss aversion: concern for a large loss, feeling of control, potential for a below-target return, and perceived degree of knowledge. Olsen finds that risk perception explained 77 percent of the variance in his analyses. The most substantial factor in his analysis was the ability to sell an asset in a relatively short period of time without suffering a loss. The liquidity risk of angel investments refers to the risk of not being able to effectively exit and thus being forced to remain in the venture or sell the investment at a high discount (Cumming, Fleming, & Schwienbacher, 2005).

Another example of loss aversion is in the stream of research on disposition effect (Heisler, 1994; Odean, 1998; Shefrin & Statman, 1985). The disposition effect is

described as the investors' disposition to sell winners too early and ride losers too long. This reluctance of investors to realize losses is an extension of Kahneman and Tversky's (1979) prospect theory to investments.

The tendency for a risk averse investor to fall prey to the disposition effect may be influenced by illiquidity (Cumming, Fleming, & Schwienbacher, 2005). The critical point in an individual investor's assessment of gains and losses is the reference point from which gains and losses are measured. Under prospect theory, the value function is defined as gains and losses from a particular reference point rather than on levels of wealth (see Figure 1). The function is concave for gains and convex for losses and steeper for losses than for gains. Usually the individual reference point would be the cost or existing market value; however, "there are situations in which gains and losses are coded relative to an expectation or aspiration level that differs from the status quo...A person who has not made peace with his losses is likely to accept gambles that would be unacceptable to him otherwise" (Kahneman & Tversky, 1979, p.287).

Odean (1998) finds, for some investments, particularly those held over a long period of time, the purchase price is only one factor in determining a reference point; thus, the reference point may be a noisy proxy for the true reference point. Rational reasons for holding losers and selling winners include selling winners to balance a portfolio, selling winners purchased on favorable information, believing they now reflect the favorable information and will not rise further, or holding after a price drop believing favorable information is not yet incorporated, and finally, to avoid higher trading costs associated with lower priced stocks. However, even after controlling for rational motivations, Odean (1998) finds that investors continue to prefer to sell winners and hold

losers, which is consistent with prospect theory and the mistaken or irrational belief that the price of winners and losers will eventually move back towards the mean or average, a term called mean reversion. Although Odean (1998) does not differentiate between irrational belief and mean reversion as to the reasons individuals hold losers and sell winners, he does suggest that they may not discern the difference, thus convincing themselves that a stock value may return rather than admit they are unwilling to take a loss. Further, if expected future returns for the losers are greater than for the winners, the belief would be considered rational; however, if they are not and investors continue to hold losers against consistent indications that conflict with this belief, then this is considered irrational (Odean, 1998).

Ibrahim (2008) provides evidence that most angel contracts are rational from a financial perspective, yet the use of their personal funds gives angels the flexibility to invest in a project for financial as well as non-financial reasons, including personal reasons. Odean (1998) also noted that, for some investments, particularly those held over a long period of time, the purchase price is only one factor for an individual to invest or to determine a reference point for an investment. Other reasons may include the excitement and opportunity to participate in a new venture or a desire to give back to the community (Ibrahim, 2008). These nonfinancial benefits, also described as “psychic income”, may shift the reference point for the value function for angel investors, thus creating additional expected value or gain and encouraging angels to hold on to investments for a longer period of time.

People’s preference to avoid losses over acquiring gains, which is to imply that a person who loses \$100 will lose more satisfaction than a person that wins \$100 gains in

satisfaction, is known as loss aversion high risk projects that contain high information asymmetry (Kahneman & Tversky, 1979). Risk aversion attempts to explain the aversion behavior of people in conditions of uncertainty to reduce uncertainty in exchange for more certain or lower expected payoffs (Holt & Laury, 2002; Pratt, 1964). Most people are risk averse in laboratory payoffs of several dollars; however, when payoffs are scaled up with higher payoffs in actual cash, subjects become sharply more risk averse (Holt & Laury, 2002). Holt and Laury (2002, p.2) further state: “The nature of risk aversion (to what extent it exists, and how it depends on the size of the stake) is ultimately an empirical issue, and additional laboratory experiments can produce useful evidence that complements field observations by providing careful controls of probabilities and payoffs.” Risk aversion affects the tendency to choose the safe option when payoffs are scaled up; however, the amount of increased payoff may be interpreted differently in relation to an individual’s final wealth. For example, Cox and Sadiraj (2006) provide evidence that suggests that expected utility theory does not provide an explanation of how an agent’s initial wealth affects its attitude towards risk; thus, initial wealth must be considered separately from income in the utility function. The authors extend the Arrow (1971) and Pratt (1964) characterization of risk aversion to consider a model in which risk attitude depends on initial wealth but income is not additive to initial wealth. Risk aversion and loss aversion literature suggests that when the same choice of prospects of gains and losses are presented in different forms, people generally have inconsistent preferences (Kahneman & Tversky, 1979).

Studies that examine the percentage of wealth placed in risky assets when a portfolio is limited find that risk aversion is a decreasing function of the proportion of

total assets (Arrow, 1971; Pratt, 1964). Prior studies, such as Cohn, Lewellen, Lease, and Schlarbaum (1975), have also investigated the effects of the percentage of wealth invested on allocation of individual portfolios to risky assets, as it influences the decisions of an investor. Their findings suggest that, as wealth increases, there is a strong pattern of decreasing relative risk aversion. Because investors are assumed to be rational, concepts of risk aversion that might influence them have been developed (Arrow, 1971; Pratt, 1964). Angel investments appear to be influenced by the angel's personal attributes, such as wealth. For example, Chua and Wu (2012) suggest that the more ventures the angels have helped establish, the larger the amount of initial and total investment they make in an investment, which may also be a function of wealth. Angel investors are typically wealthy individuals and former entrepreneurs themselves. The percentage of wealth can be a risk proxy for angel investor decisions (Chua & Wu, 2012; DeGennaro & Dwyer, 2013).

Framing.

Framing is the belief that how a concept is presented matters (Ritter, 2003). The way that investors frame an outcome affects the utility they expect to receive, such as changes in reference points, manipulations of probabilities, or decision weights (Kahneman & Tversky, 1979). This critical point addresses how individuals evaluate risky gambles and embrace risky choice behavior. Kahneman and Tversky (1979) argue that individuals use positive or negative frames in the decision making process. Further, they find that when events are framed positively, individuals will choose the certain event over the gamble even if the gamble produces equal or greater expected value. Individuals

will also choose a positively framed gamble over a negatively framed gamble even if they have equal values.

Tversky and Kahneman (1981) show that each decision choice has two specific phases: the initial phase where the event and related variables are framed and then the evaluation phase. According to Tversky and Kahneman (1981), many concurrent decisions are framed independently, thus the preferences selected would be different if the decisions were combined.

Since individuals generally value an event based on the consequences expected, the events are considered to be evaluated based on mental accounting (Thaler, 1985; Thaler & Johnson, 1990). People adopt mental accounting mode of framing because it simplifies the valuation process; it reflects the intuition that results will be linked to the factors in the event; and it reflects the sensitivity to the desirable or undesirable changes (Yazdipour & Howard, 2010). When people are faced with evaluating huge amounts of data, information and decisions, they are incapable of making the complex calculations expected under traditional finance theory and instead rely on cognitive and heuristic based strategies found in mental accounting (Yazdipour & Howard, 2010). Heuristics, which mainly result from the individual's experiences, are imperfect and result in biases and errors. Behavioralists argue that the heuristics and biases involved in framing are systematic, or characterized in a regular and methodical order, and thereby potentially last for long periods and affect decisions accordingly (Yazdipour & Howard, 2010).

According to traditional theory, the framing of an event should not impact its selection because the framing does not change the event; however, this reinforces the theory that individuals are subject to perceptual or cognitive illusions. Behavioral

finance and prospect theory specifically address individual biases and heuristics that address how an investor employs judgment when faced with investment decisions involving risk. Kahneman and Tversky (1979) find that individuals tend to choose the certain event over the gamble even if the gamble yields an equal or greater expected value and will choose a positively framed gamble over a negatively framed one; thus providing evidence that individuals are subject to perceptual or cognitive illusion. An example of cognitive illusion in framing decisions is found in DeGennaro and Dwyer (2013). The authors examine past angel investments and argue that angels do not invest based on return on investment but rather on *expected* returns on investments. Their study suggests a cognitive illusion surrounding the framing of angel investor returns. They report angel investors earn returns that are similar to venture capital returns on similar industries, but the angels have framed a cognitive illusion of expected returns of about 70 percent per year in excess of the riskless rate compared with the reported expected returns for venture capitalists of 59 percent. DeGennaro and Dwyer (2013) utilized the Angel Investor Performance Project data set employed in this dissertation (described subsequently).

Overconfidence.

Overconfidence is a bias that causes people to overestimate their knowledge, abilities, and judgment when making decisions. Researchers have found that investors are overconfident about their abilities (Barber & Odean, 2001; Ritter, 2003).

Overconfidence can manifest itself in many forms, including miscalibration, which occurs when people overestimate the precision of their knowledge. Overconfidence can

also be seen in the better-than-average effect, which describes people's tendency to rate themselves above average on their attributes or skills. Another example of overconfidence is illusion of control. Illusion of control occurs when people think they have more control over events than they actually have. A fourth form of overconfidence, excessive optimism, is evident when people assign probabilities to an event that are too high/low based on historical experience or reasoning (Ackert & Deaves, 2009; Hirshleifer, 2001).

Previous research suggests that the angel investor's expertise in the same industry as the investment, as well as angel investor interaction with the company they invested in, influences angel investment outcome (Wiltbank and Boeker, 2007b). Angel investors analyze investment choices without the benefit of a professional portfolio advisor, thus performing their own analysis of potential investments.

In comparison to angel investors who perform their own analysis and professional analysts who typically provide important information in financial markets, some professional analysts perform their tasks better than others (Stickel, 1992; Sinha, Brown & Das, 1997). Examinations of why some analysts perform better than others have resulted in conflicting results (Clement, 1999; Jacob, Lys & Neal, 1999; Mikhail, Walther & Willis, 1997). Clement (1999) finds that more experienced analysts have smaller forecast errors. Mikhail, Walther and Willis (1997) develop a model that suggests that as people practice a task, they improve and analysts with more experience issue more accurate forecasts. However, Jacob, Lys and Neal (1999) argue that the association between experience and forecasting accuracy results not from experience, but from survival bias – weaker performers are forced out of the profession.

As more information becomes available to investors, they tend to believe they can make better decisions (Zacharakis & Shepherd, 2001). And, more information should enable the investor to avoid problems; however, the additional information may make the decision more complex due to contradictory information, and lack of full or proper analysis may lead to lower decision accuracy (Zacharakis & Shepherd, 2001).

Evidence on the impact of experience on overconfidence has suggested that prior experience or familiarity influences overconfidence (Døskeland, & Hvide, 2011), but the directional influence of experience is foggy. The conflicting role of experience has been addressed in psychology-based theories that suggest that experience enhances performance through its effects on knowledge (Dane, 2010; Hunter, 1983; Libby & Luft, 1993; Schmidt, Hunter, & Outerbridge, 1986). Inasmuch, experience has been viewed as a valuable asset that that does not directly affect performance. This implies that experience provides opportunity for knowledge acquisition and greater knowledge improves performance (Koonce & Mercer, 2005). Person-specific predictors of performance may include knowledge and ability, yet there may be significant variation in the complexity of tasks across firms and time (Koonce & Mercer, 2005). Finally, experienced high-performers may underperform and be more of a burden in certain situations (Birch & Bloom, 2007; Dane, 2010; Frensch & Sternberg, 1989).

In addition to overconfidence problems associated with high levels of experience, Frensch and Sternberg (1989) argue that those with significant experience may have well-developed problem-solving routines and thus may be less flexible in their methodologies and ways of thinking than those less experienced, resulting in worse performance by highly experienced than less experienced analysts. Dane (2010) agrees that as they

acquire domain experience experienced decision makers may lose flexibility with regard to problem solving, adaptation and creative idea generation; however, he argues that the inflexibility-related limitations can be circumvented. Dane (2010) further suggests that the inflexibility arises, not from expertise, but from a high level of cognitive entrenchment. He defines cognitive entrenchment as a high level of stability in one's domain schema. The problems associated with cognitive entrenchment may be restriction of ability to identify optimal solutions, adaptation in unique situations, and the ability to generate creative new ideas. This cognitive entrenchment can be overcome by individuals focusing their attention on tasks not only within their area of expertise, but also outside their domain, which will also contribute to reduced information asymmetry problems.

Information Asymmetry Problems and Solutions

Though the heuristics, biases, risk aversion, framing, and overconfidence issues of angel investors can influence their decisions, problems associated with information asymmetry can also influence their decisions. Asymmetric information exists where parties possess different information about a transaction. This can be harmful because one party can take advantage of another party's lack of knowledge (Akerlof, 1970). Work by Leland and Pyle (1977), Grossman and Hart (1983) and Myers and Majluf (1984) suggests that information asymmetry can have profound effects on investment decisions. Information asymmetry between entrepreneurs and investors is often higher in start-up companies than in other companies (Davila, Foster & Gupta, 2003; DiGregorio & Shane; 2003; Sanyal & Mann, 2010).

Information asymmetry problems.

A potential outcome of asymmetric information is that the uninformed party will not trade with the informed party. Another possibility is that good assets can only be sold at discounts, sometimes known as the “lemon problem” (Akerlof, 1970). In the case of angel investors, entrepreneurs often have more knowledge of their company than angel investors (Ibrahim, 2008). This could lead to such outcomes as experiencing poor returns for the angel, not investing in a project with potentially good returns, or pricing the investment too low as if it were a “lemon” (Ibrahim, 2008).

Akerlof (1970), using a car example, describes a situation where information is limited or unknown. Because buyers are unable to distinguish between good and bad cars (the lemon), they rate both good and bad deals as average. Healy and Palepu (2001) describe a “lemon” problem that arises from information differences in a situation where half the business ideas are bad and half are good. Investors and entrepreneurs value deals using their own information (Leland & Pyle, 1977; Smith, Smith & Bliss, 2011). Therefore, if the “lemon” problem is not resolved, they will overvalue the bad deals and undervalue the good deals relative to the information available to them.

There are generally two manifestations of asymmetric information problems, adverse selection and moral hazard. Adverse selection occurs when parties have asymmetric information about the quality of an offering, thus causing a less than desirable offering to be selected (Clarke & Shastri, 2000).

Information asymmetry can also lead to moral hazard problems. Moral hazard occurs when the behavioral intent or actions of a party result in detriment to others, and this action is different from what it would have been if all parties were fully exposed to

the risk. It is a situation where a party takes a risk because the burden of taking that risk will not be fully felt by the party taking the risk (Hölmstrom, 1979). The party that commits the moral hazard has more information about the actions or intentions than the party paying for the consequences. Because angels are investing their money at a very high risk time and the entrepreneur's business decisions may affect the angel investors more than the entrepreneur, efforts should be taken to reduce effects of moral hazard.

The record of accomplishments for new start-ups seeking early-stage capital is often limited by their brief time in business; as such, information asymmetry for individuals considering an investment is high (Amit, Glosten, & Muller, 1990; Van Osnabrugge & Robinson, 2000; Sørheim & Landstrom, 2001). Though high levels of information asymmetry exist, angels continue to invest in start-ups (Becker-Blease & Sohl, 2007). Problems associated with information asymmetry in angel investments are well documented (e.g. Dennis, 2004; Morrissette, 2007; Van Osnabrugge & Robinson, 2000; Wiltbank, 2005).

Smith and Watts (1992) provide an example of problems associated with information asymmetry by suggesting that managers of high-growth firms have superior knowledge about the firm's investment opportunity, as well as better knowledge of the expected future cash flows from their existing assets. Therefore, angel investors must assess top management and their experience in order to reduce information asymmetry and the associated adverse selection and moral hazard problems. For example, Eisenhardt & Schoonhoven (1990) empirically relate characteristics of the founding top-management team, strategy and environment to sales growth in newly founded firms in the semiconductor industry. Beckman, Burton and O'Reilly (2007) find that prior top

management team experience positively influences the rate of receiving venture capital funds and going public. Additionally, top management teams with diverse backgrounds and experience will be able to reach entrepreneurial milestones more quickly than less experienced teams. In summary, the prior experience, prior company affiliations and functional experience of the top management team are important correlates of success. Firms with experienced team members from a range of experience will be successful more quickly than other firms (Beckman, Burton & O'Reilly, 2007; Burton, Sørensen & Beckman, 2002; Chandler & Hanks, 1998; Schefczyk & Gerpott, 2001), thus suggesting that reducing the information asymmetry surrounding the top management team would help prevent adverse selection problems with the investment.

Due diligence.

Due diligence is defined as gathering information on the potential investment; it often involves verifying facts, background checks, size of the targeted market, growth potential, cash flow projections, and asset valuation (DeGennaro, 2011). The impact of investing in risky projects has been examined and it has been determined that rational investors will take steps to reduce the risk in their portfolio (Lintner, 1965; Miller, 2012). Key purposes of due diligence are to reduce information asymmetry, ascertain whether a project is suitable for funding, and improve the likelihood of positive returns (Allen & Santomero, 1997; DeGennaro, 2011; Dixon, 1991; Fiet, 1995b).

While risk aversion describes the investor who, while exposed to uncertainty in investments with similar expected returns, attempts to reduce the uncertainty (Pratt, 1964), time spent on due diligence (i.e., deeper investigation into the person, business,

and/or industry being invested in) has been shown to be positively related to reducing information asymmetry and improving angel returns (Wiltbank & Boeker, 2007b).

Although prior research determines that due diligence by angel investors is significant, that research does not explain why angel investors' time spent on due diligence varies significantly. This dissertation examines angel characteristics and deal characteristics in an effort to determine the influences that affect the amount of time an investor devotes to due diligence, as well as the factors that influence the percentage of wealth an angel invests in a project and the amount of time an angel spends on post-investment interaction with the firm.

Screening is a due diligence process for combating adverse selection under information asymmetry (Balakrishnan & Koza, 1993; Smith, 1987; Ibrahim, 2008). Investment screening typically involves an investor's examining the attractiveness of an opportunity. Initial screening usually involves two elements: an initial examination of whether a proposal meets the angel's personal investment criteria followed by a detailed investigation, or due diligence (Mason & Harrison, 2003). Investment criteria might be knowledge of the industry sector, interest in the sector, amount of funding sought, location, stage of development or perhaps "gut feel" (Mason & Harrison, 2003). Screens are designed to identify characteristics and behaviors in the entrepreneur to determine "fit" with the angel's criteria. For example, if the entrepreneur's values, management team, and strategy do not align with the angel's and are identified during the screening process, then the project might not move forward. This may involve an examination of market size, strategy, technology, competition, management team, and contract terms (Kaplan & Stromberg, 2001; Stuart, & Abetti, 1990). The opportunity may also be

examined in terms of location, kind of business, requisite amount of money, and other business criteria. The aim of this early stage is to assess whether to justify the investment of time for the additional due diligence. Riding, Dal Cin, Duxbury, Haines, and Safrata (1993) find that 72.6% of opportunities were rejected in the initial screening stage, but only 15.9% were rejected after the more detailed due diligence. As due diligence progressed, though, another 6.3% were eliminated, for a cumulative rejection rate of 94.8%.

Due diligence helps to reduce information asymmetries and decreases potential risk in angel investing. However, research suggests that an angel investor's time spent on due diligence is not correlated with the size of the initial investment and does not increase with additional investment. However, time spent on due diligence does increase with the percentage of wealth invested (DeGennaro & Dwyer, 2013; Mitteneß, Baucus & Sudek, 2012; Smith, Harrison & Mason, 2010; Wiltbank & Boeker, 2007b). Low levels of due diligence on risky projects are in direct contrast to the principles of traditional finance. Previous psychological and finance research, though, indicates that behavioral variables can help explain departures from rational behavior under conditions of risk (Ritter, 2003; Statman, 1999).

As the number of hours angels spend on due diligence varies considerably, it is important to understand reasons for differing amounts of time that an angel investor expends on due diligence and factors that affect those decisions. Though time spent on due diligence improves angel investor returns, Van Osnabrugge and Robinson (2000) find that angel due diligence is less detailed and results in lower returns than similar investments, such as venture capital. Van Osnabrugge and Robinson find that angel due

diligence typically entailed collection of fewer independent references about an entrepreneur than venture capitalists (0.96 versus 4.2 references), and angels experienced lower returns (32 percent for angels versus 90 percent for venture capitalists).

Staged financing.

Prior studies have examined the role of the stage of an investment, as well as co-investing and post-investment participation (interaction) on investment returns to angel investors (Wiltbank, 2005). That analysis finds that post-investment participation by angel investors reduces information asymmetry. It also suggests that co-investors reduce the necessity to invest time in due diligence.

Angels prefer to provide financing to companies at various stages of their growth versus all at once (Wong, Bhatia, & Freeman, 2009). Staged financing provides several benefits, including reduced risk and increased control. Staged financing is thought to work so well that Gompers and Lerner (2001) describe it as “the most potent control mechanism a venture capitalist can employ.” Angel investors often invest in the earlier stages of a firm as compared to other investors, including venture capitalists (Wong, Bhatia & Freeman, 2009). However, angels are not as reliant on the traditional forms of control such as contracts and board control (Wong, Bhatia & Freeman, 2009). More often, they reduce the agency costs by forcing the entrepreneur to hold a higher stake in the firm. The higher stakes held by the entrepreneur tends to align the interest of the entrepreneur with that of the angel investors while also reducing agency costs (Wong, Bhatia, & Freeman, 2009).

The sequential stage developmental process for new business has been studied extensively (Lewis & Churchill, 1983; Greiner, 1972; Kimberly & Miles, 1980; Ruhnka & Young, 1987). Ruhnka & Young (1987) analyzed the perceptions of 73 U.S. venture capital firms about key features of the stage development process for new business ventures. These stages are central to most “stages of development” theories and are arguably of critical importance in the growth, survival, and financial success of new ventures (Ruhnka & Young, 1987). The stages of development of a firm that angels invest in have different levels of information asymmetry and different levels of risk (Bruno & Tyebjee, 1986; Cooper, 1981; Gaibraith, 1982; Pratt & Bokser, 1998; Ruhnka & Young, 1987). The stages of firm development that an angel invests in are seed stage, start-up, early growth, late growth, and the turnaround stage.

The *seed stage* is considered the stage where a person or company approaches the angel investor for funding for an idea or product. There may or may not be a prototype product that has been fully developed or tested at this stage. There has usually not been any income generated by the firm at this stage. At the seed stage, a relatively small amount of money is needed to prove a concept or develop a product. The *start-up stage* begins after the seed stage. At this point an economic feasibility analysis of the idea or product has been completed by angel investors and a business plan has been presented to the angel investor. A fully developed prototype of the product will be built and tested during this phase. Market research is completed to determine if the market is large enough to support the idea. The start-up stage describes companies in business for less than one year and whose product has not been commercially marketed. Next, at the *early growth stage*, the idea or product is being produced and sold on the market. The

company is trying to gain market share and achieve break-even on the expenses and the investment. The growth is guided by the natural growth of the market; however, tasks are being aimed at making the firm more profitable through modifying the product and often second-generation products are beginning to appear (Gaibraith, 1982). During the *late growth, or maturity, stage* the company is trying to expand the company and the market share. Follow-up products are being introduced into the market and the company is trying to expand the life-cycle of existing products. Ruhnka & Young (1987) present data that suggests that characteristics for companies in this late growth stage generally include companies that have seasoned management, have been in business for five or more years, have an established product, breakeven or profitable financials, and increasing sales. A *turnaround stage* involves a company that is generally in financial trouble and involves a process of recovery and investment to stabilize the situation, address management issues and implement emergency actions that create value to return to profitability (Bruno & Tyebjee, 1986; Pratt & Bokser, 1998; Ruhnka & Young, 1987). The firm in this turnaround stage generally has higher competitive risks and is having difficulty increasing sales or market share. These companies may also show signs of being undercut in the market by unanticipated competitors, which may result in a closed “window” of opportunities for capital investors to offer an initial public offering or otherwise cash out their investment. This stage often requires repositioning the product or keeping the investee alive until a liquidation or merger can be achieved (Ruhnka & Young, 1987).

Angel investors tend to invest in ventures at the earlier stages of investment (seed and startup stage) when the information asymmetry tends to inhibit the securing of financing through other sources (Mason & Harrison, 1995; Prowse, 1998; Wetzel, 1983).

Syndication

Syndication occurs when two or more investors, such as angel investors or venture capitalists, share in the financing of a venture (Lerner, 1994). As of 2007, approximately 10,000 accredited angel investors belong to 265 angel groups, thus providing evidence of angel investors' desire to invest alongside other angels (www.angelcapitaleducation.org). Angel investors sometimes organize into angel groups to share research, pool their investment capital, and reduce risk (Aram, 1989; Markova & Perkovska-Mircevska, 2009; Sohl, 2012; Wong, Bhatia & Freeman, 2009). Research suggests that typically at least two or three angels invest in each deal, with most angel investors preferring to invest with other angels (Freear, Sohl & Wetzel, 1995; Gaston, 1989; Van Osnabrugge & Robinson, 2000). Given that angels desire to invest with other angels, and angels have capital available to invest, syndication provides additional growth opportunities for entrepreneurs.

Syndication attempts to formally organize angels and to create a more efficient angel market (i.e., known as "angel networks"). These networks are typically operated by a not-for-profit, such as a university (Berger & Udell, 1998). The networks provide angels opportunity to invest with other "qualified" angel investors. Qualified investors are those investors who meet the Securities and Exchange Commission accredited investor standards, which include a net worth of at least \$1 million and an annual income

of \$200,000 for the previous three years or a combined income with their spouse of \$300,000 (U.S. SEC, 2012).

Analysis of angel investor practices of investing alone or with others has been difficult, due to lack of large data sets (Bammens, & Collewaert, 2012; Fenn & Liang, 1998). Goldfarb, Hoberg, Kirsch, and Triantis (2009) analyze 182 venture financing deals including only 32 angel investors to examine syndication of deals with angels alone, angels with venture capitalists, and venture capitalists alone. Their study finds that angels who invest alone are slower to liquidate, thus suggesting that angel investors may have enhanced patience or possibly weaker control rights. The study also shows that angels frequently invest alongside venture capitalists, purchase the same stocks, and experience similar returns.

Angels are presented with many opportunities to invest over the course of a year. Angels often invest with other angels in groups. Psychoanalytic theory is useful in understanding syndication. Some angel members define their tasks, are clear about their purpose, and work together with other members in an investment. Other members may not think for themselves but engage in groupthink. Groupthink provides good feelings and comfort to group members through unconscious defenses adopted by the members rather than creative, reality-based thinking and functioning (Janis, 1982). In this scenario, a divided state of mind takes over from reality-based thinking, and information is evaluated to promote the good feelings and excitement while the negative feelings are split off from the awareness. This can result in ideas where investors become caught up in the good feelings and excitement, or unconscious wishful thinking, and split off or deny the underlying risk. Shiller (2005, p.159) describes this paradox as “completely

rational people” becoming caught up and producing “behavior that is, in a well-defined sense, irrational.” An example would be two previously successful angel investors agreeing to invest in a project and other angel investors joining the project because of the excitement, perhaps without performing due diligence. Groupthink falls under the category of emotions in behavioral finance and draws on how people’s emotions and feelings help drive all investment activity. Groupthink leads to homogenous behavior. Even the homogenous behavior may be caused by cognitive error, the more homogenous the behavior of irrational investors, the larger the effect on the investment. This groupthink can be referred to as herding - and herding based on cognitive error can steer the investment away from its fundamental value.

Although much heterogeneity exists between angels and venture capitalists investing together, the angel-only deals fail the least often (Goldfarb, Hoberg, Kirsch, and Triantis, 2009). Other studies argue that venture capitalists who network together through syndication increase their performance, as measured by better exit rates (Hochberg, Ljungqvist & Lu, 2007). Syndication, staged financing, and convertible securities are seen as solutions to information asymmetry problems between entrepreneurs and uninformed investors (Metrick & Yasuda, 2011).

Angel investors often use syndication to reduce individual angel risk by spreading risk over several investors versus taking on all the risk themselves (Wong, Bhatia & Freeman, 2009). There are other reasons that angels invest together. For example, some angel investors invest for reasons other than ROI, such as they enjoy lending their expertise to other angels and to entrepreneurs seeking angel investments (Sudek, 2006). Evidence supporting the non-financial investment reasons suggests that due diligence

decisions are affected by group structure that allows “experts” to evaluate, monitor, and vouch for deals in their area of expertise while others can invest for their own reasons (DeGennaro, 2010; Mason & Harrison, 2008). Experts who “champion” a deal tend to conduct better due diligence than they would to satisfy themselves in an effort to protect their reputation (Payne & Macarty, 2002). Thus, a kind of free rider effect regarding time spent on due diligence can occur by other angel investors. This dissertation proposes to enhance the prior qualitative approach with a quantitative analysis and incorporate additional data to test the reasons angels spend time on due diligence.

Syndication can facilitate due diligence/monitoring and add value to an investment if investors are able to share their specific knowledge and complementary skills. Syndication, however, can also hinder due diligence/monitoring because of the free-rider problem (Das & Teng, 2002; Dimov & Milanov, 2010; Wright & Lockett, 2003; Wright & Robbie, 1998; Manigart, Lockett, Meuleman, Wright, Landström, Bruining, Desbrières & Hommel, 2006; Sorenson & Stuart, 2001). The free-rider problem refers to parties who benefit without paying for the cost of the benefit.

The free-rider problem associated with angels in groups might include angels who participate in time spent on due diligence/monitoring and other angels who benefit from their efforts. Das and Teng (2002) argue that a social exchange of controls mitigates the free-rider problem when three or more parties are involved. Because the exchange of information entails reciprocity, accountability is relatively high and the free-rider problem is easy to detect. The social exchange theory also suggests a high need for trust and a deep sense of solidarity over time. When free-riding is detected, both social sanctions and a cooperative culture can be utilized to remedy the problem. Cooperative

culture is reciprocity of benefits, while social sanctions reduce free-riding by damaging the reputation of the member involved (Das and Teng, 2002). This process of social sanctions and cooperative culture typically results in all individual investors contributing to the success of the investment through their individual strengths (Das and Teng, 2002).

The information asymmetry problems in angel investing are numerous and complex, so research into solutions to reduce the information asymmetry has included increased angel investor due diligence, monitoring of the investment, staged investments of funds into the firm, and syndication of other angels into the investment. Each of these solutions has provided evidence to suggest increased investment return. The combinations of these solutions as they relate to other angel behavioral factors should lead to further enhancements in the behavioral finance literature regarding individual investors that do not use professional portfolio advisors and angel investors in particular.

Theory Development and Hypotheses

This dissertation examines the factors that influence angel investors' amount of time spent on due diligence, the percentage of wealth invested in a project, and the amount of post-investment interaction between the angel investor and the firm, the three dependent variables. The choice of the independent variables follows the prior literature, which suggests that demographic factors, experience and risk tolerance shape these decisions.

Understanding the behavioral bias and heuristic influences that affect the framing of investment choices of angel investors, including time spent on due diligence, the amount of wealth invested in a project, and post-investment interaction, may provide

implications for stock selections, asset valuation and performance based management contracts.

Dependent variables.

Time spent on due diligence.

Time spent on due diligence (i.e., deeper investigation into the person, business, and/or industry being invested in) has been shown to reduce information asymmetry and improve angel returns (Wiltbank & Boeker, 2007b). Angel investments are considered high risk projects that contain high information asymmetry. Information asymmetry exists in many areas of the investment, including the top management team (TMT), stage of the investment, the number of co-investors that will invest and the past experience of the co-investors, and the source of the investment. Past research has used a variety of factors to evaluate opportunities and risk tolerance of angel investors (Haines, Madill & Riding, 2003; Mason & Stark, 2004). Risk tolerance includes examination of the entrepreneur's management team and its prior experience/track record (Haines, Madill & Riding, 2003; Mason & Stark, 2004). The competence and experience of the top management team can assist in overcoming market challenges that arise. Van Osnabrugge and Robinson (2000) find that although angels emphasize the importance of the management team, angels are less deterred by gaps in the management team because angels can contribute to management expertise through personal involvement with the investment. However, time spent on due diligence might lead to reducing information asymmetry in many of these areas and improved angel returns. Other than returns, the factors that drive time spent on due diligence have not previously been examined. It is

unknown whether angel investors are influenced by behavioral factors that might influence their time spent on due diligence. This leads to the first testable hypothesis, stated in the null form:

Hypothesis 1 – There is no relationship between angel investor behavioral factors and time spent on due diligence.

Percent of wealth invested.

Investors are assumed to be rational and concepts of risk aversion have been developed to describe their behavior (Arrow, 1971; Pratt, 1964). Risk aversion of an investor describes the tendency of the investor to reduce the uncertainty while choosing among risky investments with similar expected returns (Pratt, 1964). Studies that examine the percentage of wealth placed in risky assets find that risk aversion is a decreasing function of the proportion of total assets. For instance, an investor whose utility for total assets is unchanging and whose assets are increasing would be willing to pay less for insurance as his risk aversion for a risky asset has decreased as his wealth increased (Arrow, 1971; Pratt, 1964). Prior studies, such as Cohn, Lewellen, Lease, and Schlarbaum (1975), have investigated the effects of the percentage of wealth invested on allocation of individual portfolios to risky assets. The percentage of wealth invested is a proxy for angel investor risk tolerance. Most angels are considered to be wealthy. An examination of the behavioral influences on the percentage of wealth invested may help explain angel investor decisions.

The same predictors included in Hypothesis 1 are included in Hypothesis 2, which consist of demographic measures, measures associated with experience, and measures associated with risk tolerance. The second testable hypothesis, stated in the null form is:

Hypothesis 2: There is no relationship between angel investor behavioral factors and the percent of wealth invested.

Since many early stage entrepreneurs may have little business experience, different contractual relationships between angel investors and entrepreneurs are required to deal with agency problems and information asymmetry, and to create additional value (Keuschnigg & Nielson, 2003). Tyebjee and Bruno (1984) present a useful guide describing post-investment activities for venture capital (VC) investors. Although there are differences between VC and angel investors, the guide is still useful in describing post-investment activities. The authors list post-investment activities as sitting on the board, orchestrating mergers and acquisitions, recruiting key executives or managers, acting as a sounding board to the CEO, evaluation of the top management team, working on strategy development, and providing guidance and business contacts. The investor interaction activities can be separated into monitoring activities and value adding activities.

Monitoring is observing and supervising activities to ensure they are on course to meet the objectives and targets. Information asymmetry results in costly monitoring of firms (Diamond, 1984; Healy & Palepu, 2001). Diamond (1984) recognizes that monitoring is critically important and that reducing costs in the investment is also important. Prior studies on the determinants of internal rates of return in venture capital

and private equity investments have found that the more advice and monitoring provided contribute to a significant increase of the internal rate of return realized (Cumming and Walz, 2009).

Gompers (1995) finds that the information asymmetry in new startups makes monitoring and governance extremely important. His evidence further suggests that the staging of capital infusions provides opportunities to gather information and monitor the progress of the firm. This monitoring may lead to further investments, or abandoning a project. The shorter the duration between rounds of financing, the more frequent the monitoring of the project. While the duration of a round of financing is one method of monitoring, the total amount provided and the number of rounds are also important in staged investments (Gompers, 1995).

While monitoring protects the interest of the angel investor, value adding activities, such as a sounding board, business advisor, professional consultant, mentor, confidant, manager recruitment and supplier and customer recruitment, also require an investment in time (Sapienza, Manigart, & Vermeir, 1996). Research suggests that post-investment interaction is value adding (Chua & Wu, 2009). Since post-investment interaction is valuable to the entrepreneur and the angel investor, the implications of behavioral influences on interaction decisions are explored.

The same predictors included in Hypothesis 1 and 2 are included in Hypothesis 3, which consist of demographic measures, measures associated with experience, and measures associated with risk tolerance. The third testable hypothesis, stated in the null form is:

Hypothesis 3: There is no relationship between angel investor behavioral factors and interaction.

Independent Variables.

Demographics.

To better understand investors' decisions, demographics such as age, gender, education, and experience have been included in prior financial research (Becker-Blease & Sohl, 2011; Dwyer, Gilkeson & List, 2002; Fünfgeld & Wang, 2009; Harrison & Mason, 2007). These demographic characteristics may influence angel investor decisions. Early extensive research finds that most angel investors are middle-aged, wealthy males with college degrees, and later works confirm that the profile still holds (Gaston, 1989; Freear, Sohl & Wetzel, 1995; Maula, Autio & Arenius, 2005; Morrissette, 2007; Stedler & Peters, 2003).

Economic researchers examining factors that influence risky investments have found that age, wealth, education, and risk perception are predictors of investor decisions (Guiso, Haliassos, & Jappelli, 2002; Perraudin & Sorensen, 2000). Age, gender and education level are typical demographic considerations in the literature. Age has been determined to affect people's attitudes and behavior (Dohmen, Falk, Huffman, Sunde, Schupp, & Wagner, 2011). As investors age, they become more cautious, seek greater certainty, and are more reluctant to adopt new technologies (Akhter, 2003; Botwinick, 1973; Gilly & Zeithaml, 1985). The influence of age and experience on angel investors' behavioral decisions to spend time on due diligence are examined.

Gender differences in attitudes and behavior have been extensively studied in the psychology and investment literatures (Croson, & Gneezy, 2009; Powell & Ansic, 1997; Schubert, Brown, Gysler & Brachinger, 1999; Weber, Blaise & Betz, 2002). Studies report that men engage in more risk-taking than women (Hinz, McCarthy & Turner, 1997; Sunden & Surette, 1998). Additionally, men tend to display more overconfidence and rely more on themselves than others in their decisions (Barber & Odean, 2001; Lewellen, Lease & Schlarbaum, 1977; Lundeberg, Fox & Punčohař, 1994). Prior studies suggest that angel investors are 84-97% male (Gaston, 1989; Freear, Sohl & Wetzel, 1995). The informal venture capital market does not appear as a gender differentiated market; however, some researchers have suggested that sufficient gender-based issues, such as gender-based perceptions of risk and possible female support for female entrepreneurs, exists. Therefore, gender should be included in the analysis of angel investor decisions (Harrison & Mason, 2007; Olsen & Cox, 2001).

The education of angel investors falls into the demographic analysis. Several studies have found that angel investors are highly educated, with Aram (1989) finding that 82% of informal investors in the US have at least undergraduate degrees and 28-42% have graduate degrees (Aram, 1989; Gaston, 1989; Van Osnabrugge & Robinson, 2000). This is consistent with the theory of planned behavior that suggests a high level of education is likely to be positively associated with perceived behavioral control and with beliefs in one's own capability to make successful investments (Ajzen, 1985). Additionally, household portfolio theory also predicts a positive relationship between level of education and successful household investments in risky assets (Guiso, Haliassos

& Jappelli, 2002). Thus, demographic influences such as age, gender, and education may be factors that influence investors in risky projects and are examined by this research.

Experience.

The level of investing experience can affect investor returns and decisions. Studies examining previous investing experience of angels in other angel investments conclude that angels have varying levels of investment experience, with most studies revealing that angels, on average, invest in one deal every two years (Freear & Wetzel, 1991; Sullivan, 1991). Furthermore, recent successes/failures in investing can influence individuals' investment decisions. The psychology literature on systematic errors in the way people think indicates that people place too much emphasis on their recent experiences (Ritter, 2003).

In order for angel investors to continue investing, they have to have been reasonably successful. Many angels have achieved success as an entrepreneur (Van Osnabrugge, 2000). Success as an entrepreneur in building their own new ventures can lead to experience that adds value to the new ventures in which they invest. The number of years that the angel investor has been an entrepreneur is an angel investor experience factor in this analysis.

Angel investors who have prior experience in founding firms likely have more experience in firm valuation (Hsu, 2007). Prior experience in valuation can remove some information asymmetry and assist with successful deal construction. Additionally, those with more successful prior funding experience exhibit a track record that infers, or signals, quality of their experience and may lead to additional deals (Spence, 1973). The

number of firms previously founded by the angel investor is another angel experience variable.

The total number of exits an angel has experienced is examined as a component of experience. There are several ways that an angel investor can exit an investment. The exit can come from a shareholder buy back, through the sale of the company, or through an initial public stock offering (IPO). These successful exits generally require the company to be developed over a period of years. Unsuccessful exits would include those where a company was closed. The total number of exits an angel has experienced may signal prior success in angel investments which could influence investing decisions through primacy and recency effects.

To examine whether individual experience attributes are related to angel investing decisions, this dissertation examines these factors: years an angel investor has spent investing, years that an angel has been an entrepreneur, the number of firms an angel has founded, the number of previous investments an angel investor has made, and the number of previous exits that an angel has experienced as the components of experience.

Top-management-team experience.

Since the quality of the top management team (TMT) is associated with positive outcomes of the firm, angel assessment of top management prior experiences and backgrounds is essential to reducing information asymmetry and the related adverse selection problems. Seven questions that reveal information on the background and prior experience of the top management team are utilized:

- Has the top management founded and led other ventures; has the top management been successful in other ventures?
- Does the top management have significant large firm experience?
- Does the top management have significant technical expertise?
- Does the top management have significant management expertise?
- Does the top management have significant sales and marketing expertise?
- Does the angel not know about the details of the top management of the investment?

There is a natural linkage between TMT and firm performance (Hambrick & Mason, 1984). In addition to evaluating the TMT experience, angels must consider whether or not the TMT is one of the top three strategic challenges the business faces. Angels may determine that they may be able to assist in choosing or training the TMT members. Williamson (2000) suggests that new venture entrepreneurs seek advice from those nearest to them. Thus, it is possible that the TMT has limited experience; however, angels may believe that this may or may not hinder the investment. Whether or not management risk is considered to be a strategic risk of the investment is considered in this analysis.

Stage of the investment.

Angel investments are considered high-risk and often result in a wide array of investment returns (Van Osnabrugge, 2000; Wong, Bhatia & Freeman, 2009). Such returns can range from total losses of an investment to yields of 50% or more (Collewaert, 2012; Mason & Harrison, 2002; Preston, 2011). The perception of risk

varies across stages of the firm's development. Ruhnka & Young (1987) provide empirical evidence that the perceived risk of loss is highest in the seed stage and decreases in later stages. The decrease in the estimated risk of loss in succeeding stages of development should influence angel investor behavior towards the amount of money invested and time spent on due diligence.

Since angel investors tend to invest in ventures at the seed and startup stage (Mason & Harrison, 1995; Prowse, 1998; Wetzel, 1983), this dissertation examines the impact of seed and start-up stage and their influence on decisions to spend time on due diligence and the percentage of the angel investor's wealth invested in a project.

Syndication.

Angel investors use syndication, or the co-investing with other angel investors, to reduce individual angel risk by spreading risk over several investors versus taking on all the risk themselves (Wong, Bhatia & Freeman, 2009). This analysis uses the number of other investors that joined in the investment at the time the angel investor invested to determine if syndication influences the decision to spend time on due diligence and the percentage of the angel investor's wealth invested in a project.

Source of the deal.

Angel investors learn about potential investments through a variety of sources, such as previous friendship with the entrepreneur, referrals from friends, group screenings, and group presentations. A trust bias may be reflected in due diligence and

percent of wealth decisions. Other biases, such as herding, may be reflected in decisions regarding investments resulting from group screenings.

The initial screening stage filters out the majority of the proposals that angels receive (Mason & Harrison, 2003). Angels may receive written investment proposals, such as an executive summary of a business plan from an entrepreneur, another angel group, or a formal intermediary. During the initial screening, deals are considered for “fit”, or whether the deal meets the investor’s criteria, such as interest, stage of development, amount of funding sought, and location (Mason & Rogers, 1997). The screening process may occur over a relatively short time, sometimes less than ten minutes, and will be subject to due diligence later (Hall & Hofer, 1993; Mason & Rogers, 1997). The initial screening can be important because the majority of deals are rejected at this stage (Feeney, Haines, & Riding, 1999).

CHAPTER 3 – METHODOLOGY

This dissertation utilizes data from the Angel Investor Performance Project (AIPP), the largest data set on accredited angel investors available. It consists of responses from 86 investor groups with 539 investors who made 3097 investments from 1972 through 2007. The Ewing Marion Kauffman Foundation and the Angel Capital Education Foundation with Willamette University and the University of Washington initiated the research to gather the data, which was collected by Wiltbank & Boeker (2007). The survey is comprised of 83 questions and was designed to be completed in between 5 and 20 minutes (see Appendix A). Respondents were offered the opportunity to receive a notification of the aggregated statistics that were compiled from the results of the survey as well as a free copy of *The Entrepreneurial Initiative*, a book by the president and CEO of the Kauffman Foundation, Carl Schramm.

Though many researchers do not distinguish between angel investors and angel groups (DeGennaro & Dwyer, 2013), an important trend is emergence of angel investor groups (Wiltbank & Boeker, 2007b). Angel investor groups are comprised of angels who work together to consider investments, offer opinions and expertise, and join forces with their capital. Angel investors invested an estimated \$26 billion in entrepreneurial business in the United States in 2007, yet little is known about the individuals who play a crucial role in start-up capital (Angel Capital Education Foundation, 2013). Research on angel investors and angel groups has been limited due to the fact that suitably large

data sets have not been available (DeGennaro & Dwyer, 2013). For example, some studies, such as Goldfarb, Hoberg, Kirsch and Triantis (2009), utilize as few as 32 angel-only investments. The Kauffman Foundation's Angel Investor Performance Project on angel investments comprises data from 588 investments.

The angel investor survey was sent to 276 angel investor groups, asking their members to respond confidentially to an online questionnaire. Eighty-six groups participated in the survey and of those eighty-six groups, thirteen percent of members (539 angel investors) responded. Wiltbank & Boeker (2007) address the possible non-response problems with the survey data and provide evidence that the AIPP data are relatively free of these types of problems. They also address the problem of relatively low response rates by comparing within-groups returns and determine that the distribution is similar in high response rate groups to those with low response rates, thus providing little evidence of correlation of returns with reporting frequency.

Initially, a series of descriptive statistics are reported to describe the variables of interest as well as this sample of investors. These descriptive statistics consist of frequency tables for categorical variables and measures of central tendency, including the mean, and measures of variability for continuous measures.

Normalizing Variables

Examining data prior to analysis to test for outliers, normality and shape of the distribution is necessary to understand and interpret the results (Hair, Black, Babin & Anderson, 2010, p.77). Outliers are common in data and can have a substantial effect on the results. To detect and modify extreme observations, Winsorizing provides the

benefit of setting all outliers to a specified percentile of the data while retaining the ordering of the data and providing more robust estimators. For example, a 90% Winsorization would typically set all values above the 95th percentile of a variable to the 95th percentile and all values below the 5th percentile of the variable to the 5th percentile. Winsorizing involves the calculation of the mean after replacing given parts of a probability distribution or sample at the high and low end with the most extreme remaining values, typically doing so for an equal amount of both extremes.

Steps are taken in order to normalize the three continuous dependent variables used in these analyses (time spent on due diligence, percentage of wealth invested, and amount of post-investment interaction). All of these variables are first Winsorized to help produce a greater level of normality, which is an assumption of many of the tests conducted. Winsorization often replaces 10 to 25 percent of the ends (Tukey, 1977); however, in the AIPP data, due to very few extreme outliers, only 2.5 percent of the ends are replaced in the Winsorization. By Winsorizing the number of hours of due diligence, a reasonable estimate of central tendency is determined by excluding the one angel investor with 5,000 hours of reported due diligence. Although Winsorization of the number of hours of due diligence is useful, the percent of wealth and amount of post-investment interaction is not impacted much with Winsorization; thus their Winsorized versions were not utilized.

Missing data are a part of almost all research. There are several reasons data may be missing. They may be missing because data were entered incorrectly, equipment malfunctioned, or the respondent did not want to answer. For example, this dataset contains the year of birth, which is used for determining the age of the respondent at the

time of the investment. In one case, a zero was entered; therefore, it was recoded as missing. One respondent entered date of birth as “69,” which was recoded as 1969. One respondent listed 2005 as birth year. Because this is not logical, it was recoded as missing. On respondent level of education, the choices are 1=Bachelor’s, 2=Master’s, 3=JD, and 4=Ph.D. After consulting with Rob Wiltbanks, the author of the survey, it was determined that no angels selected the option for high school, which was also available. Listwise deletion was utilized as the treatment for missing data.

Analysis

Hypothesis 1.

Poisson regression.

The first hypothesis focused upon the impact of demographics, experience, and risk tolerance on the time spent on due diligence. The demographic factors include age, gender, and education level. The measures of investor experience consist of years spent investing, years as an entrepreneur, number of firms founded, total number of previous investments, total number of previous exits, and years of work experience within the same industry as the investment. The model also included as risk tolerance predictors the angel investor’s assessment of top management team (TMT) experience, whether the TMT is perceived as a strategic risk, the stage of the venture, and the number of co-investors, with number of hours spent on due diligence as the dependent variable.

Poisson regression was utilized in this analysis as it was beneficial in modeling count data with a Poisson distribution. Given only the average rate of time spent on due

diligence for a certain investment and assuming the mix of processes was random, the Poisson distribution specifies how likely it was that the due diligence time would be 15, 20, 25 or any other number of hours during one period of the observation. The Poisson regression thereby predicts the degree of spread around a known average rate of time spent on due diligence.

When data are in the form of counts, researchers often utilize suboptimal strategies, such as rescaling into categories such as 0-10, 10-20, and more than 20. Gardner, Mulvey, and Shaw (1995) suggest that reducing counts to categories wastes information, may dilute statistical power, and might affect results by the choice of cut-off point for the categories. The problems using linear regression with rate data is that the linear regression model has both the wrong model for the relationship between the predictors and the expected values of the counts and the relationship between the expected values and variances of the counts. Linear regression could possibly lead to wrong inferences about the predictors (Aitchison, & Dunsmore, 1980, p.114; Gardner, Mulvey & Shaw, 1995).

Hypothesis 2.

Tobit regression.

The second hypothesis focused upon whether a relationship exists between angel investor decision factors and the percent of wealth invested. The same predictors were included in these analyses as in the previous model, which consist of demographic measures and measures for investor experience and risk tolerance.

The Tobit analysis assumes that the dependent variable has a number of its values clustered at some minimum value and provides a technique to utilize all observations (including those at the limit and above it) to estimate a regression line. Other techniques estimate a line with the observations above the limit (Tobin, 1958).

Logistic regression.

A logistic regression was used to estimate the factors that influence the percent of wealth invested. The logit model was useful since the dependent variable is categorical and there were multiple independent variables. The logistic regression has the advantage when normality of variables is not met. It is also useful in cases where the participation data are not continuous or distributed normally. Thus, logistic regression does not face the strict assumptions and is more robust when the assumptions are not met (Hair, Black, Babin, & Anderson, 2010, p. 317-319).

Ordinary least squares (OLS).

Ordinary least squares (OLS) was utilized in analysis of the second hypothesis. The OLS estimation procedure provided a prediction of the dependent variable, percent of wealth invested, for each observation in the data. The procedure set the regression weights to minimize residuals. This allowed calculation of a single predicted value of the dependent variable regardless of the number of independent variables in the regression model. Thus, the predicted value represented the total of all effects of the regression and allowed the residuals to be used as a diagnostic measure for the overall regression model

(Hair, Black, Babin, & Anderson, 2010, p. 198). The benefit of the OLS regression result is in forecasting or predicting the percent of wealth to be invested in a project.

Hypothesis 3.

Poisson regression.

The third hypothesis focused upon the impact of demographics, experience, and risk tolerance on the amount of post-investment interaction between the angel and the venture. The demographic factors include age, gender, and education level. The measures of investor experience consist of years spent investing, years as an entrepreneur, number of firms founded, total number of previous investments, total number of previous exits, and years of work experience within the same industry as in the investment. The model also included as risk tolerance predictors the angel investor's assessment of top management team experience, whether the TMT was perceived as a strategic risk, the stage of the venture, and the number of co-investors, with the number of interactions per year as the dependent variable.

Tobit regression.

The third hypothesis examined the relationship between angel investor decision factors and the amount of post-investment interaction an angel performed. The same predictors were included in these analyses as in the previous models, which consisted of demographic measures and measures associated with investor experience risk tolerance.

Ordinary least squares (OLS).

OLS regression was also used as a robustness test of the third hypothesis. The OLS estimation procedure provided a prediction of the dependent variable, amount of interaction, for each observation in the data. The OLS regression result was beneficial in forecasting or predicting the amount of interaction that will be performed in an investment.

Summary

The focus of this analysis was on angel investor decision factors that might influence angel investors to invest in projects, as well as factors that influence amount of time spent on due diligence and post-investment interaction. The purpose of the present study was to better understand the role of behavioral finance influences and angel investors. The findings of this study may be generalizable to other investors who make decisions without the use of professional portfolio advisors. Additionally, having a better understanding of angel investor decisions with relation to the amount of time spent on due diligence might provide insights into important factors that should be considered when assessing the effectiveness of pre-investment decision processes among angel investors. Finally, further study into due diligence may offer additional insights into information asymmetry.

The data set utilized in this study consisted of responses from 86 investor groups with a total of 539 investors who made 3097 investments from 1972 through 2007. A series of descriptive statistics are conducted initially. The first hypothesis included in this study focused upon the relationship between angel investor decision factors and their due

diligence decisions. A Poisson regression was estimated in order to test this hypothesis. This analysis included due diligence as the outcome measure and incorporated angel demographics, variables focusing on angel experience, variables focusing upon assessment of TMT experience, perceived TMT risk, stage of the investment, number of co-investors, and source of the deal as predictors. The second hypothesis tested in this study focused upon the relationship between the foregoing angel investor behavioral factors and the percent of personal wealth an angel invested in a project. A Tobit regression was estimated in order to explore this hypothesis. Following this, logistic regression and a linear regression were conducted as robustness checks. The third hypothesis focused on the amount of post-investment interaction between the angel investor and the firm and the above angel investor behavioral factors. A Tobit regression was utilized in this estimation. Logistic regression and an OLS regression were estimated as robustness tests.

CHAPTER 4 – RESULTS

This chapter presents the results of the study. Because there are no legal reporting requirements for angel investors, insight into their decision-making process is sparse. This dissertation utilizes data from angel investors who are members of groups. Responses were received from 539 angel investors in eighty-six angel investor groups. Initially, a series of descriptive statistics were reported to provide a description of the data set as well as the individuals included in the study. A series of regression analyses was performed focusing on the following outcomes: amount of time spent on due diligence, percentage of wealth invested, and respondent's level of interaction with the company. Additionally, correlations were estimated between the respondent's level of interaction with the company and due diligence.

Descriptive Statistics

Table 1 defines the variables utilized in the analyses. Table 2 summarizes descriptive statistics of the continuous variables, including sample size, mean, standard deviation, minimum, and maximum.

Table 2 reports descriptive statistics for due diligence and percentage of wealth invested, with and without Winsorizing. Winsorizing was particularly useful in analyzing the number of hours of due diligence because of outliers. Of 277 angel investors responding to the due diligence question, the mean hours of due diligence is 60.6 hours with a standard deviation of 317.7 hours. However, one angel investor

reported 5,000 hours, and three reported 1,000 hours. These outliers influence the reported hours of due diligence. Because the data distribution reflected very small samples of respondents with a large range of hours of due diligence, the Winsorized version of the number of hours of due diligence was less sensitive to outliers, yet still provided a reasonable estimate of central tendency. The mean hours of due diligence after Winsorizing was 34.3 with a standard deviation of 48.8 hours.

Though the percentage of wealth an angel invested was not affected significantly by extreme outliers, for comparison the Winsorized version of percent of wealth is also depicted. The number of hours spent on due diligence was determined by asking the angel investor what is the “number of hours you spent on due diligence before investing?” The average respondent spent close to 61 hours on due diligence prior to investing, with a substantial variation in due diligence (per the standard deviation and range). The percentage of wealth invested has a mean of 14%, and a substantial variation (per the standard deviation and range). The number of post-investment interactions has a mean of close to 61 times per year, and a substantial variation.

Table 1

Summary of Variables

<u>Variable</u>	<u>Description</u>
Diligence	Number of hours of due diligence this investor conducted prior to making their investment
Wealthpercent	Percentage of their personal wealth the angel investor held in angel investments
Interaction (times per year)	Frequency of interaction (times per year) this angel investor had with this company: 365 =daily, 52 = weekly, 12 = monthly, 4 = quarterly, 1 = annually, 0 = rarely if at all

Demographics

log_age	Log of age at time of investment
gender	1 = male
edlevel	Highest level of education achieved by the angel investor: 1 = Bachelor's, 2 = Master's, 3 = JD, 4 = PhD

Angel Investor Experience

yearsinv	Number of years that the angel investor has been investing
yearsentre	Number of years that the angel investor has been an entrepreneur
numfounded	Number of firms the angel investor previously founded
totalinv	Total number of angel investments that the respondent has made
totalexits	Total number of angel investment exits that the respondent has experienced
TMT_experience	TMT_experience = 1 if: foundedledteam, earliersuccessteam, largfirmexpteam, techexpteam, mgmtexpteam, salesexpteam; otherwise 0
mgmtexpteam	Angel investor's assessment of the top management's experience as one of top three risks at the time of their investment, 1 = yes

Stage of the venture at the time of investment

Stage: Seed	1= yes, this venture was in the seed stage at the time of the Investment
Stage: Startup	1=yes, this venture was in the startup stage at the time of the Investment

Syndication

Co-investors	Number of other co-investors that joined in the investment in this venture at the time this angel investor invested.
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Source

sourcegroupscreen	This angel investor “sourced” this venture investment from the initial screening meeting of their group, 1 = yes; otherwise 0
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Mean respondent age was slightly above 62 years, with the youngest respondent being 34 years of age and the oldest 87. On average, the respondents had spent slightly over 10 years investing at the time these data were collected, with a range from no experience to 49 years of experience. Mean time spent as an entrepreneur was slightly over 15 years, with a range from 0 to 50 years. Mean number of firms founded was slightly below three, with a range between 0 to 23 firms. The average respondent made close to 13 total investments, with a range from zero to 200 investments. An angel investor exit occurs when the investment is considered to end. These so-called “exits” include acquisitions by other companies or other investors, initial public offerings, and firm closures during the investment. These data represent exits that spanned the last two decades (with most exits occurring since 2004). The mean number of exits was slightly above five, with a range between 0 and 50.

Table 2

Descriptive Statistics: Continuous Variables

<u>Variable</u>	<u>N</u>	<u>Mean</u>	<u>SD</u>	<u>Min</u>	<u>Max</u>
<i>Outcomes</i>					
Due Diligence	277	60.625	317.696	0	5000
Due Diligence (Winsorized)	277	34.325	48.850	2	200
Wealth Percent	716	13.901	15.781	0	100
Wealth Percent (Winsorized)	716	13.652	14.664	1	70
Interaction (times/year)	289	60.760	123.232	0	365
<i>Predictors</i>					
Age	788	62.481	9.708	34	87
Age (Log)	788	4.122	0.163	3.526	4.466
Years Investing	814	10.484	9.381	0	49
Years Entrepreneur	769	15.293	11.028	0	50
N Firms Founded	769	2.860	3.388	0	23
Total Investments	885	12.954	16.143	0	200
Total Exits	949	5.148	9.608	0	50

Table 3 reports descriptive statistics for categorical variables. A frequency table was constructed reporting the sample sizes and percentages associated with each category of response for each variable. An angel investor's continued interaction with a company after the initial investment consists of coaching, mentoring, financial monitoring, and other forms of assistance. Responses to the amount of interaction consisted of daily,

weekly, monthly, quarterly, annually, or rarely/never. The category most commonly cited for interaction between the angel investor and the company was quarterly, with slightly over 28% of respondents providing this response. The least noted category was annually (slightly above 7%).

Approximately 87% of the sample was male. Nearly 55% of respondents had a Master's degree, 28% a Bachelor's degree, 10% a Ph.D., and 6% a JD. Only approximately 10% of respondents had some level of managerial experience, with most not having any. VC investment measured whether this venture took on venture capital prior to the exit event. This was found to be the case in approximately 15% of cases. Angel investors sourced the venture from a screening meeting of an angel group close to 65% of the time.

Table 3

Descriptive Statistics: Categorical Variables

<u>Measure</u>	<u>N</u>	<u>%</u>
<i>Gender</i>		
Female	105	13.08
Male	698	86.92
Total	803	100.00
<i>Education</i>		
Bachelors	213	28.44
Masters	413	55.14
JD	47	6.28
PHD	76	10.15
Total	749	100.00
<i>Top Management Team (TMT) Experience</i>		
No	1,163	90.09
Yes	128	9.91
Total	1,291	100.00
<i>Stage: Seed</i>		
No	1,166	90.32
Yes	125	9.68
Total	1,291	100.00

Stage: Startup

No	1,118	86.60
Yes	173	13.40
Total	1,291	100.00

Source: Group Screening

No	188	35.40
Yes	343	64.60
Total	531	100.00

Initial Models

This analysis utilized those variables necessary to examine the influencers of angel investor behavior based on the literature. Because data concerning angel investing are difficult to attain—and the data set used here is the largest dataset available—this analysis with observations ranging from 134 to 641 compares favorably with other studies, such as Goldfarb, Hoberg, Kirsch, and Triantis (2009), which utilizes 32 angel investments, and Chua and Wu (2009) using a sample size of 57.

Poisson and Tobit regressions were estimated, along with logistic regressions and OLS regressions. The logistic regressions and OLS regressions were primarily conducted for purposes of robustness tests. While these results are not reported in this chapter, the analyses can be found in Appendix B. Inferences based on the supplemental analysis are similar to those described subsequently, suggesting the results are robust across empirical specifications.

Panels A and B of Table 4 summarize the results of the Poisson regressions, with due diligence as the outcome. In panel A, six models were estimated in total, first with all experience variables and then with each measure of experience separately. The pseudo R^2 ranged from 0.03 to 0.18.

With regard to the model conducted with *all* experience variables, the coefficients on the log of age, the number of years spent as an entrepreneur, the number of firms founded, and the total number of exits are statistically significant. A statistically significant change in due diligence was found to be associated with reduced age, as well as a greater number of years spent as an entrepreneur, a greater number of firms founded, and a greater number of total exits taken. Specifically, for each additional year of age, the angel performs approximately one hour less of due diligence.

The second model in panel A included only years of investing experience out of all experience variables. In this model, log of age failed to achieve statistical significance, but statistical significance was indicated with respect to the number of years spent investing. Specifically, a statistically significant change in due diligence was associated with a greater number of years spent investing. In this model, respondent gender was also found to achieve statistical significance: male investors spent a greater amount of time on due diligence than female investors. The remaining models in panel A also indicated males spent an average of about 16-17 hours more on due diligence than females. For each additional year of investing experience, angels spent one additional hour on due diligence.

The subsequent model focused on years spent as an entrepreneur. Statistical significance was found with respect to the log of age, and respondent gender, as well as

the number of years spent as an entrepreneur. Specifically, a statistically significant change in due diligence was associated with reduced respondent age, male respondents, and a greater number of years as an entrepreneur. For each additional year an angel has spent as an entrepreneur, they perform about 1.3 hours in additional due diligence.

The fourth model focused on the number of firms founded. Statistical significance was obtained for respondent gender as well as the number of firms founded. As in the previous models, male respondents were found to spend a greater amount of time on due diligence as compared with female respondents, and a greater number of firms founded was associated with augmented due diligence. The number of firms previously founded indicated that for each additional firm the angel had founded resulted in around 2.3 to 3 additional hours of time spent on due diligence.

The following model focused on the total number of investments. Statistical significance was again found for respondent gender and also indicated with respect to the total number of investments made. The results of this analysis indicated that a greater amount of due diligence was associated with male respondents as well as a greater total number of investments.

In the final model in panel A, total exits were focused on among the set of experience measures. Findings of this analysis indicated that a statistically significant change in due diligence was associated with male respondents compared with female respondents, and greater due diligence was related to a greater number of total exits experienced. The discrete change in probability for each of the values observed is the average marginal effects (AME). The AME reflects for each additional exit the angel has experienced, he will perform and about 1.4 additional hours of due diligence.

These results suggest that angel investors' years investing, years entrepreneurial experience, number of firms founded, total previous investments, and total exits influence angels to conduct more time on due diligence. These results are *inconsistent* with prior studies that suggest entrepreneurs are more susceptible to cognitive biases than are non-entrepreneurs (Busenitz & Barney, 1997; Forbes, 2005). Busenitz and Barney (1997) contend that "those who are more susceptible to the use of biases and heuristics in decision making are the very ones who are most likely to become entrepreneurs." These cognitive biases are thought processes that include erroneous assumptions and inferences and are a natural and common phenomenon. Although these biases and heuristics represent shortcuts that can help deal with large volumes of information, they can interfere with effective decision making. Biases and heuristics associated with additional experience should have indicated less time on due diligence as experiences increased.

Research has not concluded whether entrepreneurs are a "certain kind of individual" inclined to favor instinct and spontaneity, or if entrepreneurs are accustomed to resorting to cognitive biases when experiencing conditions of information overload, high uncertainty, and time pressure (Forbes, 2005). In the case of angel investors, prior experience as an entrepreneur, a greater number of firms founded, a greater number of investments, and a greater number of total exits may have provided sufficient exposure to the challenges of new start-ups, thus tempering angels' initial judgment about their knowledge and overcoming their potential susceptibility to overconfidence bias.

Given that younger angel investors performed more time on due diligence than older angel investors, younger angel investors may have had less time than their older

counterparts to develop biases or may have realized the impact of judgmental errors on their overall portfolio, thereby mitigating their tendency to overestimate their knowledge.

Education was not significant in the models. This may be due to a lack of variation in education of the angel investors in our sample, as almost all investors in our sample have a high level of education. The lowest level reported by responding angels was a Bachelor's degree.

In the Table 4 regressions, an angel investor's time spent on due diligence changed dynamically with his experience level. Younger angels with less experience performed more due diligence prior to investing. Then, the results suggest that angel investors with more experience perform more due diligence. This could be interpreted as angels were not overconfident when they began to invest and thus performed more due diligence. Then, as the angels aged and gained experience, they performed less due diligence. Finally, they tended to develop a more realistic assessment of their abilities as they gained increased experience through their years as an entrepreneur, the number of firms founded, and the number of exits experienced. This finding is consistent with Gervais and Odean (2001), who find that traders become overconfident, learn about their abilities, and then better recognize their true ability later.

Table 4 Panel A

Due Diligence - Poisson regressions

Variable	model with all experience variables	with yearsinv experience only	with yearsentre experience only	with numfounded experience only	with totalinv experience only	with totalexits experience only
Age (Log)	-1.18** (-2.17) [-40.15]	-0.58 (-1.08)	-1.02* (-1.92) [-34.64]	-0.24 (-0.49)	-0.22 (-0.42)	-0.25 (-0.48)
Gender	0.26 (1.26)	0.47** (2.32) [15.70]	0.48** (2.24) [16.45]	0.52** (2.47) [17.59]	0.47** (2.38) [16.23]	0.49** (2.38) [16.82]
Education	-0.08 (-0.85)	-0.06 (-0.59)	-0.09 (-0.92)	-0.06 (-0.52)	-0.03 (-0.31)	-0.03 (-0.30)
Years Investing	0.01 (0.77)	0.03*** (3.07) [1.01]				
Years Entrepreneur	0.02** (2.21) [0.83]		0.04*** (3.83) [1.32]			

N Firms Founded	0.07*** (4.03) [2.31]			0.09*** (5.41) [3.04]		
Total Investments	-0.02 (-0.97)				0.01** (2.23) [0.50]	
Total Exits	0.04** (1.97) [1.39]					0.04*** (4.15) [1.38]
Constant	7.64*** (3.55)	5.32** (2.52)	6.86*** (3.31)	3.87** (1.99)	3.92* (1.85)	4.01** (1.98)
Observations	246	248	249	249	247	249
Pseudo R ²	0.18	0.07	0.11	0.13	0.03	0.05

Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics are in parentheses. AMEs - average marginal effects are the discrete changes from the base levels and are displayed in brackets [] for statistically significant coefficients.

Next, panel B of Table 4 reports the results of the Poisson regression models on due diligence with additional predictors. As before, the outcome measure in all models is the number of hours on due diligence. Here, three Poisson models were estimated in total, consisting of the following: a model focusing on demographics, angel investor's experience, angel perception of the TMT experience, and number of co-investors. Then a model with the same variables as the first model along with the stage of the investment and whether the angel perceived the TMT as a strategic risk at the time of the investment was performed. Finally, a model that consisted of demographics, angel experience, angel perception of the TMT experience, number of co-investors, stage of the investment when the angel invested, and source of the investment as predictors was tested. The pseudo R^2 for the panel B regressions were 0.19, 0.28 and 0.27, respectively.

With regard to the first model with additional variables, statistical significance was indicated with respect to the log of respondent age, years spent as an entrepreneur, and number of firms founded. Results of this model indicated a statistically significant change in due diligence was associated with reduced respondent age, a greater number of years spent as an entrepreneur, and a greater number of firms founded which led to more time spent on due diligence. Specifically, for each additional year of age, the angel investor performed about 45 minutes less on due diligence. For each additional year as an entrepreneur, the angel performed almost an additional hour on due diligence. And, for each additional firm the angel had founded, he performed a little over 2 hours additional due diligence.

The second Poisson regression model conducted focused on management and stage of the investment risk. In this model, statistical significance was indicated with

respect to the log of respondent age, number of years spent investing, number of firms founded, and greater perceived strategic risk posed by the management team, as well as seed stage and startup stage measures. Findings of this model indicated a statistically significant change in due diligence was associated with reduced respondent age, a greater number of years spent investing, a greater number of firms founded, and a greater perceived strategic risk as posed by the management team, as well as the venture not being in the seed or startup stages. The AME indicate that for each additional year of investing experience, the angel spends about an additional hour and 20 minutes on due diligence. When the angel perceives the TMT to be a strategic risk, he perform about 20 additional hours on due diligence. When the investment is in the seed stage, angels perform about 22 hours less due diligence. When the investment is in the startup stage, the angel performs about 26 hours less due diligence. The reduced due diligence in these stages may be a result of less financial data to examine due to the early stages.

The third model estimated incorporated group screening as a source measure. If the source of the investment was determined through the angel group's initial screening efforts versus from a referral from a friend, referral from a professional, or a previous working relationship, then the deal might have more information asymmetry.

In this model, statistical significance was indicated with respect to number of years spent investing, number of firms founded, and source being a group screening. Specifically, for each year of investing experience, the angel spent about an additional hour on due diligence. When the deal source was a group screening the angel spent about 22 less hours on due diligence.

These results also suggest that younger angel investors spent more time on due diligence than older angel investors. Angels with more experience spend more time on due diligence, perhaps because they are more aware of the importance of due diligence. Angels investing after a group screening performed less due diligence, which may indicate that group screening allows more efficient due diligence. It is also possible that angels were motivated by something other than reducing information asymmetry and increasing return on investment. Their decisions might have been affected by more status or social responsibility associated with committing to an investment with their peer angels. Angels might have been willing to accept more risk to achieve such goals (i.e., Statman, 2008).

The influence of herding behavior is also considered. This behavior would be characterized by whether or not angels were influenced by other angels investing in a project. If investors commit errors only at an individual level, then the error would be neutralized given they are randomly distributed, causing the angel investing market to be efficient. However, if after a group presentation, the individual investors decide to invest based on the group behavior that may have contained errors, this investing behavior - that increases based on the number of previous adopters - is known as herding and is based on cognitive error and is irrational (Szyszka, 2008; Welch, 1999). The final due diligence model in panel B indicates that the number of co-investors is significant; however, angels perform *more* due diligence when more investors are involved; thus, herding behavior does not appear to be an influence in due diligence decisions.

Angel investors rely on deal referrals from many sources. Some sources may be more informationally reliable than others, thus reducing investment risk (Aram, 1989;

Wetzel, 1986). Angel investors in this case did not expect to be defrauded and were not what finance theorists would consider “rational expectations” investors; rather, they were “trusting investors” (Stout, 2010). Trust is an important force in explaining investor behavior, and many investors base their investments on trust. However, the trust model of behavior explains bubbles by suggesting that they occur when investors do not pay attention to fundamentals (Stout, 2010). In this model, angel investors perform less due diligence when the deal was sourced from a group screening.

Table 4 - Panel B

Due Diligence - Poisson regressions

Variable	model with additional variables	mgmtrisk	source
Age (Log)	-1.14* (-1.92) [-39.54]	-1.19* (-1.89) [-39.25]	-0.97 (-1.53)
Gender	0.02 (0.08)	0.17 (0.54)	-0.05 (-0.19)
Education	-0.00 (-0.04)	-0.08 (-0.69)	-0.00 (-0.04)
Years Investing	0.00 (0.20)	0.04** (2.22) [1.35]	0.03** (2.24) [1.11]
Years Entrepreneur	0.02* (1.81) [0.82]	0.02 (1.29)	0.02 (1.05)
N Firms Founded	0.07*** (4.01) [2.39]	0.06*** (3.07) [2.05]	0.05*** (3.16) [1.69]
Total Investments	-0.00 (-0.31)	0.00 (0.31)	0.01 (0.87)
Total Exits	0.01 (0.53)	-0.02 (-0.93)	-0.03 (-1.18)
TMT Experience	-0.07 (-0.39)	-0.34 (-1.34)	-0.26 (-1.01)
Management Risk		0.61** (2.43) [20.13]	

Stage: Seed		-0.67** (-2.57) [-22.18]	-0.27 (-1.10)
Stage: Startup		-0.79*** (-2.93) [-26.04]	-0.37 (-1.51)
Co-investors	-0.04 (-1.47)	-0.01 (-0.25)	-0.01 (-0.34)
Source: Group Screening			-0.69** (-2.39) [-22.08]
Constant	7.77*** (3.24)	8.00*** (3.13)	4.73 (1.27)
Observations	193	135	164
Pseudo R ²	0.19	0.28	0.27

Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics are in parentheses. AMEs - average marginal effects are the discrete changes from the base levels and are displayed in brackets [] for statistically significant coefficients.

Summarized in panels A and B of Table 5 are results of the Tobit regressions focusing on the percentage of wealth invested. Panel A consisted of six Tobit regression models: a model with all experience variables, with solely years investing experience, with solely years spent as an entrepreneur experience, with solely the number of firms founded experience, with solely the total number of investments experience, and with

solely the total exits experience. Panel A of Table 5 had a pseudo R^2 range from 0.01 to 0.03.

First, with regard to the Tobit regression model conducted with all experience variables, statistical significance was indicated with respect to the log of respondent age, number of years spent investing, number of years spent as an entrepreneur, number of firms founded, and total number of investments. Specifically, a statistically significant change in percentage of wealth invested was associated with reduced respondent age, a greater number of years spent investing, a greater number of years spent as an entrepreneur, a greater number of firms founded, and a greater number of total investments.

The second model focused specifically on number of years of investing experience. In this model, statistical significance was indicated with respect to the log of respondent age and respondent gender, as well as the number of years spent investing. A statistically significant change in percentage of wealth invested was associated with reduced respondent age, male respondents, and a greater number of years spent investing.

The number of years spent as an entrepreneur was the focus of the third model. Age and gender were again found to achieve statistical significance, as well as the number of years spent as an entrepreneur. Specifically, a greater percentage of wealth invested was associated with reduced respondent age and male respondents. A greater percentage of wealth invested was also associated with a greater number of years spent as an entrepreneur.

The fourth Tobit regression model focused on the number of firms founded among the predictors relating to experience. Significance was indicated with respect to

respondent age and gender, and the number of firms founded was also found to achieve statistical significance in this model. As in the previous two models, a greater percentage of wealth invested was found to be associated with reduced respondent age and male respondents, as well as a greater number of firms founded.

In the fifth model, the total number of investments was focused on among the set of predictors associated with investing experience. Statistical significance was indicated with respect to respondent age and gender, as in the previous three models, and significance was also found for the total number of investments made. The results with respect to respondent age and gender were in the same direction as the previous three models, with a greater percentage of wealth invested associated with reduced respondent age and male respondents. Furthermore, it was also indicated that a greater number of total investments was associated with an increased percentage of wealth invested.

The final model in panel A focused on the total number of exits with respect to the set of predictors associated with investing experience. In this model, significance was again indicated with respect to respondent age and gender, and significance was shown with respect to the total number of exits. A greater percentage of wealth invested was again associated with reduced respondent age and male respondents, with a greater number of total exits also found to be associated with a greater percentage of wealth invested.

Younger angel investors invested a larger percentage of their wealth; however, this may be a factor of not having as much total wealth as older investors. Experience associated with years investing, years an entrepreneur, and the number of firms founded appeared to contribute to angel confidence in investing a larger percentage of wealth in

an investment. However, these experience variables were also associated with greater due diligence, therefore, possibly confirming that angels are learning from their experiences, performing more due diligence and investing a larger percentage of wealth as they gain experience.

Table 5 - Panel A

Percentage of Wealth - Tobit regressions

Variable	model with all experience variables	with yearsinv experience only	with yearsentre experience only	with numfounded experience only	with totalinv experience only	with totalexits experience only
Age (Log)	-24.19*** (-5.81)	-20.10*** (-4.96)	-20.52*** (-4.78)	-12.63*** (-3.04)	-12.84*** (-2.76)	-12.80*** (-3.04)
Gender	0.78 (0.71)	1.95* (1.73)	2.83** (2.13)	2.97** (2.33)	2.52* (1.89)	2.83** (2.18)
Education	0.06 (0.09)	0.60 (0.89)	-0.04 (-0.05)	-0.46 (-0.65)	0.17 (0.22)	0.32 (0.40)
Years Investing	0.62*** (6.01)	0.78*** (8.16)				
Years Entrepreneur	0.10* (1.92)		0.44*** (7.93)			
N Firms Founded	0.76*** (2.97)			1.32*** (4.83)		
Total Investments	0.20* (1.93)				0.34*** (2.86)	
Total Exits	-0.20 (-1.29)					0.60*** (5.27)
Constant	101.39*** (5.99)	85.92*** (5.20)	89.35*** (5.09)	60.28*** (3.58)	60.43*** (3.25)	61.16*** (3.54)

Observations	631	637	639	639	637	641
Pseudo R ²	0.03	0.03	0.01	0.01	0.01	0.01

Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics in parentheses.

Shown in panel B of Table 5 are the results of the Tobit regressions on the percentage of wealth invested with additional independent variables. Three models were estimated in total. First the table reports on a model focusing on demographics, angel investor's experience, angel perception of the TMT experience, and the number of co-investors. Next, a model with the same variables as the first model along with the stage of the investment and whether the angel perceived the TMT as a strategic risk at the time of the investment was estimated. Finally, a model that consisted of demographics, angel experience, angel perception of the TMT experience, number of co-investors, stage of the investment when the angel invested, and the source of the investment as predictors was estimated. The pseudo R^2 in the panel B regressions were 0.05, 0.07 and 0.06, respectively.

With regard to the first model, statistical significance was indicated with respect to the log of respondent age, number of years spent investing, number of years the angel had been an entrepreneur, and angel investor's perception of TMT experience. Specifically, a statistically significant change in the percentage of wealth invested was found to be associated with younger investors, a greater number of years spent investing, a greater number of years as an entrepreneur, and when the TMT was perceived to have more experience.

In the second model in panel B, which focused on management as a strategic risk and the stage of the investment risk, statistical significance with the log of investor age, number of years spent investing, number of years spent as an entrepreneur, and number of co-investors was obtained. Specifically, a greater percentage of wealth invested was associated with reduced respondent age, a greater number of years spent investing, and a

reduced number of co-investors. These results suggest that herding may not be an influence on percentage of wealth invested.

Consistent with prior literature, the results indicate that TMT experience was a key factor in a deal (MacMillan, Zemann, & Subbanarasimha, 1987; Van Osnabrugge & Robinson 2000). Sudek (2006) found that angel investors looked for a track record of previous success in the TMT. Study results suggested that angels value previous successful experience on the part of the TMT and would invest a larger percentage of their wealth when managers fit this criterion.

Finally, in the third Tobit regression model, statistical significance was achieved with respect to the log of respondent age, education level of the angel, number of years spent investing, and number of years spent as an entrepreneur. In this model, it was found that a greater percentage of wealth invested was associated with reduced respondent age, reduced level of education, a greater number of years spent investing, a greater number of years spent as an entrepreneur.

The results of the percentage of wealth invested analyses suggested that greater investment was associated with a reduced angel investor age. Though this may be from overconfidence in younger angel investors, it is more likely a result of older investors having more total wealth. As such, the amount invested by younger investors may have been the same as that invested by older investors; yet it likely represented a larger percentage of their total wealth. Several studies find that both men and women exhibit overconfidence; however, men are generally more overconfident than women (Barber & Odean, 2001). Barber and Odean (2001) also find that men trade more often than women and tend to have a lower investment performance. This analysis suggested male angel

investors invested a larger percentage of wealth than females. Though a greater percentage of wealth invested was associated with reduced level of education, it must be noted that all the angels in this analysis were well-educated, with none of the respondents reporting less than a bachelor's degree.

Angel investor experience proxies, including a greater number of years spent investing, years spent as an entrepreneur, firms founded, and total investments, resulted in a greater percentage of wealth invested. This experience-based influence on the decision to invest a larger percentage of wealth may have been the result of recency. Recency refers to the situation where events that are most recent have a memory advantage over items retrieved from long-term memory. The investor who has invested in deals and has been successful may remember these events positively and invest in additional deals. The influence of investor past success can lead to overconfidence, less diversification, and more risk taking (Merkle, 2012).

Table 5 - Panel B

Percentage of Wealth - Tobit regressions.

Variable	model with additional variables	mgmtrisk	source
Age (Log)	-23.65*** (-3.43)	-17.75** (-2.23)	-18.97** (-2.53)
Gender	-0.81 (-0.42)	-1.45 (-0.80)	-1.76 (-0.99)
Education	-0.86 (-0.87)	-1.62 (-1.37)	-1.94* (-1.90)
Years Investing	0.63*** (3.25)	1.09*** (4.71)	1.10*** (4.51)
Years Entrepreneur	0.26*** (2.69)	0.18 (1.57)	0.28*** (2.82)
N Firms Founded	0.39 (1.15)	0.54 (1.54)	0.36 (1.00)
Total Investments	0.19 (1.27)	0.26 (1.65)	0.07 (0.41)
Total Exits	-0.26 (-0.95)	-0.33 (-1.21)	-0.19 (-0.68)
TMT Experience	3.99* (1.72)	0.11 (0.03)	
Management Risk		-0.28 (-0.13)	1.20 (0.40)
Stage: Seed		-1.87 (-0.57)	-1.57 (-0.67)
Stage: Startup		-1.94 (-0.75)	-1.07 (-0.49)
Co-investors	-0.28 (-1.39)	-0.40*** (-2.66)	-0.31 (-1.25)
Source: Group Screening			2.36 (0.76)
Constant	100.59*** (3.58)	79.75** (2.39)	83.79*** (2.73)
Observations	192	135	163

Pseudo R^2	0.05	0.07	0.06
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Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics in parentheses.

Depicted in panels A and B of Table 6 are results of the Poisson regressions focusing on post-investment interaction, measured as the number of interactions per year. In panel A, six regression models were estimated: a model with all experience variables, with solely years spent investing, with solely years spent as an entrepreneur, with solely the number of firms founded, with solely the total number of investments, and with solely the total number of exits with respect to the experience measures. The pseudo R^2 ranged from 0.02 to 0.17 for the regressions in panel A.

The model incorporating all experience variables revealed statistical significance with respect to the number of years spent investing only. Specifically, a statistically significant change in the amount of years investing, years as an entrepreneur, and number of firms founded experience were associated with greater interaction. The second model focused on the number of years spent investing with regard to these experience measures. The results of this model indicated statistical significance with regard to the number of years spent investing, with a greater amount of experience associated with more years investing experience. For both models the average marginal effects (AME) indicate that for each additional year of investing experience, the angel will provide approximately three additional interactions per year with the firm.

The third model focusing on the number of years spent as an entrepreneur revealed that a greater number of years spent as an entrepreneur was associated with a greater amount of interaction. The AMEs suggest that for every additional year of entrepreneurial experience, an angel provides approximately 2.6 additional interactions with the firm each year.

The number of firms founded was the focus of the fourth Poisson regression. Statistical significance was obtained with regard to this predictor, with a greater number of firms founded associated with a greater amount of interaction. The AME reflects one additional interaction per year for each additional firm that the angel has founded. In the final two models, focusing upon the total number of investments and the total number of exits, respectively, no statistically significant results were found.

Table 6 Panel A

Post Investment Interaction - Poisson regressions						
Variable	model with all experience variables	with yearsinv experience only	with yearsentre experience only	with numfounded experience only	with totalinv experience only	with totalexits experience only
Age (Log)	-0.58 (-0.60)	0.13 (0.15)	-0.02 (-0.02)	0.98 (1.02)	1.22 (1.27)	1.21 (1.26)
Gender	-0.11 (-0.24)	-0.01 (-0.02)	0.12 (0.25)	0.18 (0.39)	0.17 (0.37)	0.19 (0.40)
Education	-0.04 (-0.37)	0.04 (0.35)	0.04 (0.30)	0.04 (0.29)	0.10 (0.79)	0.10 (0.78)
Years Investing	0.05*** (3.97) [3.28]	0.05*** (4.13) [3.07]				
Years Entrepreneur	0.03** (2.09)		0.04*** (3.50) [2.64]			
N Firms Founded	0.05** (2.33) [2.93]			0.06*** (2.87) [1.06]		

Total Exits	-0.02 (-0.45)					0.01 (0.69)
Constant	5.91 (1.53)	3.00 (0.82)	3.41 (0.89)	-0.33 (-0.08)	-1.22 (-0.31)	-1.22 (-0.32)
Observations	242	244	245	245	243	245
Pseudo R ²	0.17	0.10	0.08	0.05	0.02	0.02

Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics are in parentheses. AMEs - average marginal effects are the discrete changes from the base levels and are displayed in brackets [] for statistically significant coefficients.

Panel B of Table 6 reports the Poisson regression results focusing upon post-investment interaction with additional predictors. Three models similar to those in Panel B of Table 5 were estimated. The pseudo R^2 in the panel B regressions were 0.21, 0.31, and 0.26, respectively.

With regard to the first Poisson regression model in panel B of Table 6, statistical significance was indicated with respect to number of years spent investing, total number of firms founded, and number of co-investors. A greater amount of post-investment interaction was associated with greater number of years spent investing, greater number of firms founded, and reduced number of co-investors. The AME indicate that for each additional year of investing experience the angels have, they will provide approximately 2.7 additional interactions with the firm. For each additional firm the angel has founded, he will provide about 2.5 additional interactions with the firm; and for each additional co-investor that is involved in the deal, the angel will provide over six fewer post investment interactions with the firm.

In the second regression model focusing on measures relating to management risk and the stage of the investment as risk predictors, statistical significance was indicated with respect to the number of years spent investing, number of years as an entrepreneur, number of firms founded, total previous investments, and management team perceived as a strategic risk. An increased amount of post-investment interaction was associated with increased years investing, increased years as an entrepreneur, increased number of firms founded, fewer total investments, and when management is perceived a strategic risk. Specifically, the AME indicate that for each additional investment the angel is involved in, the angel will provide approximately three less

interactions per year. This finding may be a result of available time when angels are involved in additional deals. The AMEs for angels reporting that they perceive the TMT to be a strategic risk indicates that the angel will perform 55 more interactions per year. These additional interactions may be for assistance in training the TMT or may be angels way of monitoring. These results suggest that experience assisted the angel investor in getting involved after the investment. This may have been to share knowledge with the entrepreneur and assist the venture to success. Additional interaction with the venture when the management team was perceived to be a strategic risk may suggest that angels perceived that they were capable of training existing managers or replacing them to insure the business succeeds. Angels investing after determining that the management team was a strategic risk suggests that angel investors believed they could overcome the problem, an indicator of confidence in their abilities. Contributing more post-investment interaction when there were fewer co-investors may be out of necessity: there are fewer co-investors to share in the responsibilities.

The final model incorporating variables associated with the source of the deal found statistical significance with respect to the number of years investing experience. Specifically, a greater amount of post-investment interaction was associated with the number of years investing experience. Economically, when angel investors invest in a deal, they will interact with the venture about 2.4 more times per year for each additional year of investing experience they have.

In these analyses, angel investors appear to have learned from prior investing experiences how much value they could add to the investment through providing additional post-investment interaction. Angel investing is unique in this aspect of

investing. Post-investment interaction is often not an option in other types of investing. However, angels can utilize their skills and previous experiences to provide post-investment interaction to improve the performance of the venture.

Table 6 - Panel B

Post investment interaction - Poisson regressions

Variable	model with additional variables	mgmtrisk	source
Age (Log)	0.32 (0.29)	-0.22 (-0.17)	0.21 (0.18)
Gender	-0.50 (-1.38)	-0.38 (-1.16)	-0.45 (-1.18)
Education	-0.09 (-0.75)	-0.19 (-1.21)	-0.06 (-0.44)
Years Investing	0.04*** (2.97) [2.69]	0.04* (1.82) [2.77]	0.04** (2.36)
Years Entrepreneur	0.03 (1.53)	0.04* (1.73) [3.20]	0.02 (0.81)
N Firms Founded	0.03** (2.12) [2.53]	0.04* (1.95) [3.00]	0.03 (1.31)
Total Investments	-0.01 (-0.63)	-0.04** (-2.16) [-3.15]	-0.01 (-0.45)
Total Exits	-0.05 (-1.13)	-0.05 (-0.78)	-0.04 (-0.80)
TMT Experience	0.30 (1.11)	0.44 (1.41)	0.23 (0.65)
Management Risk		0.75** (2.47) [55.58]	

		-0.62 (-1.46)	0.03 (0.07)
Stage: Seed			
		-0.25 (-0.63)	0.27 (0.68)
Stage: Startup			
	-0.09* (-1.93) [-6.26]	-0.06 (-1.14)	-0.07 (-1.29)
Co-investors			
			-0.83 (-1.62)
Source: Group Screening			
	3.11 (0.70)	5.23 (1.01)	3.51 (0.74)
Constant			
	185	134	162
Observations			
	0.21	0.31	0.26
Pseudo R ²			

Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics are in parentheses. AMEs - average marginal effects are the discrete changes from the base levels and are displayed in brackets [] for statistically significant coefficients..

Correlations between Interaction and Due Diligence

Finally, correlations were conducted between the measure of interaction and due diligence. First, a Spearman's correlation was estimated between interaction and due diligence. This correlation is large and significant, $\rho(252) = .5583, p < .001$. This result

indicated that a greater amount of time spent on due diligence was associated with more frequent interaction. Another Spearman's correlation was estimated for post-investment interaction and due diligence with the Winsorized version of due diligence. An almost identical result was obtained, $\rho(252) = .5582, p < .001$.

Summary

This chapter presented the results of the study. Initially, a series of descriptive statistics were computed. The focus of these analyses was on measures of central tendency and variability for the continuous items included in the investigation. Also included was a frequency table, reporting the sample sizes and percentages associated with each response category for the categorical measures. Then, several sets of regression analyses were estimated focusing on the outcome variables of number of hours spent on due diligence, percentage of wealth invested, and level of interaction the angel investor had with the company. Spearman correlations were also conducted between the level of post-investment interaction and due diligence. Overall, significant results are found in the regression models. Findings will be discussed in further detail in the following chapter, which will also serve to relate these findings to previous literature and theory.

CHAPTER 5 – DISCUSSION AND CONCLUSION

This chapter discusses the results vis-a-vis previous literature and theory, and also notes study limitations and avenues for future research. Findings of this investigation provide important implications with regard to germane extant literature and theory. Examination of the decisions of angel investors enhances our understanding of alternative investor situations where investors make risky decisions without the benefit of professional portfolio advisors. The individual investor, or angel in this case, instead of relying on a professional advisor, may have a tendency to rely on biases and heuristics to simplify risky decisions.

Discussion

Several distinct patterns of results are found regarding percentage of wealth invested. Older investors are associated with a reduced percentage of wealth invested. Also, higher values for years investing, years as an entrepreneur, number of firms founded, and number of angel investments are associated with a higher percentage of wealth invested. Number of years as an entrepreneur is consistently associated with increased due diligence, as is number of firms founded. Future researchers are cautioned against using age as an experience measure in angel investing, as angel investors not only skew older; but also experience related variables in angel investing are difficult to

disentangle from age. For example, as an angel get older, he will have more years investing, more years as an entrepreneur, and more exits.

The results of these analyses suggest that demographics and investor experience appear to be important determinants of due diligence. The greater number of firms founded and greater number of years as an entrepreneur suggest expertise in entrepreneurship. Much of the literature on expertise suggests that biases and heuristics influence experts in many areas (Gilovich, Griffin, & Kahneman, 2002). Miscalibration is often reported in expert opinion, often resulting in overconfidence. Miscalibration is the tendency to believe that information is more accurate than it actually is and can lead to poor judgment. However, education and investing experience are helpful in reducing biases (Agnew & Szykman, 2005). The current results seemingly support this conjecture. Angels tend to be highly educated, and those with more years as an entrepreneur and investment experience spend more time on due diligence; such efforts should reduce the effect of miscalibration and overconfidence.

Use of heuristics, or shortcuts, to search for solutions often involves biases that can be large. These biases can shape the nature of heuristics. Sometimes simple heuristics that require relatively little calculation effort, known as “fast and frugal” heuristics, may be efficient if the decision environment is unchanged. However, such heuristics may not perform well if all alternatives are not similar and they involve some overly familiar factors (Gigerenzer, 2004).

Because angel investors are generally wealthy, examination of biases and other influences on their investment decisions is appropriate. Bias associated with overconfidence and recency/primacy is indicated by angels investing larger percentages

of their wealth when they have more years of experience as an entrepreneur, more investing experience, and a larger number of investments. Recent success in an investment, or a previous similar investment that was very successful, may influence the percent of wealth decision. The decision may also be a result of the overconfidence bias resulting from past success in business. The tendency to take too much credit for their past successes might well lead to overconfidence in their abilities.

The findings in this study reveal that a greater percentage of wealth invested is associated with reduced age, as well as variables related to experience, including an increased number of years investing, years as an entrepreneur, number of firms founded, and number of investments. With younger investors, a smaller investment may represent a larger portion of the investor's total wealth.

Overconfidence did not appear to be a factor in reduced due diligence in the risky investment of angels. The literature suggests that more successful investors are more likely to update their beliefs; however, they overweight the possibility that their success was from their own abilities rather than from chance or outside factors. This leads to their becoming overconfident (Gervais & Odean, 2001). If angel investors with a greater number of years as an entrepreneur and a larger number of firms founded are more likely to be overconfident, we would expect them to perform less due diligence. However, we find that such angel investors perform more due diligence. This may be because angel investors with a greater number of years as an entrepreneur and a larger number of firms founded have previously experienced negative results from poor diligence or that the angel has learned how to do better due diligence over time. Another possibility is that more experienced angels "champion" a deal to perform the due diligence for others.

Payne and Macarty (2002) find that angel groups may have industry “experts” who “champion” a deal and tend to conduct the investment due diligence. Their due diligence tends to be better due diligence than they would engage in to satisfy themselves in an effort to protect their reputation. Some “champions” may also provide due diligence training to other angel investors to mentor them in the due diligence process, thus engaging in additional hours of due diligence.

Deals sourced through group screenings result in decreased due diligence. The investment in an entrepreneur’s venture indicates a trusting relationship. Trust builds on psychology of human behavior characteristics (e.g., altruism, fairness, morality, ethics). Blau (1964) found that social exchange “tends to engender feelings of personal obligations, gratitude, and trust; purely economic exchange as such does not” (p.94). Although angel investors perform less due diligence in deals sourced through group screening, they appear to develop trust in the entrepreneur and the idea as depicted by the investment. Angel investors are also likely to have some trust in other members of their groups. Therefore, this analysis adds to the literature on social exchange theory and incorporates “trust” as an additional element of a behavioral consideration between the investor and source of the deal that influences the due diligence decision.

One of the earliest sources of a potential investment is the group screening, where angels make an initial determination if a deal is a good fit. Analysis of the amount of time spent on due diligence suggests that group screening is significant. However, angels perform less due diligence when they source a deal at this initial stage. This suggests angels may be investing based on “gut instinct” which could be a result of overconfidence. Overconfidence is the belief that one’s personal qualities (such as ability

to select the right deal) are better than they really are. Fischhoff (2002) suggests a mismatch between judges and tasks may occur as a result of hindsight bias or overconfidence. Researchers offer overconfidence as an explanation for wars, stock market bubbles, and entrepreneurial failures (Glaser, Nöth, & Weber, 2004; Moore & Healey, 2008). The reduced amount of time spent on due diligence when investing after a group screening or through a referral and the increased amount of time on due diligence with being personal friends with the entrepreneur suggest issues that involve overconfidence bias. Barber and Odean (2001) find that overconfident investors tend to invest more in assets with which they are familiar. Kahneman and Frederick (2002) found that familiarity belongs to the family of recognition heuristics which “draws on ‘natural assessment’ of recognition or familiarity, may be endorsed as a deliberate strategy, makes people look smart under some conditions, and will produce systematic errors and biases.” Overconfidence and familiarity may lead to a tendency to overvalue certainty or to ignore very low probabilities (Kahneman & Frederick, 2002).

Models are also estimated involving the source of the deal on time spent on due diligence, percent of wealth, and interaction. The “source of the deal” predictors are only found to be significant in the due diligence regression models. These results generally suggest that when a respondent sources a deal through the initial group screening less time is spent on due diligence. It is not necessarily irrational to spend less time on due diligence on projects when the angel investor has superior information asymmetry. However, lower due diligence may reflect the influence of prior experience and lead to the use of heuristics or success or overconfidence bias. In this case, decisions may be less than fully rational.

Prior research suggests that due diligence decisions are affected by group structure that allows “experts” to evaluate and monitor deals (DeGennaro, 2010; Mason & Harrison, 2008). Investing alongside others, or syndication, can facilitate due diligence and post-investment interaction between the angel investor and the entrepreneur. This can add value to an investment if investors are able to share their specific knowledge and complementary skills. Das and Teng (2002) argue that a social exchange of controls is a process of social sanctions and cooperative culture which typically results in all individual investors contributing to the success of the investment through their individual strengths. Thus, social exchange theory helps explain differing degrees of post-investment interaction between angel investors and entrepreneurs.

This study collected information on interaction reported (rarely, daily, weekly, monthly, quarterly, and annually). High correlations are found between due diligence and interaction between the angel and the new firm. This result indicates that a greater amount of time spent on due diligence is associated with more frequent interaction. A series of models include interaction as the outcome measure. Two models found that a greater number of years investing was associated with greater interaction. Moreover, the angel investor having sourced the investment from the presentation meeting of the group is also related to less interaction. Angel investors can offer post-investment assistance to the entrepreneur in many different ways, including building the management team, assisting to further develop the entrepreneur’s idea, bringing the product to market, and helping locate and secure future financing. Because most angel investors invest in projects that are geographically close to their home, geographic proximity of the angel can be a major determinant of the amount of interaction. Additionally, angels who are

familiar with issues confronting ventures may be able to contribute more to the success of the firm than angels who are less familiar. An example would be a physician/angel investor may be more familiar with software relating to electronic medical records and might provide additional hours. This same analogy may explain why an investment sourced in a group screening may result in less overall interaction – one angel may “champion” the deal as it is in his/her area of expertise. Correlations are also conducted between interaction and due diligence. These correlations are found to be positive, large, and statistically significant. Additional analysis is needed to determine the reasons for increased time spent on due diligence and more frequent interaction. Possible rationales might be specific knowledge of the industry as well as interest and abilities on the part of the angel to assist the firm.

Theoretical Implications

This dissertation, while containing some similarities with the DeGennaro and Dwyer (2011) study, also contains a number of important differences. The present study provides a comprehensive analysis of predictors of due diligence, percentage of wealth invested, and interaction with the company through a series of regression models. Therefore, in these analyses, a more detailed view of the predictors of angel decisions is ascertained. Additionally, by expanding on the analyses conducted by DeGennaro and Dwyer (2011), the current study expands knowledge regarding behavioral influences on angel investors.

Behavioral finance theory presents a challenge to Modern Portfolio Theory in that within behavioral finance theory, social, cognitive, and emotional factors are considered

to influence individual decisions of investors and provide biases that influence their choices. Essentially, behavioral finance theory combines behavioral and cognitive theories of psychology with conventional economics and finance in order to help explain decisions that are made by investors (Ackert & Deaves, 2009; Ritter, 2003; Shiller, 2003). Previous study results suggest that individual investors are influenced by biases and heuristics.

The adaptive market hypothesis is a result of the challenges that behavioral finance provides to the efficient markets hypothesis. Essentially, this theory builds on the psychology of human behavior, such as altruism, fairness, and ethics that create biases and help explain market dynamics (Lo, 2004). Choices made by individuals are based on past experience and whether these experiences provided positive or negative reinforcement. In addition, this theory suggests that individuals develop heuristics that assist them in adapting to economic challenges and also help them achieve optimal solutions (Lo, 2004; Reuber & Fischer, 1994). This study finds that a greater number of years investing is associated with greater interaction. The findings may suggest support for the adaptive markets hypothesis, as such individuals seemingly made decisions (previous investments) and then learned from those decisions (based on their previous experiences); whether those previous experiences provide positive or negative reinforcement (returns) lead angels to adapt by providing greater interaction with the entrepreneur. This evolutionary model of individuals adapting by developing heuristics, experienced-based techniques, allows the traditional models of Modern Portfolio Theory to coexist with behavioral finance.

Study results also reveal that individuals who spent a greater number of years investing and as an entrepreneur, and founded a larger number of firms, invest in a greater number of angel investments. This suggests a possibility of the presence of the diversification heuristic. The diversification heuristic suggests that some portion of investing is driven by behavioral attributes, such as sensation seeking, “trying a little bit of everything” when choices are not mutually exclusive, and overconfidence. For example, sensation seekers like to try a variety of investments rather than risk missing out on a good thing, and overconfident investors have irrationally optimistic beliefs about the value of their contribution to the investment (Grinblatt & Keloharju, 2009).

In addition, those who have a more favorable perception of the top management team’s experience invested a greater percentage of their wealth. The percentage of wealth invested is a proxy for risk tolerance and perceptions of the top management team. The current work thus suggests that rational motivations, like return on investment, cannot fully explain the number of risky investments as a percentage of wealth because some of the investments appear to be driven by behavioral factors.

Limitations

The study had certain limitations that merit attention. First, the data set is cross-sectional, with a single set of respondents participating at one specific time point. Although cross-sectional data allow for examination of associations between measures, they do not allow determination of causality. Therefore, though the study offers an indication of the extent to which the measures are related, it does not establish cause-and-effect relations.

The R-squared values are low indicating that there is much variation that is not explained. Although the R-squared values in some of the regressions are low, the significant coefficients on some independent variables indicate their meaningful influence on the key decisions of angel investors.

Future Research

Experienced investors devote more time on due diligence, invest a greater percentage of wealth in a deal, and provide more post-investment interaction. Future studies should attempt to determine if expertise enables angels to identify deals that perform well.

Interaction is not an option in the majority of financial investments. This may explain why angel investors are willing to risk a greater proportion of their wealth in riskier investments, even in cases where they do not spend a large amount of time on due diligence. Future research could explore whether the ability to interact with these companies provides individuals with a sense of security, leading them to invest more and to risk a greater proportion of their wealth. Additionally, investing in groups may also provide individuals with a sense of adequate interaction to drive them to invest a greater proportion of their wealth in these riskier investments, again by providing a sense of security through their own and co-investor interaction and due diligence.

Conclusion

This final chapter provides enhanced discussion of study results. Several important theoretical implications are discussed that are derived from the findings. As

individual investors, angels may be particularly influenced by behavioral factors such as cognitive biases and social influences. There is strong evidence that experienced angel investors spend more time on due diligence, older investors spend less time on due diligence after controlling for investor experience. These results suggest that experienced angels invest in due diligence because they understand its importance. Gender, risk perception, stage of the investment, and source of the deal also influence due diligence. In addition, older angels are found to invest a smaller percentage of their wealth in a deal, perhaps because they seek to diversify holdings. More experienced angels, however, are found to invest a larger percentage of their wealth perhaps because experienced angels are more susceptible to cognitive biases such as overconfidence, or because they are able to identify ventures that will do well and choose to invest more in such ventures. Deal syndication influences the percent of wealth invested in a deal. Other results suggest that after making an investment, angels continue to interact with the companies they invest in. There is strong evidence that more experienced angels are associated with greater post-investment interaction. Gender and risk perception influence the degree of post-investment interaction. Finally, suggestions for future research are offered that include examining whether experienced angel investors are better able to identify deals that perform well.

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APPENDICES

APPENDIX A - THE ANGEL INVESTOR PERFORMANCE PROJECT SURVEY

The Performance Project: Group Angel Investor

The [Kauffman Foundation](#) and the [Angel Capital Education Foundation](#) with Willamette University and the University of Washington ([Researchers' Biographies](#)) have initiated a research initiative to gather historical performance data from group-affiliated angel investors throughout North America. This effort will help to provide benchmarks, best practices, and perspective to the continued efforts of angel investors to make savvy investments in new ventures. The aggregate data will be released on May 24th at the 2007 Angel Capital Association Summit in Chicago, Illinois.

The survey is anticipated to take between 5 and 20 minutes. In appreciation for completing the survey, you can request notification of aggregated survey statistics, as well as a free copy of *The Entrepreneurial Imperative* by Carl Schramm, president and CEO of the Kauffman Foundation.

The information you report in this survey is held strictly confidential, will be kept anonymous whether you include your contact information or not, and will be used only for non-commercial research purposes.

The Performance Project: Group Angel Investor

You are about to begin your survey. Average time to complete the survey is between 5 and 20 minutes. You will answer questions regarding your angel investments, performance of those investments (including closures), and a range of other questions to provide context for the investment.

At the top of the page, you will see a series of buttons next to the label "Steps" which will track your progress through the questionnaire. As you complete a screen click the "Next Step" button to proceed. To move back and forth, simply click these buttons; your data will not be lost if you change pages using these buttons.

Please answer all questions to the best of your ability.

Thank you for your participation.

Reminder: *The information you report in this survey is held strictly confidential, will be kept anonymous whether you include your contact information or not, and will be used only for non-commercial research purposes.*

All questions in this section refer to your actions as an individual angel investor.

1. Years you've been investing your own capital in new businesses
2. Number of new business investments you've made
3. Number of these new business investments from which you've exited (**include closures**) *Required*
4. Your years of experience working in new businesses
5. Number of new businesses for which you've been a founding member of the leadership team
6. Your years of experience working in large corporations (500+ people)
7. Please name the angel groups with which you are affiliated. *Required*
8. Year of birth
9. Your highest level of education:
In what field?
10. Gender
11. % of your wealth that you have invested directly in new businesses

The following questions ask about each new business investment from which you've exited, one company at a time. Please complete the question sets starting with your most recent exited investment proceeding to your least recent exited investment.

12. Business name
13. Business headquarters location *i.e. Portland, OR*
14. Business's primary industry of operation
15. Your prior years of experience in that industry
16. Stage of firm when you made your initial investment

Your most recent exited investment. This set of questions concerns your investment activity with the business identified on the previous screen. Include only cash investment, not 'sweat equity'.

17. Year of initial investment	<input type="text"/>
18. Initial \$ amount invested	<input type="text"/>
19. % of the business owned as a result of your initial investment	<input type="text"/>
Details of your first follow-on investment, if any	<input type="text"/> Year 20
	<input type="text"/> \$\$ 21
	<input type="text"/> % of business owned after follow-on investment 22
Details of your second follow-on investment, if any	<input type="text"/> Year 23
	<input type="text"/> \$\$ 24
	<input type="text"/> % of business owned after follow-on investment. 25
26. Total of any other follow-on \$'s YOU invested	<input type="text"/>
27. Prior 12 month revenues of this business when you made your initial investment	Select f from these ranges <input type="text"/>
28. Prior 12 month profitability of this business when you made your initial investment	Select f from these ranges <input type="text"/>
29. Number of other members of your group that invested with you at your initial investment	Select <input type="text"/>
30. Number of hours of due diligence you did before investing	<input type="text"/>

Source of the deal (check all that apply)

- | | |
|---|--|
| 31. From your angel group's initial screening efforts | 35. The entrepreneur/s were referred to you by friends |
| 32. From your angel group's main investment presentations | 36. The entrepreneur/s were referred to you by business contacts |
| 33. You were personal friends with the entrepreneur/s | 37. Other |
| 34. You had worked with the entrepreneur/s previously | |

Select the top 3 risks / challenges facing this business at the time you initially invested (no more than 3)

- | | |
|------------------------------------|-------------------------------|
| 38. Technology still developing | 43. Competitive threats |
| 39. Operational issues with volume | 44. Required a lot of capital |
| 40. High customer concentration | 45. Management team issues |
| 41. Fragmented customer base | 46. Regulatory issues |
| 42. Challenging marketing channel | |

Identify your role with the business (check all that apply)

- | | |
|--|--------------------------------|
| 47. Served on board | 52. Took a management position |
| 48. Served as board observer | 53. Paid consultant |
| 49. Lead investor | 54. Informal but active |
| 50. Represented your angel group in the deal | 55. Substantially passive |
| 51. A "sounding board" for the entrepreneur | |

Management team experience at your initial investment (check all that apply)

<input type="checkbox"/> 56. Founded and led other new ventures	<input type="checkbox"/> 60. Significant managerial experience
<input type="checkbox"/> 57. Other new ventures had succeeded	<input type="checkbox"/> 61. Significant sales/marketing experience
<input type="checkbox"/> 58. Significant large firm experience	<input type="checkbox"/> 62. I don't know
<input type="checkbox"/> 59. Significant technical experience	
63. Number of people on the founding team for this business <input type="text"/>	
64. Number of those founding team members still actively involved at the time of the exit <input type="text"/>	
65. Number of outside board members at exit (non managers, non friends/family) <input type="text"/>	
66. Total number of board of directors at exit <input type="text"/>	

Would you say the entrepreneurs leading this venture:	Disagree ----Neutral ---- Agree
67. Tried to directly influence how important factors in the market develop	
68. Tried to position the venture to benefit from expectations of a large and growing market	<input checked="" type="radio"/>
Would you say that the entrepreneurs in this venture emphasized:	Disagree ----Neutral ---- Agree
69. Acquiring the means needed in order to reach their existing goals	
70. Utilizing current means and capabilities to flexibly pursue new goals	<input checked="" type="radio"/>
Would you say that the entrepreneurs in this venture typically prioritized:	Disagree ----Neutral ---- Agree
71. Making smaller investments focused on getting quickly to positive cash flow	
72. Making larger investments, staying on plan, even if it delayed positive cash flow	<input checked="" type="radio"/>

73. Year of exit event	<input type="text"/>
74. Type of exit event	<input type="text" value="Select"/>
75. Ownership % at exit event	<input type="text"/>
76. Total cash distributions paid to you during investment period	<input type="text"/>
77. Total cash value paid to you as a result of the exit	<input type="text"/>
78. Total valuation of the firm at exit	<input type="text" value="i.e. \$0, 30M acquisition, 75M IPO valuation, etc."/>
79. Your remaining ownership % after the exit event, if any	<input type="text" value="i.e. 0% (sold whole stake), or 10% of firm, etc."/>
80. Prior 12 month revenues of the business when the exit event occurred	<input type="text" value="Select from these ranges"/>
81. Prior 12 month profitability of the business when the exit event occurred	<input type="text" value="Select from these ranges"/>
82. Total amount of formal venture capital the business took on prior to your exit	<input type="text" value="Select from these ranges"/>
83. Frequency of interaction with the business	<input type="text" value="Select from these options:"/>

Instructions:

You have completed questions concerning your investment in this company. If you need to edit any information entered for this business, click on the appropriate button in the "Steps" bar at the top of the page.

To save your responses and advance to the next exit, click on the "Done with this company" button at the top of the page.

APPENDIX B – ROBUSTNESS TESTS

Table B1 - Panel A
 Percentage of wealth - logistic regressions

Variable	model with all experience variables	with yearsinv experience only	with yearsentre experience only	with numfounded experience only	with totalinv experience only	with totalexits experience only	
Age (Log)	-4.46*** (-7.11)	-2.64*** (-5.40)	-2.91*** (-5.58)	-1.38*** (-2.98)	-2.19*** (-4.06)	-1.84*** (-3.65)	
Gender	-0.23 (-1.09)	0.05 (0.24)	0.05 (0.20)	0.16 (0.74)	0.11 (0.49)	0.06 (0.29)	
Education	-0.05 (-0.69)	-0.01 (-0.10)	-0.11 (-1.29)	-0.14 (-1.56)	-0.08 (-1.07)	-0.06 (-0.71)	
Years Investing	0.07*** (6.50)	0.11*** (9.36)					
Years Entrepreneur	0.04*** (5.30)		0.07*** (9.83)				
N Firms Founded	0.08*** (4.39)			0.17*** (5.70)			
Total Investments	0.04** (2.27)				0.07*** (5.72)		
Total Exits	0.01 (0.60)					0.11*** (7.11)	
cut1	Constant	-21.99*** (-8.26)	-14.76*** (-6.93)	-16.02*** (-7.14)	-10.15*** (-5.05)	-13.20*** (-5.73)	-12.07*** (-5.49)
cut2	Constant	-20.03*** (-7.91)	-12.85*** (-6.42)	-14.11*** (-6.68)	-8.27*** (-4.40)	-11.30*** (-5.17)	-10.18*** (-4.92)
cut3	Constant	-19.13*** (-7.59)	-12.00*** (-6.01)	-13.27*** (-6.31)	-7.46*** (-3.99)	-10.46*** (-4.80)	-9.34*** (-4.54)
cut4	Constant	-18.75*** (-7.47)	-11.65*** (-5.86)	-12.92*** (-6.16)	-7.12*** (-3.82)	-10.11*** (-4.66)	-9.01*** (-4.39)
cut5	Constant	-18.63*** (-7.42)	-11.55*** (-5.80)	-12.81*** (-6.09)	-7.02*** (-3.75)	-10.01*** (-4.61)	-8.90*** (-4.33)
cut6	Constant	-17.29*** (-6.99)	-10.35*** (-5.24)	-11.59*** (-5.56)	-5.87*** (-3.16)	-8.85*** (-4.12)	-7.76*** (-3.79)
cut7	Constant	-17.23*** (-6.97)	-10.30*** (-5.22)	-11.54*** (-5.54)	-5.82*** (-3.13)	-8.80*** (-4.09)	-7.70*** (-3.77)
cut8	Constant	-17.08*** (-6.93)	-10.17*** (-5.16)	-11.42*** (-5.49)	-5.70*** (-3.08)	-8.68*** (-4.04)	-7.59*** (-3.72)

cut9	Constant	-17.01*** (-6.90)	-10.11*** (-5.13)	-11.36*** (-5.46)	-5.65*** (-3.05)	-8.63*** (-4.02)	-7.53*** (-3.69)
cut10	Constant	-15.79*** (-6.48)	-9.05*** (-4.63)	-10.35*** (-4.99)	-4.70** (-2.54)	-7.58*** (-3.57)	-6.54*** (-3.22)
cut11	Constant	-15.60*** (-6.41)	-8.88*** (-4.54)	-10.20*** (-4.92)	-4.56** (-2.46)	-7.42*** (-3.50)	-6.38*** (-3.15)
cut12	Constant	-15.16*** (-6.24)	-8.48*** (-4.32)	-9.86*** (-4.75)	-4.21** (-2.27)	-7.04*** (-3.33)	-6.01*** (-2.96)
cut13	Constant	-15.09*** (-6.21)	-8.41*** (-4.29)	-9.79*** (-4.72)	-4.14** (-2.23)	-6.97*** (-3.30)	-5.95*** (-2.93)
cut14	Constant	-14.33*** (-5.93)	-7.68*** (-3.93)	-9.13*** (-4.41)	-3.47* (-1.88)	-6.26*** (-2.98)	-5.26*** (-2.61)
cut15	Constant	-13.89*** (-5.75)	-7.24*** (-3.72)	-8.72*** (-4.23)	-3.08* (-1.67)	-5.86*** (-2.80)	-4.87** (-2.42)
cut16	Constant	-13.54*** (-5.59)	-6.90*** (-3.54)	-8.42*** (-4.08)	-2.77 (-1.50)	-5.54*** (-2.64)	-4.56** (-2.26)
cut17	Constant	-13.49*** (-5.56)	-6.85*** (-3.51)	-8.37*** (-4.04)	-2.73 (-1.47)	-5.49*** (-2.62)	-4.52** (-2.23)
cut18	Constant	-13.22*** (-5.45)	-6.58*** (-3.37)	-8.12*** (-3.92)	-2.48 (-1.33)	-5.24** (-2.50)	-4.27** (-2.11)
cut19	Constant	-12.40*** (-5.12)	-5.81*** (-2.96)	-7.41*** (-3.56)	-1.75 (-0.94)	-4.49** (-2.15)	-3.57* (-1.76)
cut20	Constant	-12.33*** (-5.09)	-5.75*** (-2.93)	-7.35*** (-3.54)	-1.69 (-0.91)	-4.43** (-2.12)	-3.51* (-1.73)
cut21	Constant	-12.19*** (-5.06)	-5.62*** (-2.88)	-7.24*** (-3.49)	-1.57 (-0.84)	-4.31** (-2.07)	-3.40* (-1.68)
cut22	Constant	-10.94*** (-4.40)	-4.51** (-2.20)	-6.17*** (-2.84)	-0.47 (-0.24)	-3.11 (-1.46)	-2.34 (-1.10)
cut23	Constant	-10.52*** (-4.20)	-4.10** (-1.98)	-5.76*** (-2.62)	-0.05 (-0.03)	-2.67 (-1.24)	-1.93 (-0.90)
cut24	Constant	-9.82*** (-3.85)	-3.40 (-1.60)	-5.06** (-2.26)	0.65 (0.32)	-1.97 (-0.90)	-1.23 (-0.56)
Observations		631	637	639	639	637	641
Pseudo R ²		0.08	0.05	0.03	0.02	0.04	0.03

Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics are in parentheses.

Table B1 - Panel B

Percentage of Wealth - logistic regressions			
Variable	Model with additional variables	mgmtrisk	source
Age (Log)	-5.64*** (-4.28)	-4.65*** (-2.91)	-5.55*** (-3.67)
Gender	-0.77* (-1.88)	-1.11** (-2.34)	-0.88** (-1.98)
Education	-0.10 (-0.72)	-0.05 (-0.33)	-0.18 (-1.27)
Years Investing	0.06*** (2.89)	0.14*** (4.66)	0.12*** (4.42)
Years Entrepreneur	0.08*** (4.63)	0.07*** (3.35)	0.10*** (4.64)
N Firms Founded	0.07** (2.01)	0.10*** (3.30)	0.07** (2.14)
Total Investments	0.05*** (2.81)	0.09*** (4.16)	0.05** (2.51)
Total Exits	0.02 (0.52)	0.01 (0.28)	0.03 (0.78)
TMT Experience	0.52* (1.67)	-0.38 (-0.83)	0.04 (0.12)
Management Risk		-0.49 (-1.33)	
Stage: Seed		-0.12 (-0.20)	-0.21 (-0.47)
Stage: Startup		0.07 (0.14)	-0.02 (-0.04)
Co-investors	-0.08** (-2.39)	-0.11*** (-2.89)	-0.07** (-2.07)
Source: Group Screening			0.18 (0.49)

cut1	Constant	-25.34*** (-4.72)	-21.29*** (-3.26)	-24.77*** (-4.02)
cut2	Constant	-24.68*** (-4.62)	-20.69*** (-3.20)	-24.16*** (-3.96)
cut3	Constant	-24.26*** (-4.56)	-20.17*** (-3.14)	-23.69*** (-3.90)
cut4	Constant	-24.06*** (-4.52)	-19.99*** (-3.11)	-23.48*** (-3.86)
cut5	Constant	-22.41*** (-4.27)	-18.50*** (-2.90)	-21.89*** (-3.65)
cut6	Constant	-22.24*** (-4.25)	-18.31*** (-2.87)	-21.73*** (-3.63)
cut7	Constant	-22.14*** (-4.24)	-18.26*** (-2.87)	-21.69*** (-3.62)
cut8	Constant	-22.08*** (-4.23)	-18.21*** (-2.86)	-21.65*** (-3.62)
cut9	Constant	-20.48*** (-3.97)	-16.42*** (-2.61)	-19.81*** (-3.35)
cut10	Constant	-20.37*** (-3.94)	-16.22** (-2.57)	-19.67*** (-3.33)
cut11	Constant	-20.06*** (-3.88)	-15.87** (-2.50)	-19.41*** (-3.27)
cut12	Constant	-19.17*** (-3.72)	-14.39** (-2.26)	-18.15*** (-3.07)
cut13	Constant	-18.74*** (-3.64)	-14.27** (-2.24)	-17.89*** (-3.04)
cut14	Constant	-18.24*** (-3.55)	-14.00** (-2.19)	-17.44*** (-2.95)
cut15	Constant	-17.31*** (-3.39)	-12.68** (-1.97)	-16.34*** (-2.77)
cut16	Constant	-17.10*** (-3.34)	-12.40* (-1.92)	-16.12*** (-2.73)
cut17	Constant	-16.84*** (-3.31)	-12.02* (-1.88)	-15.86*** (-2.70)
cut18	Constant	-14.74*** (-2.74)	-10.76 (-1.61)	-14.37** (-2.35)
Observations		192	135	163
Pseudo R ²		0.13	0.17	0.16

Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics are in parentheses.

Table B2 - Panel A

Percentage of wealth - OLS regressions

Variable	model with all experience variables	with yearsinv experience only	with yearsentre experience only	with numfounded experience only	with totalinv experience only	with totalexits experience only
Age (Log)	-24.48*** (-6.02)	-20.51*** (-5.20)	-20.88*** (-5.01)	-13.18*** (-3.27)	-13.39*** (-2.96)	-13.34*** (-3.27)
Gender	0.92 (0.83)	2.07* (1.84)	2.96** (2.23)	3.09** (2.42)	2.64** (1.97)	2.95** (2.27)
Education	0.05 (0.09)	0.59 (0.88)	-0.03 (-0.04)	-0.46 (-0.64)	0.17 (0.22)	0.32 (0.40)
Years Investing	0.61*** (5.94)	0.77*** (8.10)				
Years Entrepreneur	0.10* (1.81)		0.43*** (7.88)			
N Firms Founded	0.75*** (2.94)			1.30*** (4.79)		
Total Investments	0.20* (1.90)				0.34*** (2.84)	
Total Exits	-0.20 (-1.26)					0.59*** (5.23)
Constant	102.69*** (6.21)	87.68*** (5.45)	90.88*** (5.33)	62.53*** (3.82)	62.73*** (3.47)	63.36*** (3.78)
Observations	631	637	639	639	637	641
R-squared	0.25	0.19	0.09	0.10	0.08	0.06

Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics are in parentheses.

Table B2 - Panel B

Percentage of Wealth - OLS regressions			
Variable	Model with additional variables	mgmtrisk	source
Age (Log)	-23.65*** (-3.34)	-17.75** (-2.11)	-18.97** (-2.43)
Gender	-0.81 (-0.40)	-1.45 (-0.76)	-1.76 (-0.95)
Education	-0.86 (-0.84)	-1.62 (-1.31)	-1.94* (-1.82)
Years Investing	0.63*** (3.16)	1.09*** (4.47)	1.10*** (4.32)
Years Entrepreneur	0.26*** (2.62)	0.18 (1.50)	0.28*** (2.71)
N Firms Founded	0.39 (1.12)	0.54 (1.47)	0.36 (0.95)
Total Investments	0.19 (1.24)	0.26 (1.57)	0.07 (0.40)
Total Exits	-0.26 (-0.92)	-0.33 (-1.15)	-0.19 (-0.65)
TMT Experience	3.99* -1.68	0.11 (0.03)	1.20 (0.38)
Management Risk		-0.28 (-0.12)	
Stage: Seed		-1.87 (-0.55)	-1.57 (-0.64)
Stage: Startup		-1.94 (-0.71)	-1.07 (-0.47)
Co-investors	-0.28 (-1.36)	-0.40** (-2.52)	-0.31 (-1.20)
Source: Group Screening			2.36 (0.73)
Constant	100.59*** (3.48)	79.75** (2.27)	83.79*** (2.62)
Observations	192	135	163
R-squared	0.33	0.43	0.39

Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics in parentheses.

Table B3 - Panel A

Post-investment interaction (times/year) - Tobit regressions

Variable	model with all experience variables	with yearsinv experience only	with yearsentre experience only	with numfounded experience only	with totalinv experience only	with totalexits experience only
Age (Log)	-38.18 (-0.49)	-5.18 (-0.07)	8.94 (0.11)	75.86 (0.96)	99.50 (1.23)	95.71 (1.21)
Gender	-9.06 (-0.28)	-9.72 (-0.30)	3.55 (0.10)	10.62 (0.32)	9.21 (0.25)	7.97 (0.23)
Education	3.59 (0.29)	6.55 (0.52)	6.18 (0.46)	8.33 (0.61)	11.73 (0.84)	11.72 (0.85)
Years Investing	7.23*** (3.14)	6.92*** (3.55)				
Years Entrepreneur	1.41 (0.93)		3.94*** (3.05)			
N Firms Founded	5.08 (1.04)			9.09* (1.85)		
Total Investments	-1.85 (-1.23)				0.43 (0.44)	
Total Exits	-2.73 (-1.07)					1.87 (0.97)
Constant	140.64 (0.45)	8.38 (0.03)	-53.04 (-0.17)	-308.21 (-0.98)	-391.66 (-1.21)	-376.03 (-1.19)
Observations	242	244	245	245	243	245
Pseudo R ²	0.01	0.01	0.01	0.00	0.00	0.00

Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics are in parentheses.

Table B3 - Panel B

Post-investment interaction (times/year) - Tobit regressions

Variable	model with additional variables	mgmtrisk	source
Age (Log)	75.69 (0.76)	42.19 (0.37)	67.91 (0.68)
Gender	-52.36 (-1.41)	-41.66 (-1.06)	-48.96 (-1.26)
Education	-4.64 (-0.31)	-16.02 (-0.98)	-6.40 (-0.43)
Years Investing	6.15** (2.44)	8.74** (2.33)	8.21** (2.48)
Years Entrepreneur	1.28 (0.69)	1.70 (0.77)	0.31 (0.17)
N Firms Founded	3.87 (0.79)	3.90 (0.77)	2.57 (0.54)
Total Investments	-0.50 (-0.26)	-1.05 (-0.56)	0.47 (0.27)
Total Exits	-8.32** (-2.07)	-8.60* (-1.96)	-7.81** (-2.04)
TMT Expereince	30.49 (0.96)	26.80 (0.62)	10.84 (0.30)
Management Risk		66.95* (1.84)	
Stage: Seed		-55.35 (-1.29)	-1.21 (-0.03)
Stage: Startup		-17.54 (-0.45)	28.00 (0.79)
Co-investors	-8.98*** (-2.67)	-6.52* (-1.68)	-7.78** (-2.12)
Source: Group screening			-40.40 (-1.41)
Constant	-216.47 (-0.55)	-81.10 (-0.18)	-189.34 (-0.48)
Observations	185	134	162
Pseudo R ²	0.00	0.02	0.03

Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics in parentheses.

Table B4 - Panel A

Post-investment interaction (times/year) - OLS regressions

Variable	model with all experience variables	with yearsinv experience only	with yearsentre experience only	with numfounded experience only	with totalinv experience only	with totalexits experience only
Age (Log)	-25.13 (-0.46)	4.09 (0.08)	9.28 (0.17)	57.37 (1.02)	76.37 (1.33)	74.38 (1.32)
Gender	-2.58 (-0.11)	-1.37 (-0.06)	6.96 (0.28)	11.70 (0.49)	11.14 (0.43)	11.39 (0.46)
Education	0.17 (0.02)	3.13 (0.36)	2.62 (0.29)	4.01 (0.43)	7.28 (0.77)	7.12 (0.76)
Years Investing	5.00*** (3.20)	4.76*** (3.58)				
Years Entrepreneur	1.26 (1.28)		2.94*** (3.48)			
N Firms Founded	4.25 (1.43)			6.89** (2.26)		
Total Investments	-1.80 (-1.64)				-0.09 (-0.14)	
Total Exits	-1.78 (-1.02)					0.82 (0.64)
Constant	119.65 (0.54)	0.26 (0.00)	-25.36 (-0.12)	-207.50 (-0.92)	-272.55 (-1.18)	-267.64 (-1.19)
Observations	242	244	245	245	243	245
R-squared	0.14	0.10	0.06	0.05	0.01	0.02

Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics are in parentheses.

Table B4 - Panel B

Post-investment interaction (times/year) - OLS regressions

Variable	Model with additional variables	Management and stage risk	Source
Age (Log)	-23.65*** (-3.34)	-17.75** (-2.11)	-18.97** (-2.43)
Gender	-0.81 (-0.40)	-1.45 (-0.76)	-1.76 (-0.95)
Education	-0.86 (-0.84)	-1.62 (-1.31)	-1.94* (-1.82)
Years Investing	0.63*** (3.16)	1.09*** (4.47)	1.10*** (4.32)
Years Entrepreneur	0.26*** (2.62)	0.18 (1.50)	0.28*** (2.71)
N Firms Founded	0.39 (1.12)	0.54 (1.47)	0.36 (0.95)
Total Investments	0.19 (1.24)	0.26 (1.57)	0.07 (0.40)
Total Exits	-0.26 (-0.92)	-0.33 (-1.15)	-0.19 (-0.65)
TMT Experience	3.99* (1.68)	0.11 (0.03)	1.20 (0.38)
Management Risk		-0.28 (-0.12)	
Stage: Seed		-1.87 (-0.55)	-1.57 (-0.64)
Stage: Startup		-1.94 (-0.71)	-1.07 (-0.47)
Co-investors	-0.28 (-1.36)	-0.40** (-2.52)	-0.31 (-1.20)
Source: Group Screening			2.36 (0.73)
Constant	100.59*** (3.48)	79.75** (2.27)	83.79*** (2.62)
Observations	192	135	163
R-squared	0.30	0.37	0.39

Note: A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level. Robust z-statistics are in parentheses.