2016

The determinants of successful Angel investors

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Capstone Paper for the 2016 MPA Class

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April 21, 2016

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Executive Summary

Angel investors are wealthy individuals who provide capital for business start-ups in return for an ownership stake. The outcomes of angel investments are not high for all angels and not evenly distributed among all investors. I examine what characteristics of angel investors affect the outcome of their investments.

This research is based on a North American survey data set. . I use the internal rate of return to measure the performance of angel investments. More specifically, I use three different standards to code it as success or failure: median standard, mean standard, and higher standard. Then, I use OLS and a probit model to regress investment success on five explanatory variables that represent the post-investment involvement of angel investors (interacted time with the company, due diligence, and duration of investment) and the basic characteristics of angel investors (their education level and their experience period in the industry of venture).

The only thing I can predict in low level of success (median and mean standard) is that the later the stage, the more likely success is. However, in the high level of success, angels may positively influence their investment performance with sufficient due diligence and maintaining long-term investment as post-investment involvement. I find that the stage of the venture at the time of their investment, due diligence and duration of investment are the primary determinants of the successful angel investors. Also, this research indicates that the post-investment involvement of angels, rather than their characteristics, is more likely to be related to the improved performance of the angel investors.

Policy makers can set criteria for select which angel investors to support, at least encouraging minimal due diligence, using this research, and with that, policy makers can increase the efficiency of government support, although lessons from one country should not be transferred naively to another.

1. Introduction

Capital is one of the main difficulties of new start-ups until they have grown to such an extent that institutional investors or banks become interested in investing in them. For these start-ups, early-stage individual investors, known as angel investors, play a critical role as suppliers of capital. An angel investor or angel (also known as a business angel, informal investor or angel funder) is defined as an affluent individual who provides capital for a business start-up, usually in exchange for convertible debt or ownership equity.

Angel investment is an important element for many start-up firms to grow. It allows a company to overcome the capital gap between seed or early-stage investment and growth-stage investment. As shown in Table 1, venture capital companies are, for the most part, focused on later stage start-ups and therefore have left a significant equity gap for the seed and early-stage start-ups (OECD, 2011). Without investment by angels, a small company has no choice but to depend on bank loans to raise capital, which forces an entrepreneur become a delinquent borrower if the business fails.

Table 1 - Equity investors at the stage of firm growth (OECD, 2011)

<table>
<tr><th colspan="2">Informal investors</th><th>Formal investors</th></tr>
<tr><td>Founders, friends and family</td><td>Angel investors (typical investment size: 25-500K USD)</td><td>Venture capital funds (typical investment size: 3-5M USD)</td></tr>
<tr><td>Seed stage investments</td><td>Early stage investments</td><td>Later stage investments</td></tr>
</table>

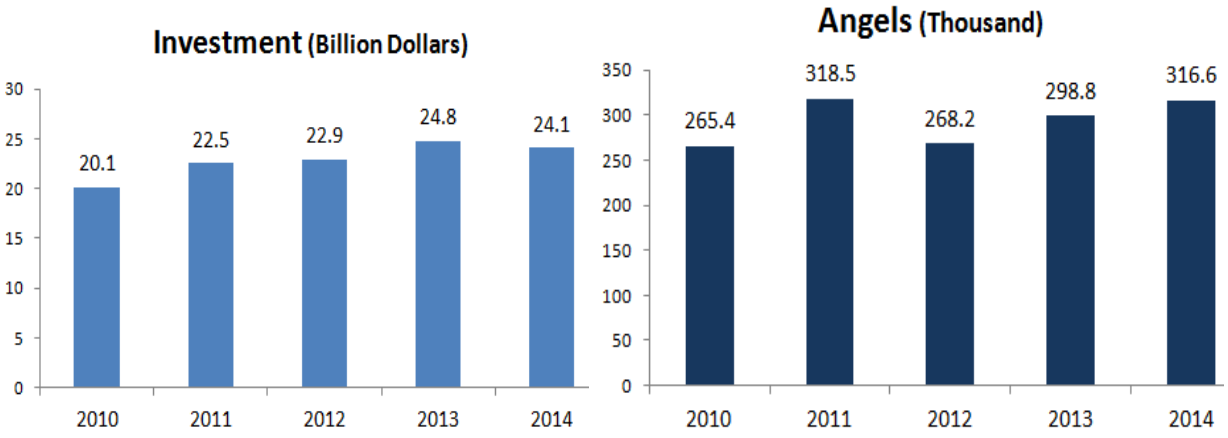
Also, an angel investor provides non-financial assistance like management consulting services in addition to the financial support. Angels are often experienced entrepreneurs, and, in many cases, they give back by helping other entrepreneurs (OECD, 2011).

Another important role of angel investors is that they are significant contributors to job growth. According to the Center for Venture Research of the U.S. (CVR), 264,200 new

jobs were created in the United States in 2014 through angel investments, which is equal to 3.6 jobs per angel investment.

In the U.S., angel investment began in earnest in the 1960s in Silicon Valley, the hub of high-tech start-ups. According to the Center for Venture Research at the University of New Hampshire (2015), 316,600 active angel investors invested a total of $24.1 billion in 73,400 entrepreneurial ventures in 2014, which is a robust amount and is close to the market high of $26.0 billion that occurred in 2007. Nowadays, there are several “angel groups.” They consist of angel investors who pool their capital and share their resources for investment and their opinions. The Angel Capital Association of the U.S. has about 300 American angel investor groups listed in its database.

Figure 1 – Angel investment and angels of the U.S.



A number of countries have adopted policies or government support ranging from tax incentives to co-investment as a catalyst for developing the angel market, citing the information asymmetries and potential spillover effects (OECD, 2011), and government intervention in angel investment has steadily increased. For example, 27 state governments in the U.S. provide a tax deduction of up to 50% of the angel investment and the Japanese government started giving a 40% income deduction for angel investment in 2008. In Korea, the government belatedly increased the ratio of tax deductions from 30% to 50% in 2014

after noticing the strong impact of angels on the venture industry, and started offering 10 million dollars matching funds in 2011 and, cumulatively 172 million dollars in 2015.

However, the outcomes of angel investment are not high for all angels, and not evenly distributed among the investors. According to David Rose (2014), a famous angel investor in New York, only 10% of angel investors get a return of 10 times their original investments, while 50% of angel investors ultimately lose. These results roughly coincide with the European Business Angel Networks (EBAN) Secretariat's report (2014) that only 53% of angel investment market makes a profit.

Then, what makes the difference in the outcomes of angel investors? In order to increase the efficiency of government support, policy makers have to know which angel investors or start-ups have a greater possibility of success, and also have to lead them to become that kind of investor or firm. What's more, from the answer, policy makers can find the most efficient way to promote angel investment.

Thus, I will analyze the factors influencing the successful outcome of an angel investor with regard to an angel's characteristics, such as frequency of interaction the angel investor had with the company, years of working experience the angel investor had in an industry related to the venture, or the number of hours of due diligence this investor conducted prior to making their investment.

The insights furnished by this study could provide a starting point for policy-makers to screen angel investors for support, and, with that, they can increase the efficiency of government support.

2. Literature Review

Numerous papers analyze the characteristics shared by successful small and medium-sized businesses. For instance, Ana M. Moreno (2007) examined the main factors, including firm's age, size, or entrepreneur's ability, that allow one to distinguish between high-growth firms and low-growth firms.

Also, there are many studies that indicate angel investors play an important role for the high-growth start-up firms. For example, Kerr, Lerner, and Schoar (2010) stated that angel funding is positively correlated with business survival, access to follow-on funding, and faster growth, using a regression discontinuity approach to compare firms that obtain funding and those that do not. Mason (2007) also highlighted the significance of the informal venture capital market in terms of offering their business skills and personal networks as well as financial investment.

However, there are only a couple of papers that look at what distinguishes more successful angel investors from less successful ones. Robert Wiltbank and Warren Boeker (2007) showed detailed information about the average return of group-affiliated angel investment, and indicated that due diligence, experience in the industry of their portfolio companies, and participation of angel investors have a positive impact on their outcomes. On the other hand, they revealed that follow-on investments of angel investors had a negative effect on the investment performance[1].

However, Wiltbank and Boeker (2007) simply compared the average returns between the group above the median and the group below the median from the perspective of due diligence time, experience, and participation. For example, the high due diligence group

[1] They say that additional research may be needed to better understand these results.

(spend more than 20 hours median due diligence) had a 5.9 times return on investment, whereas the low due diligence group (spend less than 20 hours) had only a 1.1 times return on investment. But this research is important in the way that it revealed angel investors may influence their return rate by increasing due diligence time, avoiding portfolios in unfamiliar industries, and actively participating at least a couple of times per month, even though it is not clear whether these high outcomes are a direct result of their involvement, and why the follow-on investment is correlated with their lower performance.

The effect of angel involvement on the performance of their investments can be seen in the research of Chua and Wu (2009). Chua and Wu (2009) stated that post-investment involvement of angel investors adds value. They determined that post-investment involvement of angel investors, including serving as a sounding board for management, helping management develop strategy, helping secure additional financing, or mentoring management, has a significant positive impact on the performance of angel investors. Both Wiltbank and Boeker (2007) and Chua and Wu (2009) use Kauffman Foundation data. The latter study focused on only the post-investment involvement. Thus, the other factors, such as due diligence time which was one of main factors of Wiltbank and Boeker (2007), were not considered.

Also, Lennart Pape (2014) investigated the relation between angel investors' involvement and performance. Pape characterizes business angels' involvement using Politis's (2008) four roles: sounding board/strategic management role, supervision and monitoring role, resource acquisition role, and mentoring role. According to his study, there is a mixed effect. "Providing help with finding suppliers and customers (resource acquisition role)" and "providing additional fundraising from other business angels (resource acquisition role)" have a positive impact on investment performance, whereas "providing help with the recruitment of key employees (resource acquisition role)", "providing management time

(sounding board/strategic role)" and "providing help by solving strategic/management issues (sounding board/strategic role)" all have a negative impact on the angel's outcomes. Also, "the frequency of interaction" of angel investors negatively contributes to the investment performance. These results contrast with the previous study by Wiltbank and Boeker (2007). Additionally, the study is limited in that it only investigates the impact of post-investment involvement.

Most research on this topic focuses on the relation between the investors' involvement and the performance of their investments. However, various factors besides post-investment involvement affect the outcomes of angel investors, and research sometimes showed different results regarding whether their impact is positive or negative.

In order for policy makers to find the most efficient way to promote angel investment, I will analyze the various individual characteristics influencing the successful outcome of an angel investor without being limited to angel investors' involvement. In this respect, this study will take into account several variables including the factors which were mentioned in the previous papers, such as frequency of interaction the angel investor had with the company, years of working experience the angel investor had in an industry related to the venture, or the number of hours of due diligence this investor conducted prior to making an investment.

3. Research Questions

Angel investors play a critical role as suppliers of capital for start-ups. According to the European Trade Association for Business Angels (EBAN), business angels make up 73% of the total European early-stage investment market, followed by venture capital industry investing (26%) and equity crowd funding investments (1%) in 2014.

However, because of the information asymmetries between angels and start-ups, there is market failure in seed and early-stage financing or funding gap between seed or early-stage investment and growth-stage investment. For this reason, a number of countries have chosen policies or government support, ranging from tax incentives to co-investment funds. The first policy for developing the angel market is the Enterprise Investment Scheme (EIS) which the U.K. government established in 1995 as a tax incentive. The purpose of tax incentives is to increase the number of angel investors and the amount of capital, raising the risk-reward ratio of angel investment. The details of the tax incentives are different in each country as shown in Table 2. Tax incentives can involve deduction from angel investment income, deduction of investment tax amount or deduction of angel investment loss.

Table 2 – Comparing National Tax Incentives (Seo, 2015)

Country	Deduction of investment	Deduction of profit	Deduction of loss
U.S.	10~100% (varies by state)	Deferral of tax on re-invested profits	$50,000 limit on deduction
U.K.	20%	Deduction of transfer gains	48% of income limit on deduction
Japan	40%	Deferral of tax on re-invested profit	3 years deduction carried forward
Singapore	50%	50% deduction of transfer gains	-
South Korea	30~100% (different in $)	Deduction of transfer gains	-

On the other hand, co-investment funds, also known as matching funds, have been set up to stimulate angel investments in start-ups, with their investments matched by government funds.

Table 3 – Matching Funds in Different Countries (Song, 2015)

Country	Name and year of establishment	Main contents
Scotland	Scottish Co-Investment Fund, 2003	- 72M £ - angel investor and venture capitals - 1M £ limitation per firm
Netherlands	TechnoPartners Seed Facility, 2005	- 50% of investment, maximum 4M€
New Zealand	Seed Co-Investment Fund, 2005	- 40M$ (New Zealand dollar)
U.K.	Co-Investment Fund, 2011	- 50M £ - same amount matching

If policy makers can analyze which angel investors have greater chances of success, it can result in a more efficient way to promote angel investment. For example, the South Korean government has run the Korea Fund of Funds (KFF) as a vehicle for financing for local SMEs since 2005. The KFF invests in venture capital (VC) funds that are selected in order to increase the efficiency of government support, and with the capital from the KFF, VC funds invite more capital from the private sector to increase their funds. With this mechanism, the South Korean government creates a synergy with private capital to be invested in SMEs rather than directly providing loans or guarantees. The case of the KFF could serve as an example for a policy to promote angel investment. If another kind of fund of funds, like the KFF, could be established to subsidize angel investors, or if the KFF could invest in angel investment, policy makers would need criteria to select which angel investors to support. Thus, analysis of the performance of the angels' investment and their characteristics is essential for future policies. With that, policy makers can increase the efficiency of government support and the capital in start-ups. It is not known whether characteristics shared by successful angels are the same across countries, with different institutions and attitudes toward risk-taking. Therefore, lessons from one country should not

be transferred naively to another. My analysis uses North American data, which reflect a culture that promotes risk-taking and is tolerant of failure, or even encourages it. Such a setting may attract a different pool of start-up founders than settings where this or other conditions are absent, and angels may choose among different options in different settings.

From this point of view, I will examine what factors of angel investors affect the outcome of angel investment. The research questions can be summarized as follows:

- What are the primary determinants of the successful angel investors?

- Are the basic characteristics of angel investors and the post-investment involvement of angel investors related to the improved performance of the angel investors?

4. Methodology

Data Sources

There is a paucity of data on angel investors and their investment performance.

This research is based on a survey data set from the Angel Investor Performance Project (AIPP) conducted by the Kauffman Foundation. It has been available for public use from the website (www.kauffman.org/aipp) since it was collected in 2007. According to the AIPP, 539 angel investors who are members of 86 angel investor groups throughout North America participated in an online questionnaire[2] and were asked for information on the investors' experience, their basic characteristics, the ventures in which they had invested and details about their investment in an exit from those ventures. This data set was also used in the research of Wiltbank and Boeker (2007) and Chua and Wu (2009).

[2] The response rate of the surveys was 31% out of 276 of the angel investor groups, and 13% of the members in these 86groups participated (Wiltbank and Boeker, 2007)

The data set includes following information.

* *total cash out*: sum of all dollars that the angel investor received from the venture

* *total invested*: sum of all dollars that the angel invested in the venture

* *years held*: years between the angel investors initial investment in the venture and the exit event of the venture

* y*ears inv:* years that the angel investor had been investing

* *years entre*: years that the angel investor had been an entrepreneur

* *edlevel*: their education level

* *stage*: stage of the venture at the time of their investment

* *initialinvest:* $ amount of their initial investment

* *initrevs:* revenues of the venture at the time of the investor's investment

* *coinvestors*: the number of other investors that joined in the investment in the venture at the time the angel investor invested

* *diligence*: the number of hours of due diligence the investor conducted prior to making their investment

* *industryexp*: years of working experience the angel investor had in an industry related to this venture

* *interaction*: frequency of interaction the angel investor had with the company. 6 = daily, 5 = weekly, 4 = monthly, 3 = quarterly, 2 = annually, 1 = rarely if at all

The descriptive statistics for selected variables are presented in Appendix Table 1.

Statistical methodology

The main research question of this paper is that what are the determinants of angel investors' performance? In order to address this question, I define the IRR (internal rate of return of angel investment per year) as the performance of the angel investment. It can be

calculated from the multiplier (the ratio of output to input of angel investment) and investment period (*yearsheld*).

$$multiplier = totalcashout / totalinvested \quad \text{---------- (2)}$$

$$irr = multiplier^{(1/yearsheld)} - 1 \quad \text{---------- (3)}^{3}$$

Table 4 presents the summarized results of *multiplier* and *irr*. The angels in the sample have 10.58 average multiplier which is total cash out over total investment, and have 26.8% of an average internal rate of return per year.

Table 4 – Multiplier and IRR

Variable	Obs	Means	Median	Std.dev	Min	Max
Multiplier	458	10.582	0.9687	83.44	0	1332.798
IRR	458	0.2681	-0.01439	2.3168	-1	34

IRR has a large variability from losing all of the money to making 34 times the invested funds as a result of extreme values in the data (the mean is 0.27 and the standard deviation is 2.32). In fact, startup companies have large variance in their results. In a regression, IRR has such large variance that it is difficult to find any explanatory variables that can predict the values. By coding success (return of the investment), the extreme variability of IRR is eliminated allowing the important factors to be estimated.

I will use a regression model and probit model to test whether angel investor characteristics are associated with their success, using the same variables. A probit model is useful to estimate the probability that an observation with particular characteristics will fall into one of two categories.

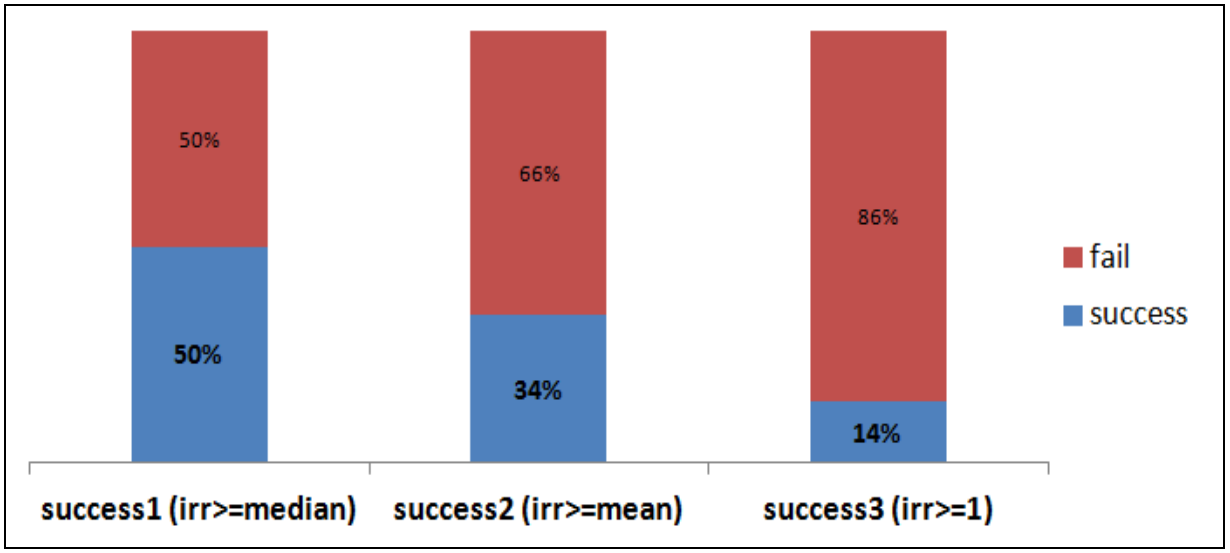
[3] I assume the *yearsheld* of investment within one year as 0.5 to avoid very high *irr* and one observation which has the *irr* over 50,000 is eliminated.

a. Dependent Variable

There are three measures of success based on increasing levels of IRR. The first definition is IRR greater than the median of all of the projects (-0.01439)[4]. The second definition is based on the mean of the projects (0.268) after eliminating one with a calculated value over 50,000, which evidently has problems with the data on years held. Only one observation is eliminated. The third definition requires IRR > = 1.0 (100%), which is a high standard of success.

Figure 2 shows that 50%, 34% and 14% of the angels are respectively observed as successful investors in their investment performance according to the measures of success.

Figure 2 – Success or Failure



The scale of success according to measurement standard is shown in Table 5.

[4] In this case, due to the negative value of the mean, losing money is ironically defined as successful of investment. Negative value of mean comes from many of -1 of IRR which is caused by the observation that invest output value is zero in the data set.

Table 5 – Success Scale

Scale	Freq.	Percent	Cum.
None Successful	227	50.00	50.00
Median Standard	74	16.16	66.16
Mean Standard	91	19.87	86.13
High standard	64	13.97	100.00
Total	548	100.00	

b. Explanatory Variable

Many factors can have an effect on the performance of the angels. Wiltbank and Boeker (2007) point out three main factors: due diligence (*diligence*), experience in the industry of their portfolio companies (*industryexp*), and interacted time with their portfolio companies (*interaction*). Chua and Wu (2009) include the following factors as their independent variables: the total amount of time spent interacting with the venture post-investment (*interaction*), time spent on due diligence (*diligence*), source of investment opportunity (*sourcegroupscreen, sourcegrouppresent, sourcepersonal, sourcepersonal1, sourcerefer, and sourcerefer2*), angel entrepreneurial experience (*yearsentre*), and angel investment experience (*yearsinv*).

For the research question about post-investment involvement, I add three factors to the independent variables: interacted time with their portfolio companies (*interaction*), due diligence (*diligence*), and duration of investment (*yearsheld*). On the other hand, for the additional research question about basic characteristics of angels, I include the factors of their education level (*edlevel*) and experience in the industry of their investment company (*industryexp*) as independent variables.

However, in order to increase the power to predict dependent variable, I created another set of variables instead of *interaction*, *diligence*, and *edlevel* variables. Whereas the

interaction variable is reported in ordinal terms (1=rarely; 2=annually; 3=quarterly; 4=monthly; 5=weekly; 6=daily), the *interaction times* variable is assigned to each ordinal ranking the number of times per year indicated (1=0; 2=1 time/year; 3=4 times/year; 4=12 times/year; 5=52 times/year; 6=365 times/year) as shown in Chua and Wu (2009). The *diligence* is highly variable, so it is coded to the *dilig20ormore* variable as at least 20 hours. Also, the *edlevel* variable is coded to the *edlevel_high* as at least J.D. or not. Education level is at least college graduate for almost all angel investors. Table 6 presents the summarized results of independent variables.

Table 6 – Independent Variables

Variable	Mean	S.D.	Min	Max
Interaction times	88.67	144.23	0.00	365.00
Dilig 20 or more	0.62	0.49	0.00	1.00
Years held	3.99	3.27	0.00	23.00
edlevel_high	0.76	0.43	0.00	1.00
Industry experience	6.69	10.36	0.00	47.00

c. Control variables

The other variables that seem to affect on the dependent variable are control variables. Control variables include angel investment experience (*yearsinv*), stage of the venture at the time of their investment (*stage*), and the number of co-investors (*coinvestors*). The summary statistics for control variables is as follows.

Table 7 – Control Variables

Variable	Mean	S.D.	Min	Max
Years inv	12.96	9.23	1.00	49.00
stage	2.14	1.09	1.00	5.00
coinvestors	3.53	4.54	0.00	12.00

5. Results and Discussion

Estimation results

The regression results of the ordinary least squared regression (OLS) model for testing the research questions are as seen in Table 8. There are 92 observations with the necessary data on the explanatory variables and on the IRR.

Table 8 – OLS Regression Estimation Results

VARIABLES	median_standard success1	mean_standard success2	higher_standard success3
Interaction times	0.000314	0.000532	0.000306
	(0.426)	(0.191)	(0.224)
dilig20ormore	0.138	0.201	0.183**
	(0.295)	(0.141)	(0.0314)
yearsheld	0.0512	0.00163	-0.122***
	(0.223)	(0.970)	(1.43e-05)
yearsheldsq	-0.00151	-0.00111	0.00450***
	(0.475)	(0.607)	(0.00113)
edlevel_high	-0.0566	0.0472	0.0913
	(0.649)	(0.712)	(0.249)
Industry exp	0.00514	0.00371	-0.000609
	(0.335)	(0.497)	(0.857)
Years inv	-0.00686	-0.00445	-0.000196
	(0.264)	(0.480)	(0.960)
stage	0.122**	0.0797	0.0444
	(0.0170)	(0.124)	(0.165)
coinvestors	0.00202	-0.00504	-0.00669
	(0.869)	(0.689)	(0.392)
Constant	0.113	0.108	0.270*
	(0.619)	(0.644)	(0.0636)
Observations	92	92	92
R-squared	0.212	0.156	0.316

p-value in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Looking at the results of the OLS regression, the lack of statistically significant predictors is clear. It is difficult to predict success of these investments. This result are very similar the results of the probit regression as shown in Appendix Table 2. However, there are several things to notice.

First, in the model of the median definition, stage is the only variable that predicts angel's success at the 95% confidence level. The median definition results in more likely success based on the stage of the project with greater success at more advanced stages, but nothing else. Given that stage is 1-5, the effect is up to about 30%. However, even though most are stages 1-3 and stages 4-5 are rare, stage 4 and 5 likely signify a high probability of success. Thus, in order to increase capital supply to early stage firms, policy-makers should encourage angel investors to concentrate on early stages. Distribution of stage level is shown in Appendix Table 3.

Second, the mean definition results in no statistically significant factors at all at the 95% confidence level as seen in Table 8. So far the results indicate that success of angel investors is very difficult to predict, which might be very well true.

However, the higher standard of a large IRR does show that the passage of more time is a strong positive factor ("years held") after a point. The model is quadratic and shows that success is declining at first (the linear term) but then increasing (the quadratic term). If only the linear term is included, the results imply negative effects of time, which is against expectations. Longer term should be a good thing. In fact it is, but only after the passage of some time. The quadratic term is important to analyze the effect of duration of investment.

The second factor that matters is diligence (hours worked on due diligence), which predicts the higher level of success, if diligence exceeds 20 hours. The amount of time varies a lot, and there is no indication that many hours make the result better, but rather that there is a minimum effort needed, which appears to be about 20 hours.

On the contrary, education level does not matter in any model, which is surprising, but note that virtually all investors here are college graduates, who could certainly acquire the necessary skills on the job, so the range of education is not relevant.

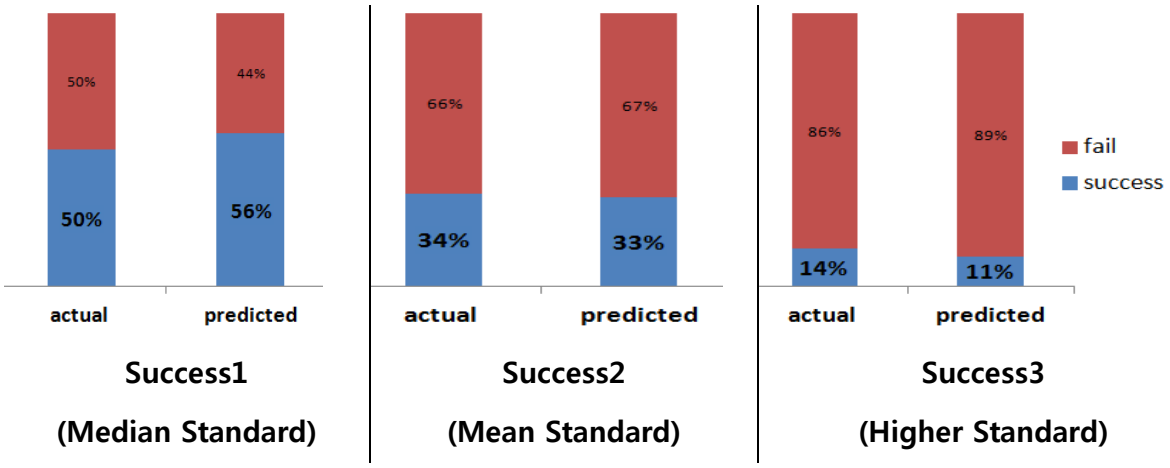
Additionally, an analysis of the amount invested shows that it is difficult to predict how much is invested – an amount that varies a great deal – but that if the investor interacts more, the investor invests more. That is logical, as frequent interaction should be associated with more money. Nothing else predicts the amount. See Appendix Table 4.

Robustness Tests

I perform robustness checks using the probit model. In the probit model, the predicted probability indicate the likelihood of y=1. If the predicted probability is greater than 0.5, I can predict that y=1, otherwise y=0. The percent corrected predicted values are the proportion of true predictions to total predictions. So, I can say the higher the predicted probabilities, the more goodness of model.

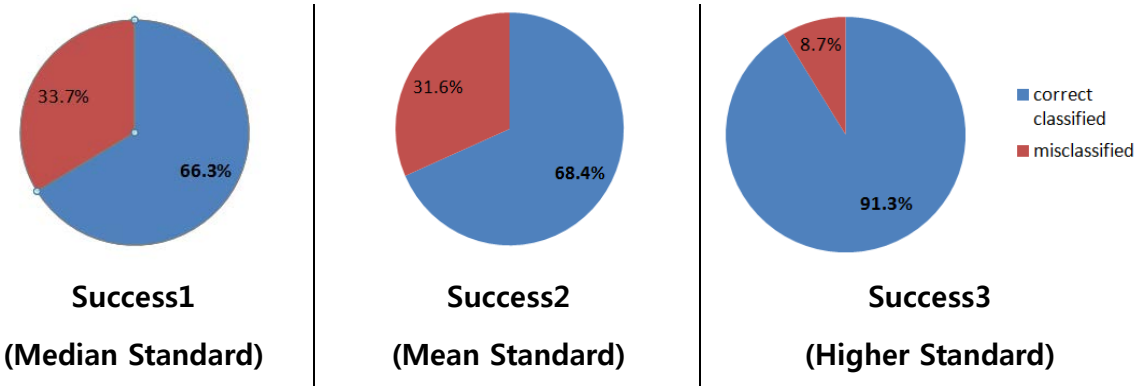
The average of predicted probabilities for successful investors is respectively about 56.5%, 32.6%, and 10.9% in three models which is similar to the actual frequency (50%, 34%, and 14%) for success. For such risky investments, these success rates are useful.

Figure 3 – Predicted Probabilities



However, the percentages of correctly classified of the values in three probit models are a very different, which are 66.3%, 68.4%, and 91.3% respectively and the rest are misclassified as shown in Figure 4. Thus, I can say that the higher standard model has a robust power to correctly predict the values, most being failure of the investment.

Figure 4 – Percentages of Correctly Classified



Limitations

The data set used for this study came from a survey which was conducted to angel investors who are members of angel investor groups with low response rate, which makes it have several inherent biases as mentioned in the two previous papers that used this data set. The data may not be representative of angels in general since angels who do not belong to groups may be different from those who were surveyed in their investment behavior. Also the data only came from angels who were still financial survivors, which may induce survivor bias, missing data from angels who failed and left the groups.

Also, this data set has difficulties with missing information within the angels who were already surveyed. Several essential variables are missing in different patterns, for different observations. As a result, the sample size for regressions is limited. This problem cannot be avoided.

However, when I consider the paucity of data on angels and rare empirical studies of angel investors, the results of this research show that diligence matters at a minimal value of 20 hours, while other factors do not predict success well.

6. Conclusions

Angel investors are vitally important for supplying capital to help start-up firms to grow, with allowing a company to overcome the capital gap in their early-stage. They also provide non-financial assistance, involving as post-investments to increase their investment performance. With the important role of angels, a number of countries have chosen policies or government support ranging from tax incentives to co-investment as a catalyst for developing angel market.

I examined what factors of angel investors affect the outcome of angel investment. Due to the large variation of IRR, I coded it as success or fail. Then, I use OLS and a probit model to estimate regressions with five explanatory variables that represent the post-investment involvement of angel investors (interacted time, due diligence, and duration of investment) and the basic characteristics of angel investors (their education level and their experience period in the industry of venture).

According to my study, the success of angel investors is very difficult to predict as most think, especially in low level of success. The only thing I can predict in low level of success is that the later the stage, the more likely it is to be successful. However, the other factors have no predictive power. Even though the stage variable is controlled in this research, in the point of public policy, policy makers can have implication to increase the capital to early-stage start-ups, with decreasing angels' investment motivation in later-stage firms.

However, this research indicates that in the high level of success, angel investors may positively influence their investment performance with sufficient due diligence and maintaining long-term investment as post-investment involvement of angel investors. There is no indication that many hours makes the outcome better, but rather that there is a minimum effort needed, which appears to be about 20 hours.

In addition, the other factors related with the basic characteristics, such as education level and experience the angel investors had in an industry related to this venture, are not statistically significant factors according to this research.

Therefore, I conclude that the stage of the venture at the time of their investment, due diligence and duration of investment are the primary determinants of the successful angel investors. Also, this research indicates that the post-investment involvement of angel investors rather than the basic characteristics are more likely to be related with the improved performance of the angel investors.

Additional research using other data sets will continue to increase understanding of angel investors and their performance, and will help policy makers set criteria to select angel investors for targeted government support.

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Appendix

Table 1 - Summary Statistics

Variable	Mean	S.D.	Min	Max
totalcashout	814878.13	2.72e+06	0.00	2.10e+07
totalinvested	128560.99	350283.61	5000.00	3.00e+06
yearsheld	4.31	3.48	0.00	23.00
yearsinv	13.20	9.11	1.00	49.00
yearsentre	19.10	9.74	5.00	49.00
edlevel	2.47	1.10	0.00	5.00
stage	2.13	1.08	1.00	5.00
initialinvest	76505.49	137323.19	5000.00	1.00e+06
initrevs	2.21e+06	9.05e+06	0.00	6.00e+07
coinvestors	3.66	4.61	0.00	12.00
diligence	114.35	539.45	0.00	5000.00
industryexp	7.10	10.88	0.00	47.00
Interaction	3.84	1.71	1.00	6.00

Table 2 – Probit Estimation Results

VARIABLES	median_standard success1	mean_standard success2	higher_standard success3
Interaction times	0.000969	0.00145	0.00224
	(0.463)	(0.191)	(0.285)
dilig20ormore	0.361	0.580	1.119*
	(0.326)	(0.119)	(0.0780)
yearsheld	0.0505	0.0291	-0.768
	(0.833)	(0.839)	(0.536)
yearsheldsq	0.00594	-0.00570	-0.0488
	(0.789)	(0.545)	(0.835)
edlevel_high	-0.172	0.127	0.967
	(0.642)	(0.709)	(0.192)
industryexp	0.0171	0.0117	0.00795
	(0.302)	(0.442)	(0.815)
yearsinv	-0.0189	-0.0128	-0.00979
	(0.334)	(0.506)	(0.878)
stage	0.367**	0.235	0.278
	(0.0185)	(0.103)	(0.219)
coinvestors	0.00182	-0.0148	-0.120
	(0.960)	(0.686)	(0.110)
Constant	-0.946	-1.175	-0.349
	(0.262)	(0.103)	(0.851)
Observations	92	92	92

p-value in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3 – Distribution of Stage Level

stage	Freq.	Percent	Cum.
1	59	30.57	30.57
2	83	43.01	73.58
3	33	17.10	90.67
4	10	5.18	95.85
5	8	4.15	100
Total	**193**	**100.00**	

Table 4 – Estimation of Amount of Initial Investment

VARIABLES	initialinvest	VARIABLES	initialinvest
Interaction times	396.9***	industryexp	-1,307
	(0.000407)		(0.371)
dilig20ormore	-2,763	yearsinv	-1,931
	(0.939)		(0.252)
yearsheld	4,564	stage	4,288
	(0.691)		(0.755)
yearsheldsq	-51.31	coinvestors	492.6
	(0.929)		(0.884)
edlevel_high	-26,222	Constant	67,570
	(0.443)		(0.279)
Observations	92		
R-squared	0.216		

p-value in parentheses
*** p<0.01, ** p<0.05, * p<0.1