# A GREEN FLAG OVER MOBILE INDUSTRY START-UPS: HUMAN CAPITAL AND PAST INVESTORS AS INVESTMENT SIGNALS

Jungkook An, Graduate School of Information, Yonsei University, 134 Sinchon-dong, Seodaemun-gu, Seoul 120-749, Korea, jace@yonsei.ac.kr

Woojin Jung, Graduate School of Information, Yonsei University, 134 Sinchon-dong, Seodaemun-gu, Seoul 120-749, Korea, hygm2003@gmail.com

Hee-Woong Kim, Graduate School of Information, Yonsei University, 134 Sinchon-dong, Seodaemun-gu, Seoul 120-749, Korea, kimhw@yonsei.ac.kr

## Abstract

*Crowdfunding and online start-up platforms are becoming important communication tools for start-ups and investors. Existing literatures on online start-up platforms usually focus on reward-based crowdfunding platform, which do not offer any equity to backers. In addition, there have not been many empirical researches about equity-based crowdfunding due to the novelty of the regulation. This study analyzes the association between funding amount and early stage start-ups' underlying characteristics, the type of past investors, and influence of investors in the context of equity-based crowdfunding. The distinction of our research is the aspect of approach that we use population data from online start-up platform for the mobile industry. We find that start-up's funding outcome is positively related to start-up's human capital and pure investors. Moreover, our study extends theoretical understanding of the importance of human capital and past investors in start-up, and also contributes to the entrepreneurship literature by examining creditable signals for early stage start-up investment.*

*Keywords: Entrepreneurs, start-ups, venture capital, angel investors, start-up platform.*

# 1 INTRODUCTION

Since online social networks are rapidly changing the way people communicate, business culture also has been changing. For instance, general social networking sites such as Facebook helps people to keep in touch with family and friends in daily practice, and a professional social network sites such as LinkedIn was designed to provide career and business opportunities for business professionals (Skeels & Grudin, 2009). Along with the emergence of various social networking sites, crowdfunding platforms and online start-up social networking sites have grown up steadily and attracted investors and ventures.

Traditionally, investors often tend to rely on offline networks when they seek out companies to invest. However, crowdfunding platforms have dramatically changed investing patterns (Hemer, 2011) by connecting companies, people, and products in online (Salminen, 2014). Recently, start-ups have more chances to raise funds from various sources in online crowdfunding, especially equity-based crowdfunding because it provides an ease of access for start-ups and connects them with investors. Likewise, investors can obtain a depth of information about companies before making their investment decisions.

There are four types of crowdfunding (donation-based, reward-based, lending, and equity-based), and equity-based crowdfunding is a relatively new concept, which contributors buy shares in the company by receiving equity or profit-sharing in the venture they support (Hemer, 2011). Due to the fact monetary returns are involved, equity-based crowdfunding investment has been controversial and faced legal issues (Mollick, 2014). On the other hand, equity-based crowdfunding helps industries and economies by boosting investment and funding, and it also can be used as investment signal tools (Kim & Viswanathan, 2013), such as start-up valuation, investment strategies, and portfolio managements (Phillips et al., 2013). As a result, the Securities and Exchange Commission (SEC) has approved equity-based crowdfunding on September 23, 2013 (JOBS Act Title II), and the adoption of the equity-based crowdfunding has greatly stimulated both investors and investees.

As equity-based crowdfunding becomes increasingly popular, many researchers have investigated crowdfunding projects and funding backers in recent years. However, few studies have extensively investigated crowdfunding receivers such as start-ups and ventures. We study AngelList, which is an equity-based crowdfunding platform provides chances to crowdsource investment for start-ups. The uniqueness of our dataset enables various approaches to find the factors are related to funding outcome. To achieve our research objective, our study addresses the following research questions.

1) What kind of start-up's *characteristics* are associated with successful *funding outcome*?

2) What types of *past investors* are associated with successful *funding outcome*?

3) Are influential *past investors* in start-up associated with successful *funding outcome*?

This study contributes to the literature on equity-based crowdfunding, signalling theory, and firm's valuation. Based on literature, the expected contributions of this research are: (1) we contribute to the literature on crowdfunding, particularly equity-based crowdfunding by highlighting start-up's important key factors, which are related to successful funding outcome (2) we add to the literature on signalling theory by identifying key signals for early stage start-up in the context of crowdfunding (3) we add to the literature on firm's valuation by providing new approaches to assess firm's underlying value using factors related to past investors.

The remainder of this paper is organized as follows. First, the related literature on crowdfunding, signalling theory, and the firm's valuation will be introduced. Second, we develop our research model and hypotheses for our research questions. Third, we explain the research context, data, and empirical analysis. Finally, we conclude by discussing results, limitations, future research, and implications for theory and practice.

# 2 LITERATURE REVIEW

In this section, we discuss relevant literatures. Prior studies have discussed about crowdfunding markets and mechanism. Agrawal et al (2013) have discussed about the underlying economics of crowdfunding to provide a preliminary exploration, and Kim & Viswanathan (2013) have examined the role of early investors as a quality signal in the online crowdfunding market. Kim & Viswanathan (2013)'s study also adds to the literature on crowdfunding and signalling theory (Spence, 1973). Based on precedent research, our study adds to the literatures on equity-based crowdfunding, signalling theory, and firm's valuation.

## 2.1 Crowdfunding

Crowdfunding comes from profit sharing and community benefit, and it is more related to investment than consumption since the crowd can support firm without necessarily becoming a consumer (Belleflamme & McGlashan, 2014). There are various types of crowdfunding (donation-based, reward-based, lending, and equity-based), and in equity-based crowdfunding, contributors buy shares in the company by receiving equity or profit-sharing in the venture they support (Hemer, 2011). Though the funding processes of all crowdfunding platforms are similar, equity-based crowdfunding could be different since monetary returns are important for funders (Bradford, 2012). As an equity funding through venture capital is a favored method of obtaining financing (Voelker & McGlashan, 2013; Gerber et al., 2012), equity-based crowdfunding has increasingly gained attention from entrepreneurs.

Burtch et al. (2011) have studied herding behavior in the context of crowdfunding market. Burch et Al. argue that the influence of herding signal is important, and explains herding behavior is apparent in larger markets. Kim & Viswanathan (2013) examine the role of reputable investors in a crowdfunding market for mobile applications and investigated whether early investments serve as quality signals for later investors. Our study adds to a growing literature on equity-based crowdfunding by highlighting start-up's important key factors, which are related to successful funding outcome. Kim & Viswanathan use the amount of app download performance as a dependent variable, which represents a part of business performance. Instead, we use a funding outcome as a dependent variable, which is a not a part of business performance, but an important factor in start-up sustainability.

## 2.2 Signalling Theory

Prior research about the role of signalling was first introduced in the early 1970's by economist Michael Spence (1973). He developed a signalling model in the job market, and the fact that employers are faced with the problems when they hire people since employees vary in quality. To convince abilities and qualities of employees, employees should send valid signals for quality such as education level and characteristics by having reputational information.

Extending to Spence's theory, Brealey (1977) studies the role of signals within the process of initial public offering (IPO), and Brealey argues that as the signer sender with the higher possibilities of success should always send clear signals to the receivers when going public. Also, Connell et al., (2011) explain information asymmetries between investors and entrepreneurs have been a great concern in venture capital financing. In order to successfully raise funds, start-ups as signal senders need to signal their values to receivers who are potential investors (Ahlers, 2012).

Our study contributes to the literature on signalling theory by identifying key signals for early stage start-up in the equity-based crowdfunding market context. Kim & Viswanathan analyze the ex-post performance of apps and find the quality signals provided by the experts' investment choices are indeed credible. In order to examine past investors as a signal, Kim & Viswanathan identify three types of investors: "App Developer Investors," "Experienced Investors," and "Crowd". However, our

study focuses primarily on two types of investors based on prior experiences whether investor had business related experiences: “Pure Investors” and “Business Investors”.

### 2.3 Firm’s Valuation

From “Theory of the growth of the firm (Penrose, 1959),” Penrose argues that managerial resources played as a pivotal role and suggested several factors may affect the growth of a firm. He emphasized the importance of human capital in the firm since it is a collection of resources, whereas Porter (1980) emphasized external factors such as population density or market forces to the firm. Teece et al. (1997) argue internal factors such as capabilities, culture, or strategy are important factors in the growth of a firm, and Shane (2000) has examined various characteristics that are unique to entrepreneurial firms. For instance, the increased number of employees at start-up is the measure of the growth signal of firms. John et al. (1994) have examined the characteristics of high net worth individuals regardless of their investment history or their interest in venture investing, and the result reveals that a various groups of investors are diversified.

According to Damodaran (2009), start-ups share some common characteristics, such as no history, small or no revenues, operating loss, dependent on private equity, failure rate, multiple claims on equity, and illiquid of investments. Start-ups are diverse and have limited histories, therefore valuing a start-up is vague and difficult. Damoran suggests two valuation models approaches: intrinsic valuation (discounted cash flow) and relative valuation (scaling value, company comparison, proxy for risks, control for survival, and adjustment for differences in illiquidity). Also, Damodaran argues that investors should have the capabilities to manage successful portfolio of investments to deal with high uncertainty. However, an importance of past investors in start-up has been severely neglected in prior studies because of lack of data and approaches. Our study contributes to the literature on the assessment of the firm’s valuation by providing new approaches that respect past investor factors as firm’s underlying growth factors.

## 3 HYPOTHESES

First, we formulate our hypotheses on how start-up’s underlying characteristics such as human capital and non-human capital are associated with funding outcome (H1a~H2d). Second, we hypothesize that there may be relationship between the past investor’s prior experience and funding outcome. (H3a, H3b). Last, we hypothesize that the past investor’s influence level is related to funding outcome by analyzing the number of past investors’ followers (H4).

**Start-up Characteristic**

Human capital is the stock of human resources involved in the production of goods and services, and its emphasis is on viewing people as capital (Lucas, 1988, 1990). The firm’s valuation literature has suggested human capital as a resource of the firm since high levels of human capital foster firm’s growth (Damoran, 2009). Examples of such human capitals include the number of *Current Team Members* and the number of *Employees* in start-up. Thus, we hypothesize:

*H1a: The number of Current Team Members will be positively associated with funding amount.*

*H1b: The number of Employees will be positively associated with funding amount.*

Further, we consider start-up’s characteristics other than human capital, and our basic expectation is that start-up’s non-human capitals might associated with *Funding Amount*. Though they are not directly related to creating economic value for start-ups, we assume that they are indirectly associated with funding outcome. Examples of such non-human capitals are: the number of *Board and Advisors*, the number of *Followers*, and the number of *Past Team Members* in start-up. Thus, we propose our hypothesis.

*H2a: The number of Board and Advisors will be positively associated with funding amount.*

*H2b: The number of Followers will be positively associated with funding amount.*

*H2c: The number of Past Team Members will be positively associated with funding amount.*

### 3.1 Past Investors

Kim & Viswanathan (2013) examine the influence of past investors in crowdfunding market, and they make influential hypothesis based on three types of investors: "App Developer Investors," "Experienced Investors," and "Crowd." Differently, our study categorizes past investors by business experience, whether they are pure investors or not. The biggest difference between *Pure Investors* and *Business Investors* is that *Pure Investors* are investing expert, whereas *Business Investors* are business expert. Generally, experts have a better understanding of product information, and they can discriminate important and unimportant (Alba et al., 1987). Hence, our question is 'Who are the real experts in equity-based crowdfunding platform?' Using the number of pure investors and business investors causes correlation problem since every start-up has a different number of investors. Therefore, we calculated the sum of pure investors and business investors each, then we divided them by total investors. In hypotheses 3a and 3b, we consider the ratio of pure or business investors in start-up. Thus, we hypothesize:

*H3a: The ratio of Pure Investors will be positively associated with funding amount.*

*H3b: The ratio of Business Investors will be positively associated with funding amount.*

Further, we examine the relationship between the average influential level of investors and *Funding Amount*. We examine *Investors' Followers Average* variable, which is computed by using the sum of past investors' followers and the total number of investors. To calculate *Investors' Followers Average*, we divided the sum of past investors' followers by the number of investors. As Kim & Viswanathan (2013) examine earlier investment as an investment signal for later investors, we also examine the relationship between reputable investors and start-up's funding outcome. Moreover, whereas previous research has focussed on how earlier investors can influence sales performance and later investors (Burtch et al., 2011), our study focuses on start-up's underlying growth factors, which are important to potential investors. Thus, we hypothesize:

*H4: Investors' Followers Average will be positively associated with funding amount.*

## 4 RESEARCH CONTEXT AND DATA

### 4.1 Research Context and Data Collection

We collected data from AngelList, which is one of the largest global equity-based crowdfunding investment platform. AngelList was founded in 2010, and as of December 2014, over 397,000 companies and 840,000 users are registered. As not only equity-based crowdfunding platform but also start-up social networking service, the site attracts investors, start-ups, venture capitalist, incubators, and accelerators by providing industrial information.

Our study covers a mobile industry sector in the United States, and we have built datasets by using AngelList API. In addition, we have collected various information from the website. We finally have built cross-sectional population data in a mobile industry on AngelList, and our observed start-ups' current funding activities include 'Seed', 'Series A', 'Series B', 'Series C', 'Series D', 'Acquired', and 'No Stage.' In order to examine the factors related to funding outcome, we excluded start-ups have no funding activities. Therefore, our data set includes 1,111 companies, 11,969 user profiles, and 19,677 company-user link data. User profile data is publicly available, and we created a company-user link dataset that can be used to derive variables related to past investors' types and occupations such as

pure investors, business investors, entrepreneurs, advisors, and angels. The data were collected in December, 2014 and contains enough records to explain our research questions.

Table 1 gives summary statistics of start-up distribution by current funding stage, and provides statistics for each of our variables. On the funding stage level, there are clear differences across stages. Basically, our study mainly focuses on early stage start-ups, which current stages are seed or series A. As Table 1 displays, seed stage has a relatively large number of observations (N=687) compare to all the other stages. As a seed stage are regarded as early stage, most of the variables such as funding amount, current team members, employees, board & advisors, founded, followers, and past team members are smaller than other stages.

| **Variable** | **Seed** | **Series A** | **Series B** | **Series C** | **Acquired** | **No Stage** |
|---|---|---|---|---|---|---|
| Funding Amount | 1,212 | 10,819 | 20,748 | 28,789 | 4,837 | 3,108 |
| **Startup Characteristics** | | | | | | |
| *Human Capital* | | | | | | |
| Current Team Members | 1.71 | 3.71 | 6.03 | 10.00 | 4.48 | 2.26 |
| Employees (4pt int.scale) | 1.16 | 1.75 | 2.05 | 2.18 | 1.46 | 1.27 |
| *Non-Human Capital* | | | | | | |
| Board & Advisors | 0.38 | 1.48 | 1.74 | 4.18 | 1.17 | 0.70 |
| Founded (weeks) | 38.21 | 48.72 | 48.06 | 59.20 | 48.18 | 48.94 |
| Followers | 91.79 | 189.56 | 231.05 | 483.55 | 356.83 | 78.66 |
| Past Team Members | 0.45 | 1.65 | 2.77 | 6.64 | 1.55 | 0.81 |
| Published News | 0.89 | 3.06 | 17.46 | 27.36 | 1.72 | 1.01 |
| Quality Score | 5.45 | 7.34 | 8.44 | 8.73 | 7.34 | 5.34 |
| **Past Investors** | | | | | | |
| *Type* | | | | | | |
| Business Investors | 1.43 | 2.75 | 2.69 | 3.64 | 7.66 | 1.46 |
| Pure Investors | 2.11 | 5.26 | 5.95 | 11.27 | 12.24 | 2.51 |
| Other Investors | 1.09 | 1.63 | 1.10 | 1.36 | 4.76 | 1.47 |
| Total Investors | 4.63 | 9.63 | 9.74 | 16.27 | 24.66 | 5.44 |
| *Influence* | | | | | | |
| # of Investors' followers | 6,358 | 19,028 | 27,395 | 54,137 | 41,693 | 6,011 |
| Investors' followers (avg.) | 636 | 1,440 | 1,969 | 2,603 | 1,716 | 491 |
| **N** | 687 | 167 | 39 | 11 | 29 | 169 |

*Table 1. Summary Statistics: Start-up distribution by current stage*

Table 2 provides an initial outlook of data we use in our research. Our data set contains various and detailed information about start-ups and users. Our unique dataset includes start-up's accumulated funding outcome, human capital, past investors, and quality score from AngelList.

We can observe *funding amount* has a max number of $171,000,000 and an average of $4,205,820. We also observe that there are more *pure investors* (mean = 3.13) than *business investors* (mean = 1.86). *Followers* indicates the number of users who subscribe to start-up's information, such as updated news on AngelList. Since *follower* has the average of 119.90 and standard deviation of 208.38, we infer that there are huge gap between popular start-ups and unpopular start-ups on AngelList platform. In addition, the number of investors' followers has a large standard deviation, and this also indicates that many investors are concentrated in few start-ups, which are probably well-known and popular among investors on AngelList.

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Funding Amount | 1,111 | 4,205,820 | 13,000,000 | 13 | 171,000,000 |
| **Startup Characteristics** | | | | | |
| *Human Capital* | | | | | |
| Current Team Members | 1,111 | 2.42 | 3.31 | 0 | 30 |
| Employees (4pt interval scale) | 1,085 | 1.32 | 0.56 | 1 | 4 |
| *Non-Human Capital* | | | | | |
| Board & Advisors | 1,111 | 0.72 | 1.73 | 0 | 20 |
| Founded (weeks) | 784 | 42.97 | 29.50 | 4 | 491 |
| Followers | 1,111 | 119.90 | 208.38 | 1 | 1,892 |
| Past Team Members | 1,111 | 0.87 | 2.51 | 0 | 31 |
| Published News | 1,111 | 2.12 | 14.99 | 0 | 449 |
| Quality Score | 1,111 | 5.92 | 2.20 | 1 | 10 |
| **Past Investors** | | | | | |
| *Type* | | | | | |
| Business Investors | 1,111 | 1.86 | 4.88 | 0 | 51 |
| Pure Investors | 1,111 | 3.13 | 6.38 | 0 | 59 |
| Other Investors | 1,111 | 1.32 | 3.12 | 0 | 37 |
| Total Investors | 1,111 | 6.31 | 13.35 | 0 | 147 |
| *Influence* | | | | | |
| Number of Investors' followers | 1,111 | 10,344 | 26,304 | 0 | 230,071 |
| Investors' followers (Avg.) | 1,111 | 836 | 2,048 | 0 | 37,393 |

*Table 2. Summary Statistics: Statistics by variable*

## 4.2 Variables

Our data allows industry level analysis in the mobile sector to determine whether a specific start-up's characteristics and past investors are associated with funding amount. Since our research is to suggest various perspectives to both investors and start-ups, the dependent variable of this research is funding amounts. Funding amount is an accumulated dollar amount the company raised from investors since they started the business.

### *4.2.1 Start-up's Characteristic*

Stage is the companies' current funding stage, which is classified as seven common categories; 'Seed', 'Series A', 'Series B', 'Series C', 'Series D', 'Acquired', 'No Stage.' 'Seed' funding is a fundraising for early-stage start-ups before 'Series A', and usually angel investors and VCs invest in seed rounds. Series A, B, C, and D are sequential rounds, whereas 'Seed' and 'Acquired' are not. 'Seed' round can be skipped by getting 'Series A' fund, and 'Acquired' represents the start-up's acquisition, which is a common business strategy for big companies. Also, IPOs (Initial Public Offering) are rare cases for start-ups, therefore we excluded them. The round is not a one-time event, thus some start-ups may have several rounds in each stage. Especially, seed funds usually refer to fundraising that occurred before the formation of a corporation, therefore start-ups at seed stage can have past investors.

*Current Team Members* is the total number of people who are in a management level, whereas *Employees* is the number of people who are employed at the start-up. *Past Team Members* is the total number of people who were in a management level. *Board & Advisors* is the number of board members and advisors. *Followers* is the number of users who subscribe and receive start-up's updated

information by following start-up's page on AngelList. *Funded* is the start-up's age in weeks. *Published News* is the number of news published about start-up. *Quality Score* is a quality indicator by AngelList, which is updated every 48 hours and reflects the company's rank on AngelList. *Quality Score* ranges between 0 and 10, and higher numbers mean better quality.

Our study has tried to include many control variables as possible. However, some variables were vague and missing data, such as 'the number of products,' 'the number of competitors,' and 'acquisition'. Companies decide how many products and competitors, they have, therefore we concluded that those variables are not suitable for our analysis. Also, typical crowdfunding platform projects such as Kickstarter projects may have distance effects since they are also focusing on fundraising projects for local events (donation-based and reward-based). Instead, equity-based crowdfunding fundraisings are similar to online stock investment, which do not have distance effects.

### *4.2.2 Investor's Type*

Our assumption of this research is the backed companies from creditable investors have more probability of success. Therefore, the role of the past investors is very important for the company since past investors are influential for later investors.

| **TYPE** | | **VARIABLE** | **DEFINITION** |
|---|---|---|---|
| Dependent Variable | | Funding Amount | Accumulated dollar amount of start-up's funding outcome |
| **Start-up Characteristics** | Human Capital | Current Team Members | Number of current team members of start-up |
| | | Employees | Number of employees of the startup (4 point interval scale) |
| | Non-human Capital | Board & Advisors | Number of board members and advisors |
| | | Followers | Number of users who subscribe to start-up's information on AngelList |
| | | Founded (weeks) | Start-up's age |
| | | Past Team Members | Number of past team members of start-up |
| | | Published News | Number of news published about start-up |
| | | Quality Score | Start-up quality measured by AngelList (1~10) |
| **Past Investors** | Investors' Type | Pure Investors | Ratio of investors who are investor types (non-business) in start-up |
| | | *Advisors* | Ratio of investors are advisor |
| | | *Attorneys* | Ratio of investors are attorney |
| | | *Angels* | Ratio of investors are angel |
| | | *Investors* | Ratio of investors are investor |
| | | *Venture Capitalists* | Ratio of investors are capitalist |
| | | Business Investors | Ratio of investors who are both business and investing types |
| | | *Designers* | Ratio of investors are designer |
| | | *Developers* | Ratio of investors are developer |
| | | *Entrepreneurs* | Ratio of investors are entrepreneur |
| | | *Marketing* | Ratio of investors are marketing |
| | | *Operations* | Ratio of investors are operation |
| | | *Project Management* | Ratio of investors are project management |
| | | *Sales* | Ratio of investors are sales |
| | Investors' Influence | Investors' followers | Accumulated number of subscribers of each investor in startup |
| | | Investors' followers avg. | Average of Investors' followers (dividing by number of investors) |

*Table 3. Variable Types and Definition*

Table 3 shows the definition of the variables regarding to past investors. We define two distinctive types of past investors in terms of their past experience. *Business investor* is an investor who had business experiences in the past, and *pure investor* is opposite. Though *pure investor* is non-experienced in business, he or she has better market insights from investment experiences. In other words, *business investor* is a product expert, but *pure investor* is a market or investment expert. To distinguish them, we track investors' past work experiences and roles in the companies.

# 5 EMPIRICAL ANALYSIS

This study aims to identify factors associated with funding amount such as companies' specifications and past investors. To estimate the regression coefficients, we assume the funding amount of start-up is computed by explanatory variables such as *CurrentTeamMembers, Employees, PastTeamMembers, BoardsAdvisors, InvestorsType, InvestorsInfluence, Followers, PublishedNews, Founded, and QualityScore* where i denotes a company.

Our data contains a series of observations on funding status for every start-up, and our estimation equation is given by

$$\begin{aligned}\ln(\text{Funding}_i) = \alpha &+ \beta_1 \text{CurrentTeamMembers}_i + \beta_2 \text{Employees}_i + \beta_3 \text{PastTeamMembers}_i \\ &+ \beta_4 \text{BoardsAdvisors}_i + \beta_5 \text{InvestorsType}_i + \beta_6 \text{InvestorsInfluence}_i \\ &+ \varphi_1 \text{Followers}_i + \varphi_2 \text{PublishedNews}_i + \varphi_3 \text{Founded}_i + \varphi_4 \text{QualityScore}_i + \varepsilon_i\end{aligned}$$

where $Funding_i$ is the company's accumulated funding amount raised from all funding projects since the business get started; *CurrentTeamMembers* is the number of current team members; *Employees* is the number of employees of the start-up can refer to company size; *PastTeamMembers* is the number of past team members; *BoardsAdvisors* is the number of board members and advisors; *InvestorsType* is the type of past investors based on experiences; *InvestorsInfluence* is the average of investors' followers which divides accumulated number of subscribers of each investor in start-up by the number of investors; *Followers* is the number of users who subscribe start-up's information on AngelList; *PublishedNews* is the number of news published about start-up; *Founded* is Start-up's age in weeks; *QualityScore* is the quality indication by AngelList; ε is an unobserved error term representing all causes of *Funding* other than main variables.

# 6 RESULTS

Our analysis mainly estimates how companies' underlying characteristics are associated with the funding amount in the mobile industry. First, we show regression result for the hypotheses for start-up's underlying characteristics such as human capital, past investor type, and past investor's influence (6.1). Second, we show regression for the hypotheses regarding to past investor's occupation (6.2).

## 6.1 Start-up Characteristics

*What kind of start-up's characteristics are associated with successful funding outcome?*

Table 4 presents regressions that examine the association of the start-ups' attributes with funding outcomes. First, our human capital hypotheses 1a and 1b were supported. The number of *Current Team Members* and *Employees* are regarded as human capital since they have abilities to perform labor. In addition to a productivity perspective, Current Team Members, and Employees are directly related to start-up's productivity. Our result shows that Current Team Members, and Employees have significant, positive relationship with accumulated Funding Amount.

Second, hypotheses 2a through 2c were not supported. We examined how start-up's characteristics other than human capital are related to *Funding Amount*. Our results show that *Boards & Advisors Followers, and Past Members* are not related to start-up's *Funding Amount*.

| | (1) All | (2) Seed | (3) Series A | (4) Series B | (5) No Stage |
|---|---|---|---|---|---|
| **Startup Characteristic** | | | | | |
| *Human Capital* | | | | | |
| Current Members | **0.0746*****<br>(0.018) | **0.0859****<br>(0.026) | **0.0475***<br>(0.023) | -0.0034<br>(0.053) | **0.149***<br>(0.058) |
| Employees | **1.2240*****<br>(0.098) | **0.957*****<br>(0.168) | **0.8450*****<br>(0.126) | **0.8540***<br>(0.312) | **0.9720*****<br>(0.227) |
| *Non-Human Capital* | | | | | |
| Board & Advisors | 0.0532<br>(0.027) | 0.0262<br>(0.044) | 0.0409<br>(0.032) | -0.0327<br>(0.061) | 0.0050<br>(0.076) |
| Followers | 0.0003<br>(0.000) | 0.0003<br>(0.000) | 0.0002<br>(0.000) | **0.0013***<br>(0.001) | 0.0001<br>(0.001) |
| Founded (weeks) | **0.0059*****<br>(0.002) | **0.0126*****<br>(0.003) | 0.0019<br>(0.004) | 0.0055<br>(0.007) | 0.0044<br>(0.002) |
| Past Members | 0.0004<br>(0.023) | 0.0123<br>(0.036) | -0.0011<br>(0.030) | 0.0359<br>(0.058) | -0.0105<br>(0.070) |
| Published News | -0.0012<br>(0.003) | 0.0036<br>(0.016) | 0.0042<br>(0.010) | 0.0010<br>(0.004) | 0.0647<br>(0.049) |
| Quality Score | **0.3610*****<br>(0.034) | **0.2530*****<br>(0.044) | **0.1820****<br>(0.061) | -0.0309<br>(0.120) | **0.4110*****<br>(0.102) |
| **Past Investors** | | | | | |
| *Type* | | | | | |
| Pure Investors | **0.0035***<br>(0.002) | 0.0029<br>(0.002) | -0.0025<br>(0.003) | 0.0014<br>(0.005) | 0.0064<br>(0.004) |
| Business Investors | -0.0030<br>(0.002) | -0.0014<br>(0.002) | 0.0035<br>(0.004) | -0.0093<br>(0.009) | -0.0086<br>(0.005) |
| *Influence* | | | | | |
| Investors' Followers avg. | **-0.0001****<br>(0.000) | **-0.0001***<br>(0.000) | -0.0001<br>(0.000) | -0.0001<br>(0.000) | **-0.0002***<br>(0.000) |
| R-sq | 0.58 | 0.39 | 0.47 | 0.65 | 0.62 |
| N | 769 | 448 | 128 | 33 | 121 |

*Table 4. Full Model Regression*

## 6.2 Past Investors

*What kind of investors' experiences are associated with successful funding outcome?*

Hypothesis 3a was supported, indicating that the ratio of *Pure Investors* has a positive relationship with *Funding Amount*, while hypothesis 3b was not supported. Surprisingly, our influential hypothesis (H4) concerning the positive influence of past investors' followers average was significant in the opposite direction. Thus, hypothesis 4 was not supported, and it clearly explains that many influential past investors in start-up can be a noise instead of a good signal.

We found most of the coefficients are statistically significant at the 5% or 10% confidence level for *Pure Investors*, however the signs are opposite. This result suggests that the higher ratio of *Pure Investors* is an investing signal for later investors, whereas *Business Investors* is not.

| | | (1) All | (2) Seed | (3) Series A | (4) Series B | (5) No Stage |
|---|---|---|---|---|---|---|
| **Pure Investors** | Advisors | 0.0182 | **0.0257*** | **0.0769*** | -0.0922 | 0.0108 |
| | | (0.011) | (0.012) | (0.033) | (0.273) | (0.018) |
| | Angels | **0.0223***** | **0.0154***** | 0.0039 | 0.0069 | **0.0201**** |
| | | (0.002) | (0.002) | (0.003) | (0.011) | (0.006) |
| | Attorneys | -0.0001 | -0.0049 | -0.0036 | 0 | 0.2130* |
| | | (0.014) | (0.012) | (0.033) | (.) | (0.092) |
| | Investors | **0.0214***** | **0.0148***** | **0.0140**** | -0.0021 | 0.0129 |
| | | (0.004) | (0.004) | (0.005) | (0.021) | (0.009) |
| | Venture Capitalists | **0.0479***** | **0.0311***** | **0.0135***** | 0.0065 | **0.0470***** |
| | | (0.003) | (0.005) | (0.004) | (0.009) | (0.012) |
| **Business Investors** | Designers | 0.0333 | 0.0233 | -0.016 | -0.0973 | 0.0689 |
| | | (0.021) | (0.021) | (0.034) | (0.179) | (0.070) |
| | Developers | -0.0037 | -0.0057 | 0.0363 | 0.0877 | -0.0159 |
| | | (0.007) | (0.006) | (0.023) | (0.092) | (0.032) |
| | Entrepreneurs | **0.0046*** | 0.0030 | **0.0088*** | -0.0092 | -0.0039 |
| | | (0.002) | (0.002) | (0.004) | (0.011) | (0.006) |
| | Marketings | 0.0077 | 0.0126 | **0.0493*** | -0.0035 | 0.0039 |
| | | (0.010) | (0.009) | (0.025) | (0.059) | (0.032) |
| | Operations | **0.0267*** | 0.0137 | **0.0903***** | 0.0318 | 0.1120 |
| | | (0.012) | (0.011) | (0.025) | (0.053) | (0.072) |
| | Project Mgt. | 0.0125 | 0.0095 | 0.0106 | -0.0369 | 0.0772 |
| | | (0.008) | (0.007) | (0.020) | (0.097) | (0.060) |
| | Sales | 0.0185 | 0.0224 | -0.061 | 0.3530 | 0.0161 |
| | | (0.013) | (0.012) | (0.046) | (0.300) | (0.053) |
| | R-sq | 0.25 | 0.16 | 0.26 | 0.14 | 0.25 |
| | N | 1111 | 687 | 167 | 39 | 169 |

*Table 5. The association between Investors' Occupations with Funding Amount*

Additionally, Table 5 shows extended analysis of type of past investors. Interestingly, it shows clearly different results within same past investors' type when we break down into occupations. For *Pure Investors*, the result explains the expert investors, such as *Angels, Investors, and Venture Capitalists* are significantly associated with *Funding Amount*, whereas un-expert pure investors, such as *Advisors* and *Attorneys* are not. Though the ratio of *Business Investors* (H3b) was not supported, Table 5 shows the ratio of *Entrepreneurs* and *Operations* are significantly associated with *Funding Amount*.

# 7 DISCUSSION AND IMPLICATIONS

## 7.1 Discussion of Findings

The testing results explain how companies' underlying characteristics are associated with funding outcome in the mobile industry. Table 4 shows all results with main research questions, and additionally, an extended the type of investors is reported in Table 5.

Conventionally, the investors such as venture capitals and business angels seek out companies through offline network. However, a popularity of online start-up platforms increases digital visibility of start-ups to promote their potential to investors by having ease of access to all publicly available information instantly. Based on our findings, we believe that the number of people related to start-up

is strongly associated with funding outcome. Therefore, having great human capitals can leverage start-up's potential, and an ability of backing from professional investors is a growth signal for the start-up's future success.

For start-up, obtaining a fund from investors is very important because it aids innovation and helps a sustainability of start-up. Funding is a non-banking financing that investors receive dividends or distributions instead of interests. From the aspect of risk management, funding enables start-up to share the risk with investors since the start-up does not pay off, unlike the start-up should pay off the loan amount with interests for a debt financing. Therefore, start-up's funding from investors is used for avoiding the risk of debts, whereas a start-up takes all risks from bank financing. In addition to avoiding the risk, a start-up's funding history builds up a reputation for potential investors.

### 7.2 Limitation and Future Research

There are several limitations of this study. First, our dependent variables, funding amount are not correlated with business success of start-up (Porter, 1980). Fundraising lots of money does not always lead companies to business success. Therefore, our result cannot be generalized to start-up's success. Also, start-ups' business performance factors are not considered, such as revenue, profitability, and market shares. Second, our data is a cross-sectional data and only focuses on early stage start-up in the mobile industry. Due to this fact, we cannot examine the causal relationship between funding outcome and factors. In our future studies, we will further examine panel data to capture longitudinal variances during several months is worth. Third, we did not consider proximity and homophile effects in this study. Thus, we are interested in studying herding and homophile behaviors by investigating college, past work, and location information as key factors in our future study. Last, our study may have endogenous issues since many factors are considered. In our future studies, we will focus primarily on key factors by controlling other characteristics which may affect funding outcome. In addition, we need to conduct endogeneity test such as Durbin-Wu-Hausman test in the next step.

### 7.3 Implications for Research and Practice

Our results have several research implications. First, our study identified key signals in equity-crowdfunding market based on signalling theory (Spence, 1973). We especially applied signalling theory to the context of the mobile industry, and we empirically examined the association between start-up's funding amount and start-up's underlying characteristics such as human capital, past investors.

Second, we focus on more in-depth analysis in human capital to see how human capital as a resource of start-up (Penrose, 1950) are related to start-up's funding outcome. From our finding, the ratio of pure investors in start-up has a positive relationship to *Funding Amount* compare to the ratio of business investors. This is due to the fact that pure investors are the investing experts whose main interests are investing. In addition, our results show that Angels, Investors, and Venture Capitalists are associated with the funding outcome when we break down investors types into occupations. Interestingly, the number of board & advisors, the number of followers, the number of past team members, and the number of published news are not associated with funding outcome.

Third, we examined the average investors' followers to see how the funding outcome is related to influential investors in the context of equity-based crowdfunding. Kim & Viswanathan (2013) explain that earlier investors can be a creditable investment signal for later investors, and our results conclude that higher investors' followers' average has a negative relationship to *funding amount*. Additionally, start-up's human capital is more related to *funding amount* than the past investor's type or influence level.

In addition to research implication discussed above, our research also provides some practical implications. The primary goal of this research is to provide suggestions on both investors and start-

ups by understanding what kind of start-ups are more likely to attract financing. For investors' perspective, our results provide empirical support to identify key signals for measuring the valuation of start-ups (Damodaran, 2009). For start-up's perspective, our study suggests how human capital management and quality signal building is important to maximizing funding outcome by understanding what can attract investors into financing (Penrose, 1950). For equity-based crowdfunding and start-up social networking service providers, this study suggests that providing the quality of information is valuable for site users.

Also, our study can provide future implication for a Fintech platform since AngelList offers features such as the formation of syndicates. For example, investors who are registered on AngelList can form syndicates, whereby they pledge money to mirror the investment backing of prominent investors.

From our understanding, this research methodology, which uses population data for the mobile industry is the first attempt to analyze the relationships between funding outcomes and start-ups' underlying characteristics in online start-up platform. We hope that our work can guideline for identifying key signals in the online crowdfunding market.

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