

Swimming with the Sharks: Entrepreneurial Investing Decisions and First Impression

Abstract

We examine the relation between entrepreneurial investing decisions and first impression regarding entrepreneurs' characteristics, as featured in the TV show "Shark Tank." We ask respondents through Amazon Mechanical Turk to rate still photographs of entrepreneurs contestants along six dimensions and summarize these dimensions through their two principal components: competence/confidence and appearance/likability. We find that the likelihood of receiving a shark's offer is associated positively with both components. However, conditional on getting an offer from a shark investor, the component capturing competence/confidence remains positively associated with the sharks' offered cash and valuation, while the component capturing appearance/likability is negatively associated.

This study investigates the relation between entrepreneurial investors' decision-making patterns and entrepreneurs' individual characteristics in a face-to-face setting. Entrepreneurial startups are increasingly viewed as the engine of employment and the economy. Young companies have created an average of 1.5 million jobs per year over the past three decades. They also drive the dynamics of the economy by increasing competition and spurring innovation (Wiens and Jackson (2014)). Early-stage financing is especially important not only because it provides financial support, but also because it contributes value-added services and intensive monitoring, both of which have been shown to improve the performance of the funded ventures (Kerr, Lerner, and Schoar (2014)).

In the course of their business pursuits, entrepreneurial investors hear many pitches, but decide to fund only some of them. The immediate question is what criteria entrepreneurial investors deploy while reaching these decisions. This question may be posed from a multitude of angles, two of which are central to this paper. First, in simplest terms, any proposed venture could be disentangled into the business idea and the human capital that implements it. To borrow from the vernacular, entrepreneurial investors could primarily bet on the horse (i.e., the business idea) or on the jockey (i.e., human capital or management team). Second, business decisions are driven by both hard and soft information. It appears sensible to state that both play a role in the present setting, but there currently is no *prima facie* evidence to back up such a claim, let alone offer further nuances.

The difficulty encountered in the extant literature is the absence of suitable data to pursue such simple and direct inquiries. Most datasets only allow the researchers to observe successfully funded ventures (Kaplan and Stromberg (2004); Kaplan, Sensoy, and Stromberg (2009)). Such datasets, regardless of how valuable they are for some research questions, are not

suitable for studying entrepreneurial investors' decisions because they contain no information pertaining to the projects that had not received funding. Extant studies have employed different methodologies in an effort to overcome this challenge of data paucity. Some studies have relied on issuing questionnaires to venture capitalists (Macmillan, Siegel, and Subbanarasimha (1985, 1987)). This approach has inherent limitations, including selection issues because responses are voluntary and typical response rates are humble, often below 50%. Recent studies exploit new data sources that, conceivably, could cover the full set of ventures. For example, Bernstein, Korteweg, and Laws (2016) run field experiments with randomized investor information sets on AngelList (an online platform that matches start-ups with potential investors) and study how different types of information (e.g., founding team, start-up traction, identity of current investors) affect investor decisions. However, the decisions in their paper are measured by whether the investor chooses to learn more about the firm on the platform; such decisions do not require the commitment of actually investing a large amount of money in the selected firms. Brooks, Huang, Kearney, and Murray (2014) study the relation between pitch success and gender and physical attractiveness of those making the pitch. Their data set is small, based on 90 pitches from three entrepreneurial pitch competitions in the United States. The information regarding outcome only reflects whether a pitch is awarded in the competition, not specific cash amount and valuation. Moreover, the investment amounts are likely on a much smaller scale compared to those featured on Shark Tank.

In this paper, we tackle these challenges by exploiting a novel setting, presenting itself serendipitously through ABC's reality TV show "Shark Tank." It features a panel of "shark" investors, usually five angel/venture capital investors, who hear business presentations from entrepreneur-contestants. Following the presentations, the sharks offer certain comments, ask

clarifying questions, and state whether they are interested in making a deal or whether they choose to pass.¹ After every shark has had a turn (the turn is determined randomly for each presentation), if any of sharks had expressed interest, further discussion among the sharks and between sharks and entrepreneur-contestants ensues. The discussion takes a wide range of directions, from inquiries about sales projections, market penetration, or similar, to details concerning financing and terms of the offer. It is a *de facto* negotiating process, at the end of which a deal may, but need not be, struck between one or more sharks and the entrepreneur-contestants. In case a deal is struck, the sharks commit their own money and, if applicable, other resources (such as distribution channels).

This setup, aside from providing entertainment to its viewers, provides several unique features that make it a highly desirable laboratory to study the previously unexplored aspects of entrepreneurial decision-making. One unique feature of this setting is that it contains the sharks' entire choice set, the overall pool of ventures encompassing both funded and unfunded proposals. Another unique feature is that the interaction is captured in a video recording. Unlike written documents on entrepreneurs and ventures, video recordings offer a much richer spectrum of information concerning both verbal and nonverbal cues (e.g., appearance, body language). Such a rich information environment enables an investigation of the role of soft information in shaping entrepreneurial investors' decisions. A third unique feature is the sheer fact that, although aired as part of a show that can readily be classified as entertainment programming, the sharks make decidedly real business decisions—there is nothing hypothetical in this setting. One could argue that the amounts typically committed to the showcased projects are miniscule relative to the sharks' overall business interests and wealth, ostensibly characterizing these

¹ These decisions are not irreversible; sharks have been known to change their mind mid-stream and re-enter the discussion and bidding.

business decisions as an extended form of sharks' play and indulgence of their egos. The latter, if anything, offers another unique advantage. In short, sharks have every incentive to behave rationally in this setting. It is plausible to assume that the sharks are superb in what they do because they took decades to establish their business reputation and demonstrate the strength of their business acumen. It would not serve any purpose for them to pursue irrationally a particular project. The reputational damage that could result from such capricious conduct far exceeds the actual non-pecuniary benefits they might extract by engaging in a contest with other sharks just so they would emerge victorious. Finally, the interactions that we observe among "shark" investors are unique in their own right. This feature of the video recordings opens other avenues, not pursued in the current project, for a study of the ways the discussion and the bidding take place, how entrepreneurs compete or coordinate with each other, and so on.

This paper mainly exploits the first two unique features by studying the relation between shark investors' decisions and different dimensions of soft information related to the entrepreneur contestants. An early study by Macmillan, Siegel, and Subbanarasimha (1985) uses questionnaires to show that five of the top ten most important criteria venture capitalists use in shaping their decisions to fund an entrepreneur's project relate to the entrepreneur's experience or personality. The video information integral to our setting provides tremendous soft information about the entrepreneurs' personal traits, helping us establish our main results concerning the relation between sharks' funding decisions and entrepreneurs' personal traits in a set of pitches that either succeed or fail to obtain sharks' funding.

Prior studies in other contexts suggest that individuals may ground inferences about a person's disposition on the basis of their facial appearance. For example, Todorov, Mandisodza, Goren, and Hall (2005) find that inferences of competence based solely on the facial appearance

of political candidates—with no prior knowledge about the person—predict U.S. congressional election outcomes. 680 respondents in our study, obtained through Amazon Mechanical Turk, have evaluated several traits of the entrepreneurs-contestants for a total of 322 pitches aired on the “Shark Tank” between 2009 and 2014. We asked the respondents to use still photographs (screen snapshots extracted from the video recording) to rate entrepreneurs-contestants along six dimensions considered highly relevant to entrepreneurs’ success: capability, confidence, trustworthiness, the ability to work under pressure, physical attractiveness, and likability (Macmillan, Siegel, and Subbanarasimha (1985, 1987)). To simplify the interpretation of our results, we rely on principal component analysis to come up with two main principal components based on the loading of these personal traits.

Besides extracting several characteristics of our entrepreneur-contestants, we use the video recordings to collect a rich set of decision variables, including the likelihood of making an offer, the investors’ valuations of the projects, and the funding structure (funding in terms of equity, debt, or royalties). We manually collect these data from the video recordings, including both basic information about the entrepreneurs and their projects, and detailed information about the asking offers from the entrepreneurs and the decisions by the shark investors. Overall, these decision variables separate shark investors’ decisions into two stages: (1) whether they are willing to make an offer; (2) conditional upon deciding to make an offer, what terms they are willing to provide. In this paper, we focus on two corresponding questions. First, we explore the relation between the likelihood that sharks would make an offer and our collection of measures of entrepreneur contestants’ personal traits that focus on their competence/confidence and their physical appearance. Second, we explore the relation between the valuation of the offers the

sharks made and the entrepreneur contestants' competence/confidence and their physical appearance.

Using a probit regression analysis, we find that the likelihood of getting a shark's offer on the pitch is associated positively with both factors for competence/confidence and physical appearance. Conditional on getting an offer from a shark investor, the factor capturing competence/confidence is positively associated with the shark's valuation of the entrepreneur's business. However, the factor capturing physical appearance is *negatively* associated with the shark's valuation of the entrepreneur's business, suggesting that sharks tend to discount the values of the business of the more physically attractive entrepreneurs.

Our study contributes to the literature on the decision-making of entrepreneurial investors such as venture capitalists and angel investors. Based on a sample of 50 ventures that eventually go public, Kaplan, Sensoy, and Stromberg (2009) conclude that the business idea (the horse) is more important than the management team running it (the jockey). Our evidence suggests that in the early stage of making an investment decision to fund an entrepreneur, soft information such as the first impressions entrepreneurs make (through their confidence/competence and physical appearance) matter in securing funding from entrepreneurial investors. Our study also complements the results from Bernstein, Korteweg, and Laws (2016) that suggest the perception of the founding team of entrepreneurs is a significant determinant of angel investors' decisions to invest in the business and thereby indicate that soft information concerning the entrepreneurs plays an important role in the early stages of firms' life cycles.

Finally, our study helps address the "natural challenge that unobserved heterogeneity across entrepreneurs, such as ability of ambition, might drive the growth path of the firms as well as the venture capitalist's decisions to invest" (Kerr, Lerner, and Schoar, 2014). Using the full set

of pitches made to shark investors, we can provide a more complete picture of the entrepreneurial world by focusing on the full set of pitched projects, both the pitches that succeeded in generating an offer (and, in most such cases, accepting an offer) and those that failed to do so, and can link the outcomes of the entrepreneurs' pitches to their personal traits.

The remainder of the paper proceeds as follows. Section I describes the TV show and details about our data collection, and presents summary statistics. Section II details the process of collecting first impression scores through MTurk. Section III presents the results of our examination of the relation between shark investor's decisions and first impressions. Section IV concludes.

I. TV Show and Data

The TV show "Shark Tank" is an American reality television series, first aired on August 9, 2009, on ABC.² It features aspiring entrepreneur-contestants who seek investments for their business and products making business presentations to a panel of potential investors, called "sharks," who then choose whether or not to invest. The sharks are paid for their participation in the show, but the money they invest is their own. The entrepreneur making a pitch can make a deal on the show if a panel member is interested. However, if all of the panel members opt out, the entrepreneur leaves empty-handed.

We collect data from the first five seasons during the period from 2009 to 2014, extending over 80 episodes that feature a total of 322 pitches. Table I summarizes sample statistics for contestant and product characteristics. For each pitch, we collect data on their

² The show is a franchise of the international format Dragons' Den, which originated in Japan in 2001 with the Japanese show Tigers of Money. The show, however, more closely resembles the format of the British version, Dragons' Den, which premiered in 2005.

presentation format—whether the pitch is presented by one contestant (solo) or by a team. As Table I shows, of the 322 pitches, 185 come from solo entrepreneurs, and 137 come from teams of entrepreneurs. For the solo presentation, we collect data on the contestant’s gender. The majority of the solo-presentations are done by men; of the 185 solo entrepreneurs, 130 are males and 55 are females.

Combining the description of the product and online search about product information, we assign each product to an industry, picking among food, kitchen and related, novelty items, services and events, baby and kid items, tech-gadgets and apps, health and related, education and information, clothes and accessories, home and furnishings, sport and outdoor, and others. Examples of projects assigned for each industry are listed in Table A.I in the Appendix. Food and clothes-and-accessories are the most frequently represented industries. Taken together, they account for about 1/3 of all products (Table I).

During the presentation and the conversation between contestants and shark investors, some business-related information is revealed. Typical examples of such information include the stage of the business, patent status, past sales, and initial self-investment. We code the stage of business into three levels—early stage/development, growth, and expansion. About 24% of the pitches pertain to early stage businesses. The patent status is coded into three levels—the product with an approved patent, rejected patent, or pending patent. Of the 107 products for which we have patent information, 70 had already obtained the patent.

At the beginning of each presentation, the entrepreneur-contestants state the amount of cash they request for, and the percentage of shares they are willing to provide in exchange for the cash amount (all asking terms have equity-only structure). It also tells us what contestants think their companies are currently worth (firm valuation perceived by contestants). Panel A in Table

II presents details on the entrepreneur-contestants' asking terms. It shows that the average (median) asking cash amount from the entrepreneurs is 271 (125) thousand. There are small-scale business projects, but there are also projects that ask for investments as large as 10 million dollars. The average (median) equity share the entrepreneurs are willing to relinquish in exchange for the requested financing is 19.09% (20%). The average (median) implied firm valuation by the entrepreneur (cash asked/equity share exchanged) is about 2 million (833 thousand).

Sharks decide whether they want to make an offer or opt out after hearing a product pitch. Sharks sometimes enter a bidding war for the more appealing pitches and revise their offers during the discussion. In our analyses, we consider the sharks' final offers. Specifically, there are 404 offers made to the 322 pitches in our sample. Panel D of Table II provides a frequency distribution of the number of offers made by the sharks on each pitch. About two thirds of the pitches receive at least one offer; 125 of them receive more than one offer; 11 pitches create huge interest among sharks, receiving offers from all five sharks.

Most of the offers are structured as equity-only, but some offers come with royalty or loan;³ 348 out of the 404 offers have equity-only structure. As Panel B of Table II shows, the average (median) cash funding offered by the sharks is 276 (150) thousand. However, the sharks are raising the equity shares for which they are willing to exchange their cash, with a mean (median) of 34.31% (30%). Based on the cash amount that sharks offer and the equity percentage they require in exchange (on offers with an equity-only structure), firm valuation implied from the sharks' calculation averages to 1.2 million. In Panel C of Table II, we report the comparison

³ For example, in the instance of the Rapid Ramen cooker pitched in Season 5, Robert Herjavec offered a \$300,000 cash investment for 25% of the company, which came with a "royalty" clause that would pay back \$0.75 for each item sold; Mark Cuban offered a \$150,000 cash investment and a \$150,000 loan for the same \$300,000 total and the same share of the company with no royalty.

between the asking terms and the terms of the offer. It appears that the sharks' average (median) offering cash is 1.63 times (the same as) the entrepreneurs' asking amount, but the average (median) firm valuation in the sharks' assessment is only 88% (60%) of that of the entrepreneurs.

II. First Impression Score

We recruited a nationally representative sample of 680 U.S. respondents (45.73% female) over Amazon's Mechanical Turk (MTurk) to provide responses to a Qualtrics survey by evaluating six dimensions concerning the entrepreneur-contestants in our sample: (1) capability; (2) confidence; (3) trustworthiness; (4) ability to handle pressure; (5) appearance; and (6) likability. The details of the survey questions and a sample of the survey are included in the Appendix.

For each pitch, we take a standardized screenshot of the presenter (team). To avoid introducing bias potentially embedded in expressions, we take the screenshot when the headshots of the entrepreneurs appear on the screen the first time. The photos of solo presenters and teams are resized so that the head of each individual has similar size in each photograph. We randomly assign 20 pictures to each MTurk respondent, who in turn rates the first impression on the six dimensions using a 9-point scale. At the end of each survey, we collect the respondents' personal characteristics—age, gender, marital status, ethnic origin, education, employment status, profession, income, and net worth. Figure 1 depicts the location in latitude and longitude of the 680 MTurk respondents based on their IP addresses. These respondents appear to be widely scattered geographically. Single geographic clusters are unlikely to drive our results. The distribution of respondents' personal information is reported in the Appendix.

We compare the distribution of ratings across dimensions and across respondents. For each respondent's ratings, we calculate the mean and standard deviation along each dimension.

Table III reports the summary statistics on these means and standard deviations across all respondents for each dimension. We observe large variation in the distribution of respondent ratings. For example, some respondents give low scores (below 3) on average, while others give high scores (above 8) on average; some respondents give homogeneous scores (with standard deviations of their responses lower than 0.5), while others give heterogeneous scores (with standard deviations of their responses higher than 3). To foster comparability across respondents' ratings, we standardize their raw scores by calculating their standardized Z-scores. Specifically, let $R_{cd,i}$ denote respondent i 's rating on dimension d of contestant c . For respondent i , we compute the mean of ratings on dimension d across all contestants, $\mu_{d,i}$, and the standard deviation, $\sigma_{d,i}$. The standardized Z-score is calculated as:

$$Z_{cd,i} = \frac{R_{cd,i} - \mu_{d,i}}{\sigma_d}$$

After the Z-score standardization, the scores provided by all respondents will share the same scale, with a zero mean and one unit of standard deviation. The final score for contestant a on dimension d is the average of the Z-scores across all N respondents:

$$Z_{cd} = \sum_i Z_{cd,i} / N$$

Panel A of Table 4 presents the correlation matrix of the normalized scores for the six characteristics. All the six characteristics are positively correlated with each other; some are more highly correlated among themselves, and others are less so. For example, confidence and capability have a correlation of 88.9%, while the correlation between appearance and capability is only 33.5%.

III. Investors' Decision-Making and First Impressions

In this section, we evaluate the relation between the outcome of the entrepreneurs' pitches to the sharks and the entrepreneurs' individual characteristics. We begin by presenting graphical evidence for all six characteristics, upon which we apply a principal component analysis to these six characteristics and conduct multivariate regression analyses that rely upon the resulting principal components.

A. Graphical Evidence

Figure 2 illustrates the relation between decisions made by sharks after hearing pitches and the respondents' first impression on the six characteristics of entrepreneur contestants. We consider shark investors' decisions as two stages: (1) willingness to make an offer; (2) conditional upon deciding to make an offer, the terms they are willing to provide.

Figure 2A displays the relation between the likelihood that sharks would make an offer and our collection of six measures of first impression. The bar on the left corresponds to the pitches with normalized first-impression score below median, while the bar on the right corresponds to the pitches above median. The figure shows that shark investors have been more likely to make an offer to contestants if the contestants had higher scores for each of the six dimensions—rated as more capable, more confident, more trustworthy, better able to handle pressure, more attractive, and more likable.

Figures 2B and 2C plots the relation between the cash amount (Figure 2B) and valuation (Figure 2C), respectively, of the offers the sharks made and our collection of six measures of first impression. As the figures show, if a contestant looks more capable and more likely to be able to handle pressure, shark investors offer a larger amount of cash investment as well as higher

valuation. However, looking more attractive and more likable seems to reduce the cash amount and valuation shark investors are willing to offer. First impressions concerning confidence and trustworthiness are not associated with significant differences in the cash amount and valuation decisions.

B. Principal Component Analysis

Because the six characteristics we collected from MTurk respondents regarding individual contestants (contestant teams) may capture similar underlying factors (as evinced, among others, by their high correlations), we apply a principal component analysis to simplify and streamline our multivariate regression analyses.

According to the scree plot in Figure 3, the first two components explain most of the variability because the line depicted in the figure starts to straighten afterwards. The first two components explain 84.37% of the variability; the remaining factors explain a very small incremental fraction of variability, and are likely unimportant. Panel B of Table 4 shows that the two principal components generated from the principal component analysis appear to capture different aspects of the underlying characteristics. The first component has higher loading on characteristics that capture individuals' competence/confidence (including capability, confidence, trustworthiness, and ability to handle pressure). In contrast, the second component appears to have stronger correlation with appearance and likeability. The loading plot in Figure 3 also visualizes how the characteristics that make up each component fall close to each other in the sample space.

C. Regression Results

In a regression framework, we focus on the relation between shark investors' decision-making and first-impression factors. We start by using a probit model to capture the likelihood that a shark makes an offer to an entrepreneur. The dependent variable indicates whether a shark s makes an offer after hearing the presentation by contestant (team) c in season t . The specification is as follows:

$$P(O_{cst} = 1) = \Phi(\beta_0 + \beta_1 FI_{ct}^1 + \beta_2 FI_{ct}^2 + \gamma_s + \eta_t + T'X_{cst}),$$

where $\Phi(\cdot)$ denotes the cumulative standard normal distribution function. FI_{ct}^1 and FI_{ct}^2 are the first two principal components of the normalized scores on the six characteristics for contestant (team) c in season t .

To ensure the results are not driven by a particular season or a specific shark investor, we include the Shark Tank show's season fixed effects γ_s and shark-specific fixed effects η_t . To isolate the effect of first impression on soft information, we also control for X_{cst} , the hard information about pitches we obtained from the video recordings of the TV show. Specifically, we include indicator variables for the pitch presentation format (whether it is presented by a team), the gender of the solo presenter, different business stages of the pitches, patent status, as well as the logarithms of annualized past sales and initial self-investment. To alleviate the concern that the six characteristics may be confounded with the project quality, we use the perceived valuation by contestants as a proxy for project quality.

Table 5 presents the results. Column (1) shows that, without controlling for any additional characteristics of the entrepreneurs or the pitches, the likelihood of a shark making an

offer is positively associated with appearance/likeability (component 2). The specification presented in column (2) controls for gender and for whether a pitch comes from a solo entrepreneur or a team. It shows that both components become positively associated with the likelihood of a shark making an offer. Finally, covariates from column (3) also include hard information characteristics of the pitches such as stage of the business, patent status, past sales, entrepreneurs' self-investment and asking terms. The pitches with higher valuation perceived by entrepreneurs and with approved patents are more likely to obtain an offer from shark investors. The likelihood of a shark's offer remains positively associated with both components. Specifically, these findings indicate that, while the sharks may not be actively evaluating the entrepreneurs' soft characteristics, the first impression of these characteristics does seem to play a role in the sharks' decisions to fund an entrepreneur. Moreover, the likelihood of a shark making an offer is positively related to both the competence/confidence and appearance/likability.

Our final analysis examines the relation between the terms of the sharks' offers and the characteristics of the entrepreneurs, conditional on the fact that the shark had made an offer on a pitch. Panel A of Table 6 reports the analysis using the logarithm of the amount of cash offered by the shark as the dependent variable. We estimate the following:

$$\log(Cash_{cst}) = \beta_0 + \beta_1 FI_{ct}^1 + \beta_2 FI_{ct}^2 + \gamma_s + \eta_t + T'X_{cst} + \epsilon_{cst}.$$

Columns (1) through (3) show that the amount of cash offered by the sharks is significantly positively associated with competence/confidence (component 1), and significantly negatively

associated with appearance/likeability (component 2). In addition, the cash offer amount from the sharks is positively associated with a secured patent.

Panel B of Table 6 reports the analysis of the logarithm of the sharks' assessment of firm valuation using offers containing an equity-only structure (345 offers). We estimate the following:

$$\log(\text{Valuation}_{cst}) = \beta_0 + \beta_1 FI_{ct}^1 + \beta_2 FI_{ct}^2 + \gamma_s + \eta_t + T'X_{cst} + \epsilon_{cst}.$$

Similar to our findings in Panel A, the sharks' assessment of firm valuation continues to be significantly positively (negatively) associated with component 1 (component 2). We find that female entrepreneurs are associated with higher firm valuation than their male counterparts. Growth-stage businesses also tend to receive lower firm valuation from the sharks.⁴

Taken together, the results in Table 5 and Table 6 suggest that, there is a positive association between an entrepreneur's likelihood of receiving a shark's offer and both competence/confidence and appearance/likability, these two components seem to have the opposite effects on sharks' decisions concerning the cash amount they offer and their valuation of the entrepreneurs' businesses.

The positive association between both the likelihood of receiving an offer and the received cash amount/valuation and competence/confidence is intuitive. Assuming that, *ceteris paribus*, sharks apply the same reservation prices for projects, sharks' valuations of the projects pitched by entrepreneurs who seem more competent and confident are higher, and are more likely to exceed the reservation price, thereby leading to an offer.

⁴ Our models generate fairly high R² (76.7% and 65.6%, respectively) when more characteristics of both the pitches and the entrepreneurs are introduced into the specification.

However, this intuition does not carry over to the opposite relation between the likelihood of receiving an offer and appearance/likability and the received cash amount/valuation and appearance/likability. If contestants' better appearance/likability induces sharks to discount project valuations, it is unlikely that sharks apply the same reservation prices across various projects that, all else equal, differ by the contestants' appearance/likability. If that were the case, sharks would have also reduced their likelihood of making offers to entrepreneurs. Therefore, following this logic, one potential explanation is that sharks apply lower reservation prices for projects presented by more attractive and likable entrepreneurs.

If sharks are more generous and willing to accept lower valued projects with more attractive and likable entrepreneurs, even though sharks' valuation on projects does not vary with appearance/likability, the pool of projects with more attractive and likable entrepreneurs conditional on receiving an offer may have lower valuations on average. Nonetheless, it is still possible that sharks might discount the valuation of projects with more attractive and likable entrepreneurs. Indeed, sharks may take appearance/likability into account as a correlate of future increased probability of success and profitability, and may be deliberately making lower offers because doing so amounts to extracting rents from the contestants' appearance/likability.

IV. Conclusion

We exploit a novel setting through a popular TV show "Shark Tank" to study entrepreneurial investors' decision-making. The sample overcomes past challenges to the study of entrepreneurial decision-making by covering the full set of ventures (both successfully funded and failed ones) and involving investments of large amounts of real money investment.

We collect first impression scores for entrepreneur contestants from respondents through Amazon Mechanical Turk along six dimensions: capability, confidence, trustworthiness, the ability to work under pressure, physical attractiveness, and likability. Through principal component analysis, we summarize these six dimensions into two main principal components—competence/confidence and appearance/likability. The likelihood of an entrepreneur receiving an offer from a shark is related positively to both components. However, whereas the relation between the cash amount/valuation offered by shark investors and competence/confidence is positive, the relation between the cash amount/valuation offered by shark investors and appearance/likability is negative. The results suggest, therefore, that reservation prices applied by shark investors vary with appearance/likability—the more attractive and likable an entrepreneur, the lower the reservation price. The results also point out the possibility that shark investors may discount the values of the business of the more attractive and likable entrepreneurs.

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Table I
Sample Statistics: Applicant and Product Characteristics

This table contains the basic summary statistics of the sample of pitches from the Shark Tank, taken across the shows aired over a five-year period from 2009 to 2014. Panel A presents the presentation formats of pitches. Panel B reports the distribution of industries, patent status and stage of business of the products presented in the pitches.

Panel A: Applicant characteristics (Obs: 322)

Presentation format	#Pitches
Solo (Male: 130; Female: 55)	185
Team	137
Total	322

Panel B: Product characteristics (Obs: 322)

Industry	#Pitches	Patent status	#Pitches
Food	58	Yes	70
Kitchen and related	12	No	12
Novelty items	34	Pending	25
Services and events	24	Not applicable	215
Baby and kid items	26	Total	322
Tech, gadgets and apps	16		
Health and related	27		
Education, info and related	13	Stage of current business	#Pitches
Clothes and accessories	45	Early stage/Development	76
Home, garden and furnishings	17	Growth	32
Sport and outdoor	12	Expansion	24
Other	38	Not applicable	190
Total	322	Total	322

Table II
Sample Statistics: Funding Information

This table contains the basic summary statistics of funding information for the sample of pitches by sharks from the Shark Tank, taken across the shows aired over a five-year period from 2009 to 2014. Panel A presents the statistics of funding terms asked by the applicants. Panel B presents the statistics of funding terms offered by sharks. Firm valuation is only computed for offers with equity-only structure. Panel C presents the ratio of offer-term over asking term for both cash amount and firm valuation. Panel D tabulates the number of pitches by the number of offers applicants receive.

Panel A: Asking terms

	#Obs	Mean	SD	Min	P25	P50	P75	Max
Cash amount (in thousands)	322	270.84	691.24	10.00	75.00	125.00	250.00	10000.00
Equity share (%)	322	19.09	10.81	3.00	10.00	20.00	25.00	100.00
Firm valuation (=Cash amount/Equity share, in thousands)	322	2027.43	6248.69	40.00	367.50	833.33	1785.71	100000.00

Panel B: Offer terms

	#Obs	Mean	SD	Min	P25	P50	P75	Max
Cash amount (in thousands)	404	275.91	413.72	20.00	100.00	150.00	300.00	6000
Equity share (%)	404	34.31	22.25	0.00	20.00	30.00	45.00	100
Firm valuation (=Cash amount/Equity share, in thousands)	348	1209.28	2415.24	35.00	312.50	609.15	1000.00	23333.33

Panel C: Comparison between offer terms and asking terms

	#Obs	Mean	SD	Min	P25	P50	P75	Max
Cash amount ratio (Offer/Asking)	402	1.63	2.81	0.33	1.00	1.00	1.25	40.00
Firm valuation ratio (Offer/Asking)	348	0.88	1.62	0.06	0.40	0.60	0.88	23.22

Panel D: Distribution of #offers received by each pitch

#Offers from shark	Freq.
0	133
1	62
2	64
3	36
4	16
5	11
Total	322

Table III
Sample Statistics: Scores Given by MTurk Respondents

This table contains the basic summary statistics of the scores assigned by 680 MTurk respondents. Each respondent is asked to assign scores on six dimensions for 20 randomly selected pictures of applicants (applicant teams). For each respondent, we calculate the mean and standard deviation of the raw scores across the 20 pictures for each dimension. Panel A presents the statistics of the mean across all respondents. Panel B presents the statistics of the standard deviation across all respondents.

Panel A: Summary statistics on the mean of raw scores given by each MTurk respondent

Question	Mean	Stderr	Min	P25	Median	P75	Max
Capability	5.98	0.94	2.30	5.29	5.94	6.67	8.27
Confidence	6.15	0.97	2.30	5.47	6.20	6.87	8.50
Trustworthiness	5.74	1.00	2.33	5.07	5.70	6.39	8.40
Ability to handle pressure	5.76	0.95	2.60	5.13	5.75	6.37	8.33
Appearance	5.62	1.08	1.77	5.00	5.67	6.31	8.45
Likability	5.92	1.01	2.55	5.30	5.93	6.57	8.30

Panel B: Summary statistics on the std dev of raw scores given by each MTurk respondent

Question	Mean	Stderr	Min	P25	Median	P75	Max
Capability	1.34	0.56	0.25	0.92	1.25	1.69	3.76
Confidence	1.46	0.56	0.18	1.04	1.41	1.83	3.29
Trustworthiness	1.39	0.57	0.18	0.97	1.31	1.76	3.26
Ability to handle pressure	1.48	0.57	0.18	1.05	1.42	1.87	3.52
Appearance	1.38	0.51	0.31	1.00	1.32	1.70	3.60
Likability	1.30	0.52	0.18	0.93	1.23	1.62	3.39

Table IV
Characteristics Correlations and Principal Component Analysis

This table contains the correlation matrix associated with the principal component analysis of the Shark Tank entrepreneurs' six characteristics (normalized) scores collected through MTurk. The characteristics score is normalized to zero mean and unit variance within each MTurk respondent.

Panel A: Correlation between normalized scores

	Capability	Confidence	Trustworthiness	Ability to handle pressure	Appearance	Likability
Capability	1					
Confidence	0.716***	1				
Trustworthiness	0.889***	0.717***	1			
Ability to handle pressure	0.876***	0.794***	0.832***	1		
Appearance	0.335***	0.494***	0.401***	0.288***	1	
Likability	0.385***	0.464***	0.573***	0.365***	0.566***	1

Panel B: Principal component loadings

Variable	Comp1	Comp2
Capability	0.4492	-0.3079
Confidence	0.4369	-0.0469
Trustworthiness	0.4658	-0.1298
Ability to handle pressure	0.4464	-0.3554
Appearance	0.2929	0.6624
Likability	0.3245	0.5667

Table V
Investor Decision: Likelihood of a Shark Making an Offer to an Entrepreneur

This table contains the results of a logit regression analysis that estimates the likelihood of a shark making an offer to an entrepreneur. The dependent variable, $\text{OfferMade}(i, j, t)$, is an indicator variable set to 1 if Shark i makes an offer to entrepreneur (team) j in season t , and set to 0 otherwise. The two key independent variables of interest are the two principal components describing confidence/competency (component 1) and appearance/likability (component 2). Other controls are industry effects, business stage effects (base category: early stage/development), patent status effects (base category: patent rejected), logarithm of past annualized sales, logarithm of self investment amount, team presentation effect, entrepreneurs' gender (for solo presenters), and their asking terms. The regression also features two fixed effects, capturing sharks, and seasons.

	(1)	(2)	(3)
Dependent variable:	A shark makes an offer to an entrepreneur (team)		
Scores for component 1	0.0279 (0.017)	0.0310* (0.018)	0.0327* (0.019)
Scores for component 2	0.0655* (0.034)	0.0642* (0.039)	0.0899** (0.042)
Control variable:			
Team		0.0446 (0.082)	0.144 (0.088)
Female		0.0674 (0.111)	-0.0991 (0.119)
Log(asking firm valuation)			0.0778** (0.036)
Stage of business: growth			0.113 (0.149)
Stage of business: expansion			-0.110 (0.173)
Stage of business: not applicable			0.256** (0.113)
Patent: pending			-0.220 (0.243)
Patent: yes			0.425* (0.219)
Patent: not applicable			-0.0581 (0.209)
Log(past sales)			0.0105 (0.007)
Log(self-investment)			0.00796 (0.007)
Shark effect	No	Yes	Yes
Season effect	No	Yes	Yes
Observations	1587	1587	1587
Pseudo R-squared	0.007	0.012	0.062

Table VI**Investor Decision Conditional upon Making an Offer: Cash Amount and Valuation**

This table contains the estimates of the regressions relating the cash amount offered to the entrepreneurs (Panel A) or the valuation (Panel B) on two key independent variables of interest—the two principal components describing confidence/competency (component 1) and appearance/likability (component 2). Panel B only contains offers with equity-only structure. Other controls are industry effects, business stage effects (base category: early stage/development), patent status effects (base category: patent rejected), logarithm of past annualized sales, logarithm of self investment amount, team presentation effect, entrepreneurs' gender (for solo presenters), and their asking terms. The regression also features two fixed effects, capturing sharks, and seasons.

Panel A: Cash amount			
	(1)	(2)	(3)
Dependent variable:	Log(offer cash amount)		
Scores for component 1	0.0505** (0.022)	0.0376* (0.022)	0.0312** (0.013)
Scores for component 2	-0.273*** (0.045)	-0.276*** (0.051)	-0.117*** (0.031)
Control variable:			
Team		-0.0550 (0.101)	-0.0692 (0.060)
Female		0.178 (0.139)	0.145* (0.082)
Log(asking firm valuation)			0.885*** (0.037)
Stage of business: growth			-0.0314 (0.107)
Stage of business: expansion			-0.0179 (0.121)
Stage of business: not applicable			0.0692 (0.083)
Patent: pending			0.0895 (0.177)
Patent: yes			0.320** (0.152)
Patent: not applicable			0.291* (0.151)
Log(past sales)			-0.0121** (0.005)
Log(self-investment)			0.00725 (0.005)
Shark effect	No	Yes	Yes
Season effect	No	Yes	Yes
Observations	400	400	400
R-squared	0.092	0.192	0.767

Panel B: Valuation			
	(1)	(2)	(3)
Dependent variable:	Log(offer firm valuation)		
Scores for component 1	0.105*** (0.028)	0.0693** (0.027)	0.0650*** (0.020)
Scores for component 2	-0.216*** (0.060)	-0.233*** (0.065)	-0.106** (0.051)
Control variable:			
Team		-0.0680 (0.127)	-0.160 (0.097)
Female		0.282 (0.173)	0.408*** (0.132)
Log(asking firm valuation)			0.883*** (0.059)
Stage of business: growth			-0.417** (0.168)
Stage of business: expansion			-0.157 (0.190)
Stage of business: not applicable			-0.113 (0.136)
Patent: pending			-0.171 (0.304)
Patent: yes			0.336 (0.268)
Patent: not applicable			0.505* (0.262)
Log(past sales)			0.00912 (0.008)
Log(self-investment)			-0.0137* (0.008)
Shark effect	No	Yes	Yes
Season effect	No	Yes	Yes
Observations	345	345	345
R-squared	0.072	0.251	0.656

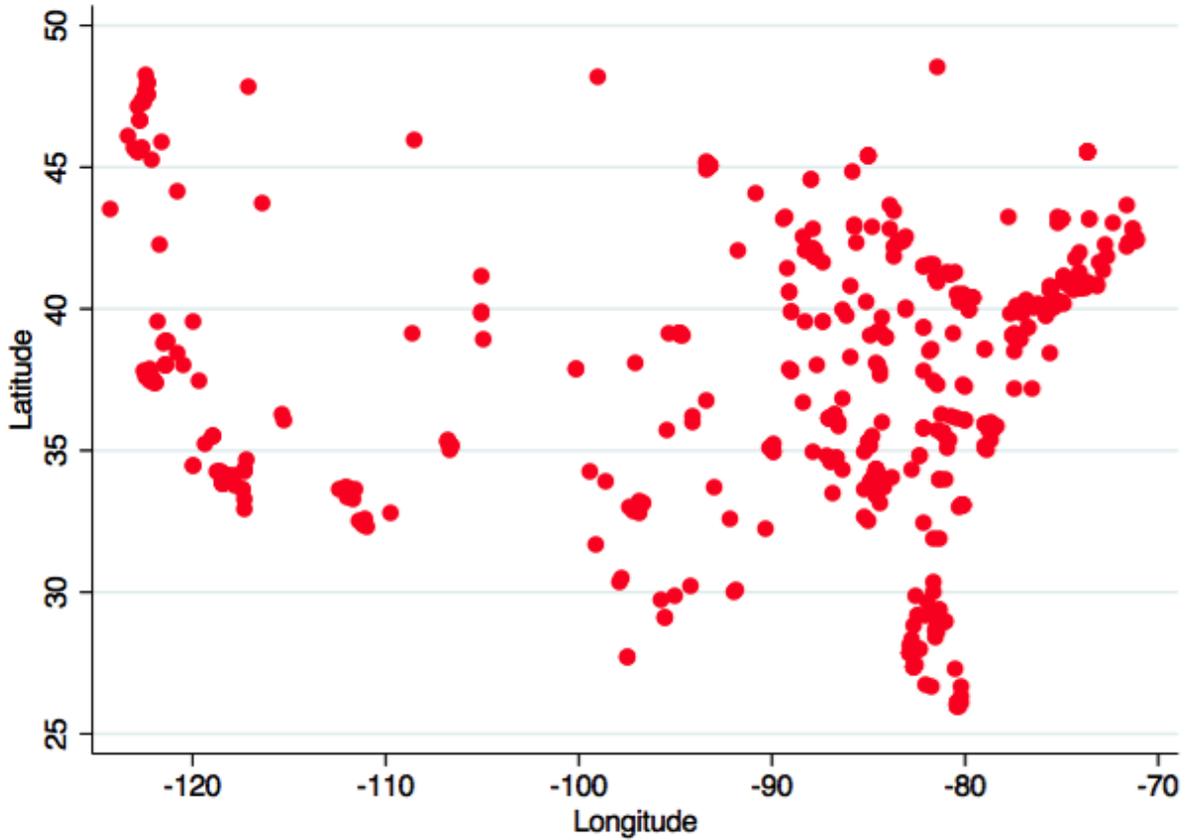


Figure 1: Geographic Distribution of MTurk Respondents.

This figure depicts the location (latitude and longitude) of the 680 MTurk respondents based on their IP address. Each respondent is asked to assign scores on six dimensions for 20 randomly selected pictures of applicants (applicant teams).

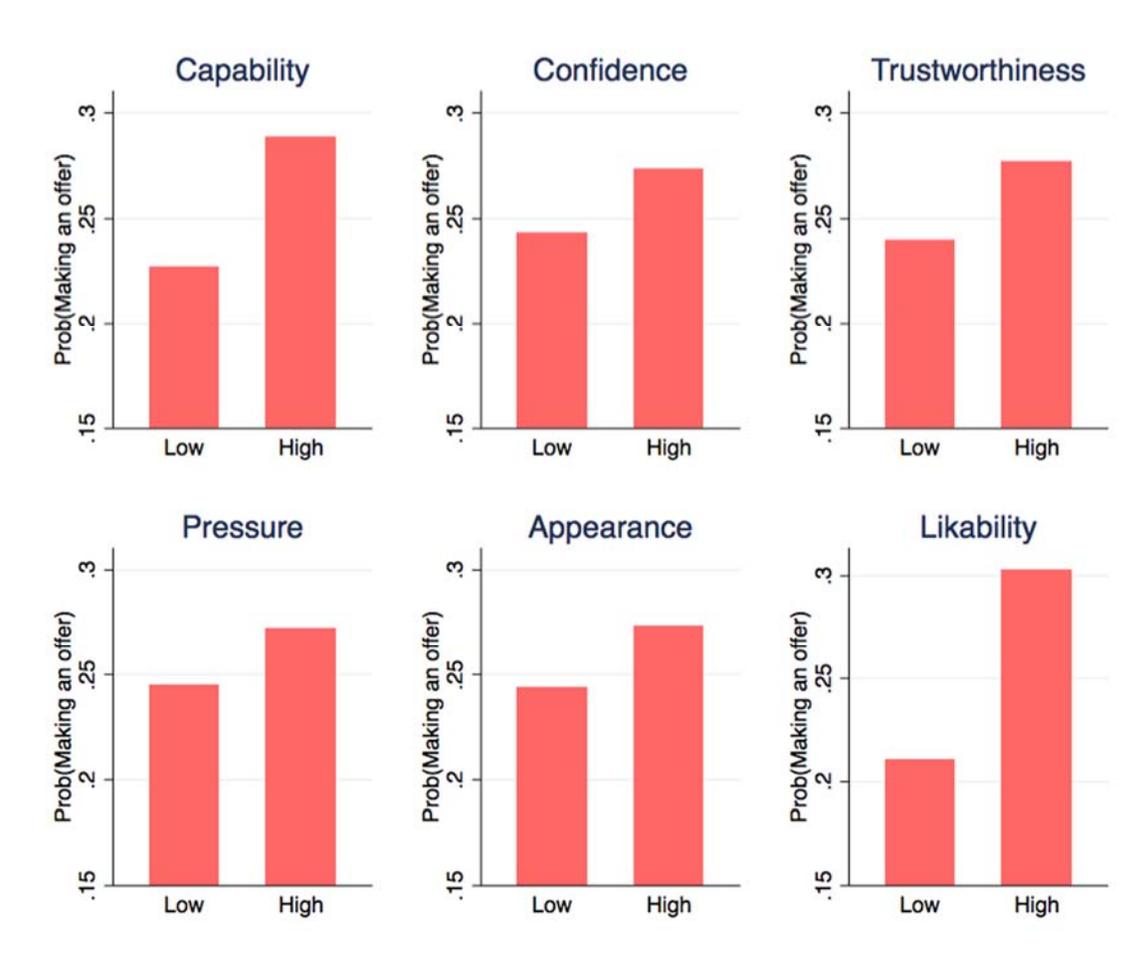


Figure 2A: Investor Decision: Likelihood of a Shark Making an Offer to an Entrepreneur (Team)

The entrepreneurs (teams) are sorted by the normalized score on six dimensions and divided into two groups. Group Low has the entrepreneurs (teams) with scores below median, while Group High has the ones with scores above median. The figure plots the probability of a shark making an offer to an entrepreneur (team) for each group.

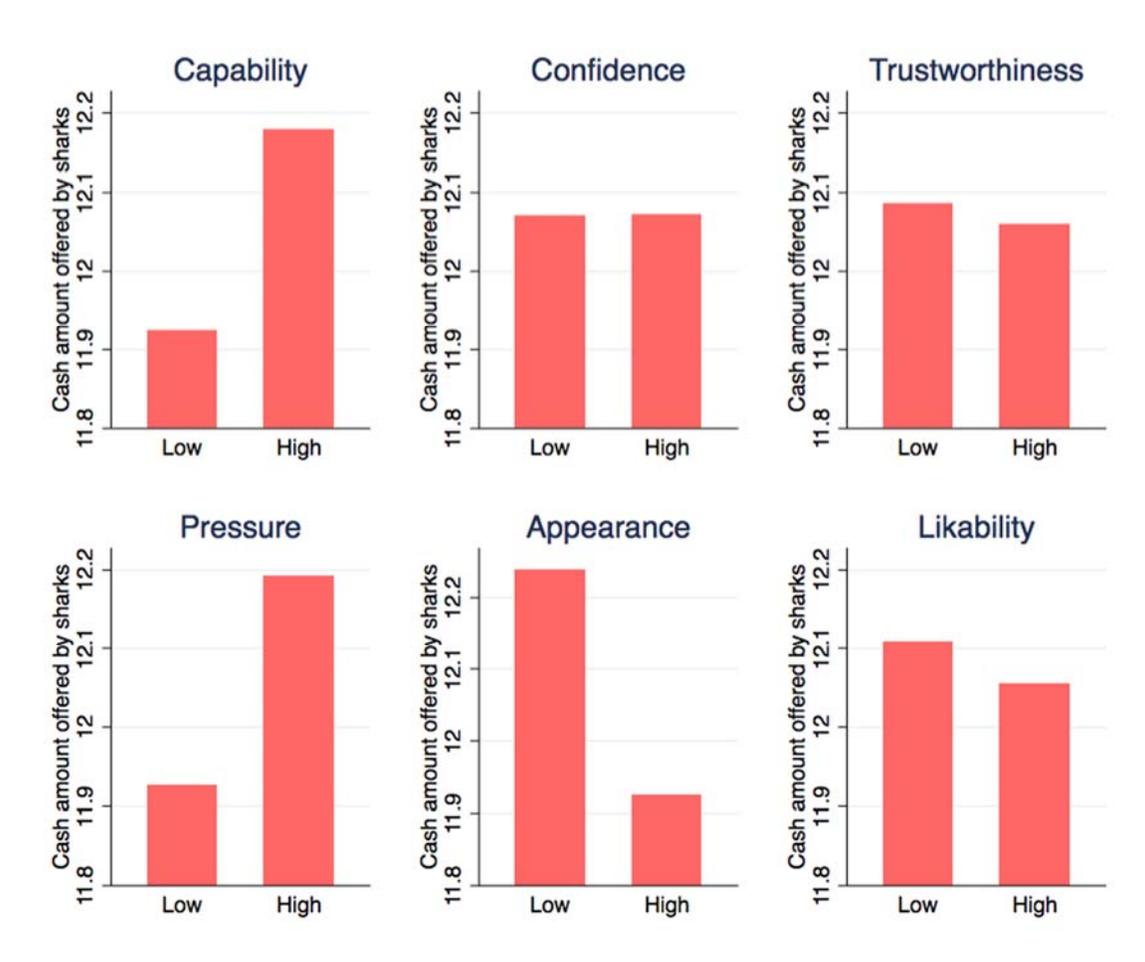


Figure 2B: Investor Decision Conditional upon Making an Offer: Cash Amount

The entrepreneurs (teams) are sorted by the normalized score on six dimensions and divided into two groups. Group Low has the entrepreneurs (teams) with scores below median, while Group High has the ones with scores above median. The figure plots the average cash amount offered by a shark to an entrepreneur (team) for each group.

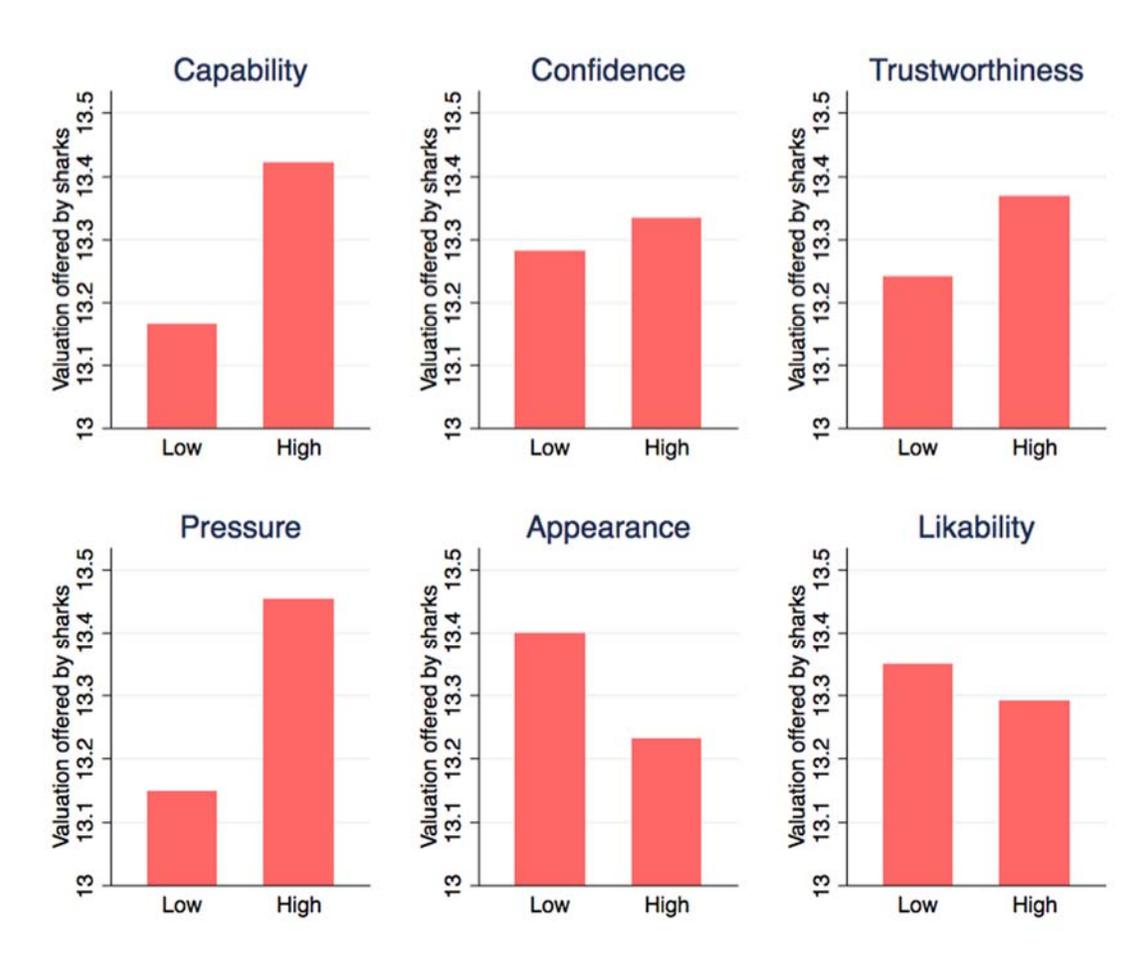


Figure 2C: Investor Decision Conditional upon Making an Offer: Valuation

The entrepreneurs (teams) are sorted by the normalized score on six dimensions and divided into two groups. Group Low has the entrepreneurs (teams) with scores below median, while Group High has the ones with scores above median. The figure plots the average firm valuation offered by a shark to an entrepreneur (team) for each group. The sample here only contains offers with equity-only structure.

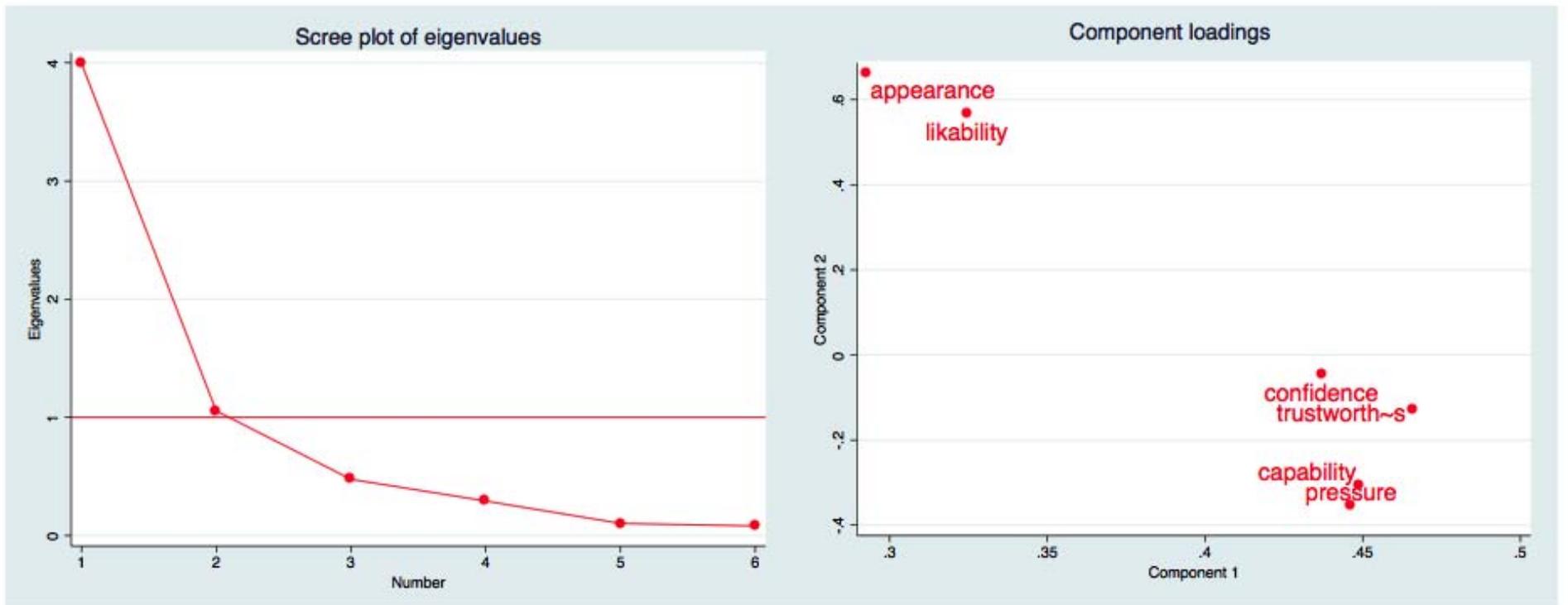


Figure 3: Principal Component Analysis of the Entrepreneurs' Six Characteristics.

This figure displays the Scree plot (left panel) and component loadings (right panel) for the principal component analysis of the Entrepreneurs' six characteristics (normalized) scores collected through MTurk. The characteristics score is normalized to zero mean and unit variance within each MTurk respondent.

Appendix

A.1 Industry Classification: Project Example

We assign each product to an industry out of food, kitchen and related, novelty items, services and events, baby and kid items, tech-gadgets and apps, health and related, education and information, clothes and accessories, home and furnishings, sport and outdoor, and others. Table A.I lists some examples of projects assigned for each industry.

A.2 Qualtrics Survey Questions

For each contestant (team), we ask six questions to elicit the first impression of “naïve” MTurk respondent on the contestant (team) in the picture. A sample of the survey is displayed in Figure A.1.

- (1) Capability: How capable do you think this person (or team) would be to run a start-up business successfully?
- (2) Confidence: How confident do you think this person (or team) is?
- (3) Trustworthiness: To what extent would you trust this person (or team) in a business environment?
- (4) Ability to handle pressure: How well do you think this person (or team) can handle intense pressure?
- (5) Appearance: How good-looking do you think this person (or team) is?
- (6) Likability: How likable do you think this person (or team) is?

Table A.I**Project example for assigned industries**

Industry	Product example	Product description
1 Food	Element Bars	Customized energy bars. Select own type of bar and labels.
2 Kitchen and related	Vinamor	A wine aerator that aerates the wine while it pours and works perfectly
3 Novelty items	Wake N' Bacon	Alarm clock that wakes you up with bacon
4 Services and events	Games2u	Gaming company that brings the game to a kids party.
5 Baby and kid items	Ride on Carry On	Device that attaches to any luggage that is a seat for young children so you do not have to bring a stroller to the airport.
6 Tech, gadgets and apps	Breathometer	First smartphone breathalyzer; small pocket device connects to audio outlet; turn on app on phone, blow into device, and in seconds it tells you're your BAC level
7 Health and related	NitroForce Titan 1000	A revolutionized piece of workout equipment that can offer many different forms of workouts
8 Education, info and related	Classroom Jams	Teaching product where shakespeare and other lessons are put into song. Sold in DVD form.
9 Clothes and accessories	Hoodie Pillow	Pillow with an attached hood; has pouch for phone or remote and a headphone slit
10 Home, garden and furnishings	Doorbot	video doorbell built for the smartphone; allows you to see and speak with anyone at your door from your phone; if someone rings your doorbell, you get a video call on your phone
11 Sport and outdoor	Power Paddleboarding	paddle boards, surf boards that you use with a paddle



Please look at this picture for 5 seconds before answering the following questions. Using the 1-9 scale, please indicate which values best describe your first impressions. Please answer according to what your first impressions really are, rather than what you think they should be. Please note that there are no right or wrong answers. It truly is about your first impressions.

How capable do you think this person (or team) would be to run a start-up business successfully?

1 - Not at all	2	3	4	5	6	7	8	9 - Extremely
<input type="radio"/>								

How confident do you think this person (or team) is?

1 - Not at all	2	3	4	5	6	7	8	9 - Extremely
<input type="radio"/>								

To what extent would you trust this person (or team) in a business environment?

1 - Not at all	2	3	4	5	6	7	8	9 - Extremely
<input type="radio"/>								

Figure A.1: Sample Qualtrics Survey