Swimming with the Sharks: Entrepreneurial Investing Decisions and First Impression*

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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 entrepreneur 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.

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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.[1]

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

[1] For example, Goetzmann, Ravid, and Sverdlove (2012) find that both hard and soft information variables are priced in screenplay sales.

methodologies to overcome this challenge of data paucity. Some studies have relied on issuing questionnaires to venture capitalists (Macmillan, Siegel, and Subbanarasimha (1985, 1987)). That approach has inherent limitations, including selection issues because responses are voluntary and typical response rates are humble, often below 50%.

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.[2] 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

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

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 that, although aired as part of a show that can readily be classified as entertainment programming, *the sharks make decidedly real business decisions*. 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 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.

This paper exploits these unique features by studying the relation between shark investors' decisions and various 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 valuable 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, (MTurk) have evaluated several traits of the entrepreneur 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 entrepreneur contestants along six dimensions considered highly relevant to entrepreneurs' success: capability, confidence, trustworthiness, the ability to work under pressure, physical attractiveness,[3] 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. 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 a stronger correlation with appearance and likability.

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

[3] The labor economics literature features ample evidence regarding the relation between workers' earnings and their looks. In their seminal work on beauty and the labor market, Hamermesh and Biddle (1994) find that, *ceteris paribus*, workers with below-average looks earn lower wages than average-looking workers. On the other hand, workers with above-average looks earn a premium in wages compared to those with average looks. A recent study by Mobius and Rosenblat (2006) extends Hamermesh and Biddle (1994) by decomposing the documented beauty premium in an experimental labor market. Their experiment shows that physically attractive workers are more confident, and the confidence, in turn, increases wages through the workers' oral interaction with the employers. After controlling for worker confidence, they further show that employers expect more attractive workers to perform better than the less attractive workers, reflecting a certain degree of stereo-typing by the employers.

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. We focus on the 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 appearance/likability. Second, we explore the relation between the bidding parameters of the offers the sharks made and the entrepreneur contestants' competence/confidence and their appearance/likability.

We find that the likelihood that an entrepreneur contestant will receive a shark's offer on the pitch is associated positively with factors capturing first impressions of both competence/confidence and appearance/likability. Moreover, conditional on making an offer, however, parameters of the shark's offer (cash bidding amount and the bidding investment valuation, defined as the ratio of the cash bidding amount and the equity share in the firm) are *positively* associated with the entrepreneur contestant's competence/confidence, yet *negatively* associated with the entrepreneur contestant's appearance/likability. To better understand these findings and to gain further insights into the predictions regarding the relation between the value of the business and first impressions, we develop a conceptual framework that lends itself to five hypotheses regarding the role of first impressions not only in sharks' decision-making during their encounter with entrepreneur contestants—as captured by the above results—but also in subsequently revealed value of the business.[4]

[4] Hypotheses are outlined in more detail in Section III, and the entire conceptual framework is presented in full detail in Appendix II.

The first hypothesis, *the information channel hypothesis*, is that first impression may contain information about the quality or the underlying value of the project, so that higher first impression relates to higher underlying value of the project. This will affect positively the probability that the sharks will make an offer, the offer terms, and the valuation of the project. The second hypothesis, *the premium channel hypothesis*, is that first impressions induce a shark's bias by means of which shark investors may perceive a higher valuation of the projects when they have higher first impression of the entrepreneurs. These circumstances will lead to predictions similar to those associated with the information channel, with one key difference—in the setting of the premium channel, the average underlying value of the projects that receive an offer decreases with first impression (because some projects that receive an offer under the premium channel would not be able to do so had the shark investors accurately perceived the valuation of the project).

The remaining hypotheses revolve around sharks' propensity to relax thresholds they apply in their decision-making in light of the first impressions they form about the contestants. The third hypothesis, *the valuation threshold relaxation channel hypothesis*, is that first impressions may affect shark investor's inclination to make an offer by relaxing the threshold the sharks apply to the perceived project valuation, so that entrepreneurs engendering more favorable first impressions are more likely to receive an offer, yet the projects that receive an offer have lower underlying value and, hence, lower bidding investment value. The fourth hypothesis, *the rent-extraction threshold relaxation channel hypothesis*, is that shark investors are more likely to make an offer, yet extract lower rents, if their first impression of entrepreneur contestants is higher. Willingness to extract lower rents translates into higher bidding investment valuation, yet, because threshold relaxation happens along the dimension of extracted rents, the underlying value of projects that receive offers remains unaffected. Finally, the fifth hypothesis,

the rent expropriation channel hypothesis, is that shark investors are more likely to make an offer and expropriate more rents from entrepreneurs with higher first impression. Sharks' tendency to extract more rents results in lower bidding investment valuation, yet, as with the previous hypothesis, because threshold relaxation happens along the dimension of extracted rents, the underlying value of projects that receive offers remains unaffected.

The relation between the underlying value of projects that received an offer and first impression scores could help further disentangle these hypotheses. We pursue a pragmatic approach and use the businesses' propensity to survive as a simple, if imprecise proxy for the underlying value of projects. We find that the hazard rate of the businesses that had received an offer at "Shark Tank" is negatively related to competence/confidence (i.e., the underlying value increases with competence/confidence), yet is unrelated to appearance/likability. Taking these results together with the empirical results reported in previous sections, we conclude that the role of competence/confidence is explained by the information channel hypothesis (Hypothesis 1) and the role of appearance/likability is explained by the rent expropriation channel hypothesis (Hypothesis 5).

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 competence/confidence and appearance/likability) matters in securing funding from entrepreneurial investors.

Our paper also relates to recent studies that exploit new data sources that, conceivably, could cover the full set of ventures to study the decision-making of entrepreneurial investors. 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, the 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 in other settings, including Shark Tank.

Our study complements the results from these papers 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. Our study also shows that part of entrepreneurial investors' perception can come from the entrepreneurs' attractiveness/likability and their competence/confidence.

Finally, our study helps address the "natural challenge that unobserved heterogeneity across entrepreneurs, such as ability or ambition, might drive the growth path of the firms as well as the venture capitalists' decision 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.

I. TV Show and Data

The TV show "Shark Tank" is an American reality television series, first aired on August 9, 2009, on ABC.[5] 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 (i.e., shark) is interested. However, if all of the sharks 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 its 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 entrepreneur 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,

[5] 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.

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 entrepreneur 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 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;[6] 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 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 Scores

We recruited a nationally representative sample of 680 U.S. respondents (45.73% female) over Amazon Mechanical Turk (MTurk) to provide responses to a Qualtrics survey by evaluating six

[6] 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.

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 entrepreneur contestant (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 contestant 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 distribution of the locations of the 680, indicating a wide geographic coverage congruent with the U.S. population density.

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 rated by the same MTurk respondent, $\mu_{d,i}$, 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 IV 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

The following three figures illustrate 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 2 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 a normalized first-impression score below the median, while the bar on the right corresponds to the pitches above the median. The figure shows that shark investors have been more likely to make an offer to entrepreneur 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 3 and 4 plots the relation between the cash amount (Figure 3) and valuation (Figure 4), respectively, of the offers the sharks made and our collection of six measures of first impression. As the figures show, if an entrepreneur 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 firm valuation that 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 5, 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 IV 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 a stronger correlation with appearance and likability. The loading plot in Figure 5 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 (team). The dependent variable indicates whether a shark *s* makes an offer after hearing the pitch by entrepreneur 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 Φ(.) 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 entrepreneur contestant, 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 the contestants as a proxy for project quality. In addition, the regression features three fixed effects, capturing industry-, shark-, and season-specific effects.

Table V 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 both components—competence/confidence and appearance/likability. The specification presented in column (2) only controls for hard information characteristics of the pitches such as gender, pitch presentation format, 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. Column (3) includes both first impression and hard

information characteristics. 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 (team). Moreover, the likelihood of a shark making an offer is positively related to both the competence/confidence and appearance/likability components.

Our next 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. Table VI 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/likability (component 2). In addition, the cash offer amount from the sharks is positively associated with a secured patent.

Table VII reports the analysis of the logarithm of the sharks' bidding investment valuation using offers containing an equity-only structure (345 offers). We estimate the following:

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

Similar to our findings in Table VI, the sharks' bidding investment 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 a lower firm valuation from the sharks.

D. Further analyses

The results in Table V, Table VI, and Table VII suggest positive relations between an entrepreneur's likelihood of receiving a shark's offer and both competence/confidence and appearance/likability. On the other hand, both sharks' decisions concerning the cash amount they offer and their valuation of the entrepreneurs' businesses expressed through the parameters of their offer appear to relate to the two components in opposite ways—positively to competence/confidence and negatively to appearance/likability. In this section, we explore plausible channels through which these results may have arisen and their relevance for our findings. We also examine some additional testable predictions.

D1. Plausible channels

First impression could influence shark's decision to make an offer and their bidding investment valuation through multiple channels. Appendix A.3 illustrates a conceptual framework of shark investors' decision-making. As shark investors evaluate a project, they form their beliefs about its value and decide whether to make an offer with a bidding investment value. The difference between the perceived project value and their bidding investment value represents the rent shark investors seek to extract. They may not make offers to all positive NPV projects, and we consider two scenarios: (1) shark investors decide to make an offer if their

perceived project value exceeds a threshold; or (2) shark investors decide to make an offer if the rent they could extract exceeds a threshold.

The information channel hypothesis. First impression may contain information about the quality or the underlying value of the project. Higher first impression relates to higher underlying value of the project (Hypothesis 1); *ceteris paribus,* entrepreneurs with higher first impression are more likely to present a project with value exceeding the valuation cutoff, thereby leading to receiving an offer. On average, projects that receive an offer are of higher quality. Because sharks extract the same amount of rent from these projects, the bidding investment valuation would be higher as well.

The premium channel hypothesis. Similar to the beauty premium documented in the labor economics literature (Hamermesh and Biddle (1994)), shark investors may perceive a higher valuation of the projects when they have higher first impression of the entrepreneurs (Hypothesis 2). Higher first impression of the entrepreneur(s) leads to a higher perceived valuation, which increases the likelihood that the project exceeds the threshold and, consequently, the entrepreneur(s) receive an offer. The higher perceived value will also increase the bidding investment valuation. The only prediction that differs from the information channel is that, in the setting of the premium channel, the average underlying value of the projects that receive an offer decreases with first impression. This is because some projects that receive an offer under the premium channel would not be able to do so had the shark investors accurately perceived the valuation of the project.

The valuation threshold relaxation channel hypothesis. First impressions may influence shark investor's willingness to make an offer by relaxing the threshold they apply. We first consider the setting in which they apply a threshold on perceived valuation. In this scenario,

investors are willing to make an offer to projects with lower perceived value if the first impression is better (Hypothesis 3). Therefore, entrepreneurs with higher impression are more likely to receive an offer. As a result of this sample selection, the projects that receive an offer would have lower underlying value, and hence lower bidding investment value.

The rent-extraction threshold relaxation channel hypothesis. Alternatively, we consider the setting in which investors apply a threshold on the extracted rent. Investors are willing to make an offer and extract lower rents if the first impression is better (Hypothesis 4). Similar to the valuation threshold relaxation, entrepreneurs with higher impression are more likely to receive an offer. In contrast to the valuation threshold relaxation, because investors are willing to extract less rents from entrepreneurs with higher first impression, the bidding investment value given an offer had been made would be higher. However, because the threshold relaxation happens along the dimension of extracted rents, the underlying value of projects that receive offers would not be affected by this sample selection.

The rent expropriation channel hypothesis. Even if shark investors apply the same rent-extraction threshold to all projects, their likelihood of making an offer may still vary with first impression if first impression affects their rent extraction. Shark investors may expropriate more rents from entrepreneurs with higher first impression (Hypothesis 5), who, consequently, are more likely to receive an offer. Because more rents are extracted, the bidding investment value would be lower. However, the underlying value of projects that receive offers would not be affected by this sample selection because the selection happens along the dimension of extracted rents.

Our finding that competence/confidence increases both the likelihood of making an offer and the bidding investment value is consistent with the information channel, the premium channel and the rent-extraction threshold relaxation channel, whereas the evidence that

appearance/likability increases the likelihood of making an offer but decreases the bidding investment value is consistent with the valuation threshold relaxation channel and the rent expropriation channel. As described above and suggested by Table A.II, these channels could be further disentangled by analyzing the underlying value of the project. We next proxy for the underlying value of projects by their post-show survival rates and analyze how the survival rates relate to the first impression scores for the projects that have received offers.

D2. Post-show business survival

To disentangle the valuation threshold relaxation and rent expropriation channels, we focus on the projects that had received offers from shark investors and analyze how post-show business survival relates to entrepreneurs' first impression characteristics. Specifically, in Table VIII we report the results of estimating a Cox proportional hazards model for the hazard rate of a firm going out of business given the firm survives in previous years. We manually collect firms' survival/failure data through the Internet. A firm is coded as going out of business if their company website is not alive, not available to place an order, or their social media account has not been updated.[7] We did not regarded the instances in which a firm is acquired by other firms, changes its name, or changes its marketing venues are not counted as going out of business.

We model the hazard rate of an entrepreneur contestant's firm c going out of business in year y_c after its presentation on the show as follows:

$$\mathrm{h}(y_c) = h_0(y_c)\exp[\beta_0 + \beta_1 FI_c^1 + \beta_2 FI_c^2 + T'X_c]$$

[7] For example, Kookn' Kap was presented in Season 5 Episode 3 with original air date October 4th, 2013. The firm's most recent post is from their Twitter account and is dated from February 3rd, 2014. This firm is coded as going out of business in 2014.

where $h_0(y_c)$ is the unspecified baseline hazard rate. Key independent variables of interest are the two principal components describing competence/confidence (component 1, FI_c^1) and appearance/likability (component 2, FI_c^2). X_c represents control variables.

Specifically, we control for other characteristics of each firm, including the logarithm of past annualized sales, the logarithm of self-investment amount, team presentation effect, entrepreneurs' gender (for solo presenters), their asking terms, as well as season-fixed effects, industry effects, business stage effects (base category: early stage/development), and patent status effects (base category: patent rejected). Also, we control for the positive media advertising effects in two ways. First, in column (1) of Table VIII, we include TV Nielsen ratings for the episode within which the pitch was aired, thereby addressing the possibility that more favorable first impression scores may be positively correlated to the TV ratings, which, in turn, may have a positive influence on post-show business performance. Second, Shark Tank occasionally features post-show follow-up of some successful pitches that had appeared earlier in the show (had they received offers or not), providing additional exposure that may boost the firm's post-show business and increase the probability of its survival. To further control for these effects, we include an indicator variable in column (2): "Featured" set to 1 if the firm is featured in a subsequent episode on the show. The results remain the same.

As the result shows, competence/confidence is negatively related to the hazard rate of business failure and is statistically significant – among the entrepreneurs who had received offers from the sharks, those perceived as more capable and more confident are less likely to go out of business after the show; appearance/likability is statistically insignificant. The coefficients on control variables are generally consistent with our expectations – the firms with larger past sales or asking

for larger investments are more likely to survive. Therefore, interpreting the survival rate as a proxy of the value of the business, we can evaluate the role of the two first impression components.

The role of competence/confidence is consistent with the information channel hypothesis (Hypothesis 1) because the probability of receiving an offer, the parameters of the offer, and the subsequent value of the business (estimated through its survival rate) are all related positively to the competence/confidence measure. On the other hand, the role of attractiveness/likability is consistent with the rent expropriation channel hypothesis (Hypothesis 5) because the probability of receiving an offer is related positively to attractiveness/likability, the parameters of the offer are negatively related to attractiveness/likability, and, finally, the subsequent value of the business (estimated through its survival rate) is unrelated to attractiveness/likability.

Moreover, Shark Tank occasionally features post-show follow-up of some successful pitches which appeared earlier in the show (had they received offers or not). The fact of being featured in the show may also relate to or have additional impact on firm's post-show business. To further control for these effects, we include an indicator variable in column (2): "Featured" set to 1 if the firm is featured in a subsequent episode on the show. The results remain the same.

IV. Conclusion

We exploit a novel setting through a popular TV show "Shark Tank" to study entrepreneurial investors' (i.e., sharks') 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.

We collect first impression scores for entrepreneur contestants from respondents through MTurk 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 positively related to both components. However, the bidding cash amount and investment valuation by the shark offer are positively related to competence/confidence, whereas they are negatively related to appearance/likability. To separate further the different hypotheses, finally, we use of a noisy measure of subsequent survival as a proxy for the value of the business to estimate its relation with competence/confidence and appearance/likability to find a positive relation with the former, but no relation for the latter.

Taken together, our empirical results indicate that the role of *competence/confidence* is best explained by the *information channel hypothesis*—because first impression of competence/confidence contains information about the quality of the underlying value of the project, higher first impression signals a higher underlying value of the project, affecting positively the probability that the sharks will make an offer, the offer terms, and the valuation of the project. On the other hand, the role of appearance/likability is best explained by *the rent expropriation channel hypothesis*—shark investors are more likely to make an offer and expropriate more rents from entrepreneurs with higher first impression of appearance/likability, so the sharks' tendency to extract more rents from attractive/likable contestants results in lower offer parameters, yet, because threshold relaxation happens along the dimension of extracted rents, the subsequent project value of the projects that receive offers is unaffected by attractiveness/likability..

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Table I

Sample Statistics: Entrepreneur contestant 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

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

Panel B: Product characteristics

Industry	#Pitches
Food	58
Kitchen and related	12
Novelty items	34
Services and events	24
Baby and kid items	26
Tech, gadgets and apps	16
Health and related	27
Education, info, and related	13
Clothes and accessories	45
Home, garden and furnishings	17
Sport and outdoor	12
Other	38
Total	322

Patent status	#Pitches
Yes	70
No	12
Pending	25
Not applicable	215
Total	322

Stage of current business	#Pitches
Early stage/Development	76
Growth	32
Expansion	24
Not applicable	190
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 entrepreneur contestants. 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 entrepreneur contestants receive.

Panel A: Asking terms

	#Obs	Mean	SD	Min	P25	P50	P75	Max
Cash amount (in $ thousands)	322	271	691	10	75	125	250	10,000
Equity share (%)	322	19	11	3	10	20	25	100
Firm valuation (=Cash amount/Equity share, in thousands)	322	2,027	6,249	40	368	833	1,786	100,000

Panel B: Offer terms

	#Obs	Mean	SD	Min	P25	P50	P75	Max
Cash amount (in $ thousands)	404	276	414	20	100	150	300	6,000
Equity share (%)	404	34	22	0	20	30	45	100
Firm valuation (=Cash amount/Equity share, in thousands)	348	1,209	2,415	35	313	609	1,000	23,333

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 the number of offers from sharks received by each pitch

	0	1	2	3	4	5	Total
Frequency	133	62	64	36	16	11	322

Table III
Sample Statistics: Scores Given by Amazon Mechanical Turk (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 entrepreneur contestants (entrepreneur contestant 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 MTurk respondents							
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 standard deviation of raw scores given by MTurk respondents							
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	Handle pressure	Appearance	Likability
Capability	1					
Confidence	0.716***	1				
Trustworthiness	0.889***	0.717***	1			
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

	Component 1	Component 2
Capability	0.4492	-0.3079
Confidence	0.4369	-0.0469
Trustworthiness	0.4658	-0.1298
Handle pressure	0.4464	-0.3554
Appearance	0.2929	0.6624
Likability	0.3245	0.5667

Panel C: Summary statistics of component scores

	Mean	SD	Min	P25	P50	P75	Max
Component 1 ("Competence/confidence")	0.000	1.998	-5.648	-1.392	0.157	1.352	4.463
Component 2 ("Appearance/likability")	0.000	1.028	-2.630	-0.752	-0.042	0.674	3.960

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, 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 key independent variables are the two principal components describing competence/confidence (component 1) and appearance/likability (component 2). Other controls are 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 three fixed effects, capturing potential industry-, shark- and season-specific effects.

	(1)	(2)	(3)
Dependent variable:	A shark makes an offer to an entrepreneur (team)		
Competence/confidence	0.033*		0.0327*
	(0.018)		(0.019)
Appearance/likability	0.0843**		0.0899**
	(0.038)		(0.042)
Control variables:			
Team		0.206**	0.144
		(0.083)	(0.088)
Female		0.193*	0.099
		(0.112)	(0.119)
Log(asking firm valuation)		0.0695**	0.0778**
		(0.035)	(0.036)
Stage of business: growth		0.115	0.113
		(0.147)	(0.149)
Business stage: expansion		-0.112	-0.110
		(0.171)	(0.173)
Business stage: not applicable		0.238**	0.256**
		(0.112)	(0.113)
Patent: pending		-0.241	-0.220
		(0.243)	(0.243)
Patent: yes		0.421*	0.425*
		(0.219)	(0.219)
Patent: not applicable		-0.0577	-0.0581
		(0.209)	(0.209)
Log(past sales)		0.0104	0.0105
		(0.007)	(0.007)
Log(self-investment)		0.00663	0.00796
		(0.007)	(0.007)
Shark effect	Yes	Yes	Yes
Season effect	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes
Observations	1,587	1,587	1,587
Pseudo R-squared	0.038	0.058	0.062

Table VI

Investor Decision Conditional upon Making an Offer: Cash Amount

This table contains the estimates of the regressions relating the cash amount offered to the entrepreneurs and two key independent variables of interest—the two principal components describing competence/confidence (component 1) and appearance/likability (component 2). Other controls are 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 three fixed effects, capturing potential industry-, shark- and season-specific effects.

	(1)	(2)	(3)
Dependent variable:	Log(offer cash amount)		
Competence/confidence	0.0505**		0.0312**
	(0.022)		(0.013)
Appearance/likability	-0.140**		-0.117***
	(0.028)		(0.031)
Control variables:			
Team		-0.138**	-0.0692
		(0.057)	(0.060)
Female		-0.233***	-0.145*
		(0.079)	(0.082)
Log(asking firm valuation)		0.906***	0.885***
		(0.037)	(0.037)
Stage of business: growth		0.0165	-0.0314
		(0.108)	(0.107)
Business stage: expansion		0.0312	-0.0179
		(0.123)	(0.121)
Business stage: not applicable		0.110	0.0692**
		(0.084)	(0.083)
Patent: pending		0.294*	0.0895
		(0.155)	(0.177)
Patent: yes		0.180*	0.320**
		(0.180)	(0.152)
Patent: not applicable		0.342**	0.291*
		(0.155)	(0.151)
Log(past sales)		-0.0124**	-0.0121**
		(0.005)	(0.005)
Log(self-investment)		0.00984*	0.00725
		(0.005)	(0.005)
Shark effect	Yes	Yes	Yes
Season effect	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes
Observations	1,587	1,587	1,587
Pseudo R-squared	0.753	0.755	0.767

Table VII
Investor Decision Conditional upon Making an Offer: Bidding Investment Valuation

This table contains the estimates of the regressions relating the sharks' bidding investment valuation and two key independent variables of interest—the two principal components describing competence/confidence (component 1) and appearance/likability (component 2). The sample only contains offers with equity-only structure. Other controls are 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 three fixed effects, capturing potential industry-, shark- and season-specific effects.

	(1)	(2)	(3)
Dependent variable:	Log(bidding investment valuation)		
Competence/confidence	0.0513**		0.0650***
	(0.021)		(0.020)
Appearance/likability	-0.109**		-0.106**
	(0.048)		(0.051)
Control variables:			
Team		-0.219**	-0.160
		(0.093)	(0.097)
Female		-0.467***	-0.408***
		(0.126)	(0.132)
Log(asking firm valuation)		0.905***	0.883***
		(0.059)	(0.059)
Stage of business: growth		-0.351**	-0.417**
		(0.170)	(0.168)
Business stage: expansion		-0.0971	-0.157
		(0.193)	(0.190)
Business stage: not applicable		-0.0515	-0.113
		(0.137)	(0.136)
Patent: pending		0.542**	-0.171
		(0.266)	(0.304)
Patent: yes		-0.0179	0.336
		(0.308)	(0.268)
Patent: not applicable		0.406	0.505*
		(0.273)	(0.262)
Log(past sales)		0.00837	0.00912
		(0.008)	(0.008)
Log(self-investment)		-0.0111	-0.0137*
		(0.008)	(0.008)
Shark effect	Yes	Yes	Yes
Season effect	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes
Observations	345	345	345
Pseudo R-squared	0.613	0.639	0.656

Table VIII
Firms' Subsequent Survival and First Impression

This table presents the results of estimating a Cox Proportional Hazards model of a firm going out of business during a year given the firm had survived in previous years. The sample includes all projects that received at least one offer from the show. The key independent variables are the two principal components describing competence/confidence (component 1) and appearance/likability (component 2). Other controls include the logarithm of past annualized sales, the logarithm of self-investment amount, team presentation effect, entrepreneurs' gender (for solo presenters), their asking terms, TV Nielsen ratings for each episode, an indicator variable "Featured," set to 1 if the firm is featured in a subsequent episode on the show, as well as season effects, industry effects, business stage effects, and patent status effects.

	(1)	(2)
Competence/confidence	-0.303*	-0.301*
	(0.158)	(0.172)
Appearance/likability	0.108	0.0509
	(0.275)	(0.284)
Log(past sales)	-0.0933*	-0.106*
	(0.049)	(0.054)
Log(self-investment)	0.0588	0.0799*
	(0.048)	(0.049)
Log(asking firm valuation)	0.0263	-0.0397
	(0.298)	(0.330)
TV Nielsen ratings	-2.110*	-2.052*
	(1.146)	(1.161)
Featured		-1.504**
		(0.644)
Number of firms	148	148
Pseudo R-squared	0.146	0.180

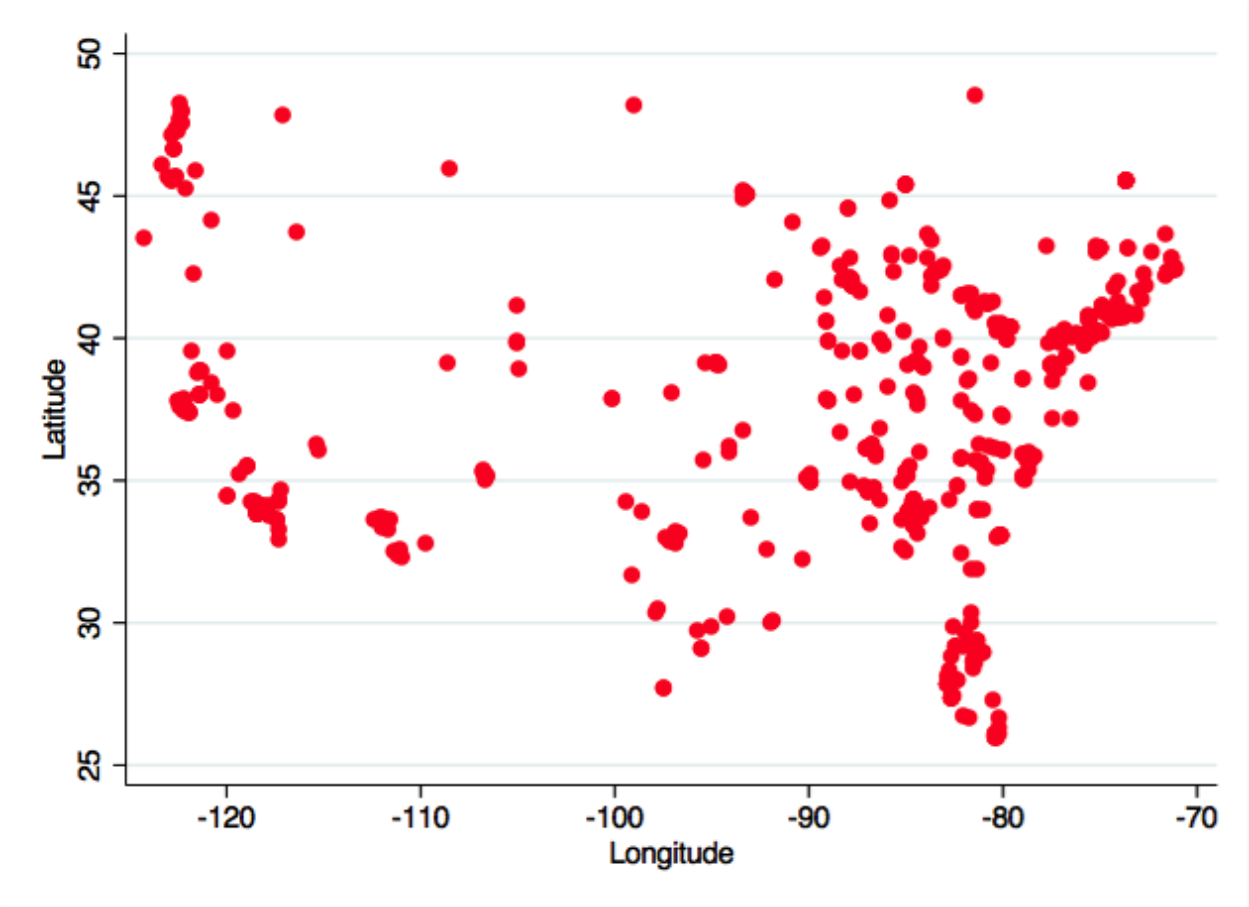

Figure 1: Geographic Distribution of MTurk Respondents

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

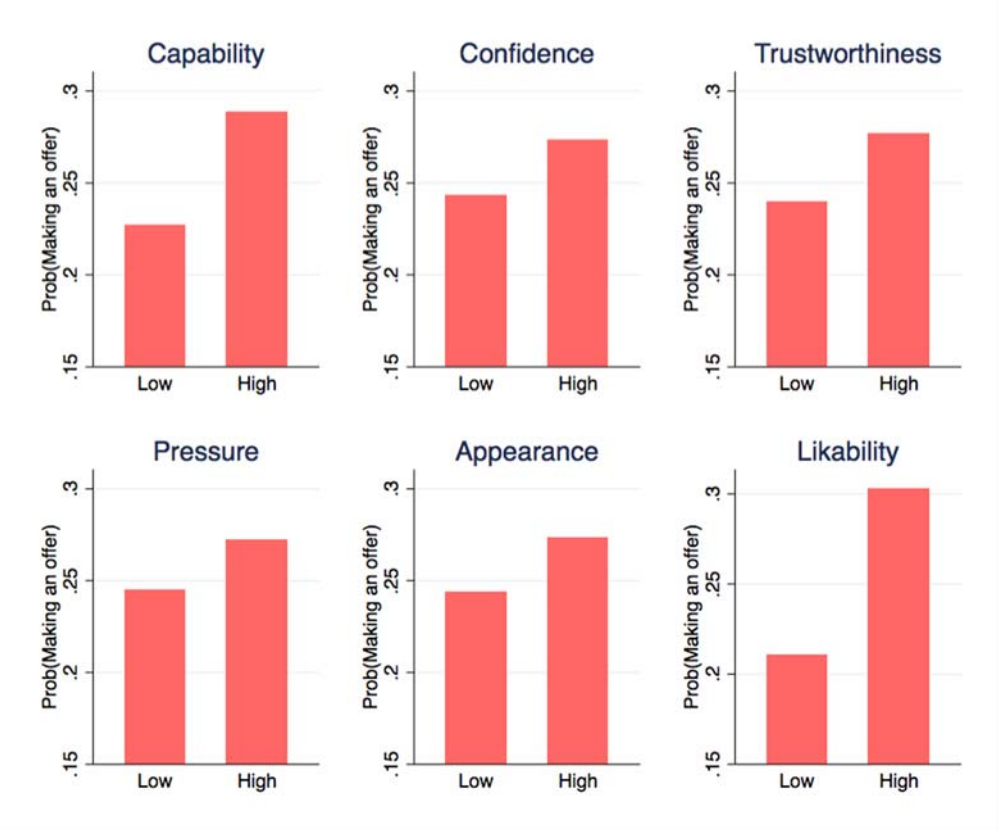

Figure 2: Investor Decision: Likelihood of a Shark Making an Offer to an Entrepreneur (Team)

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.

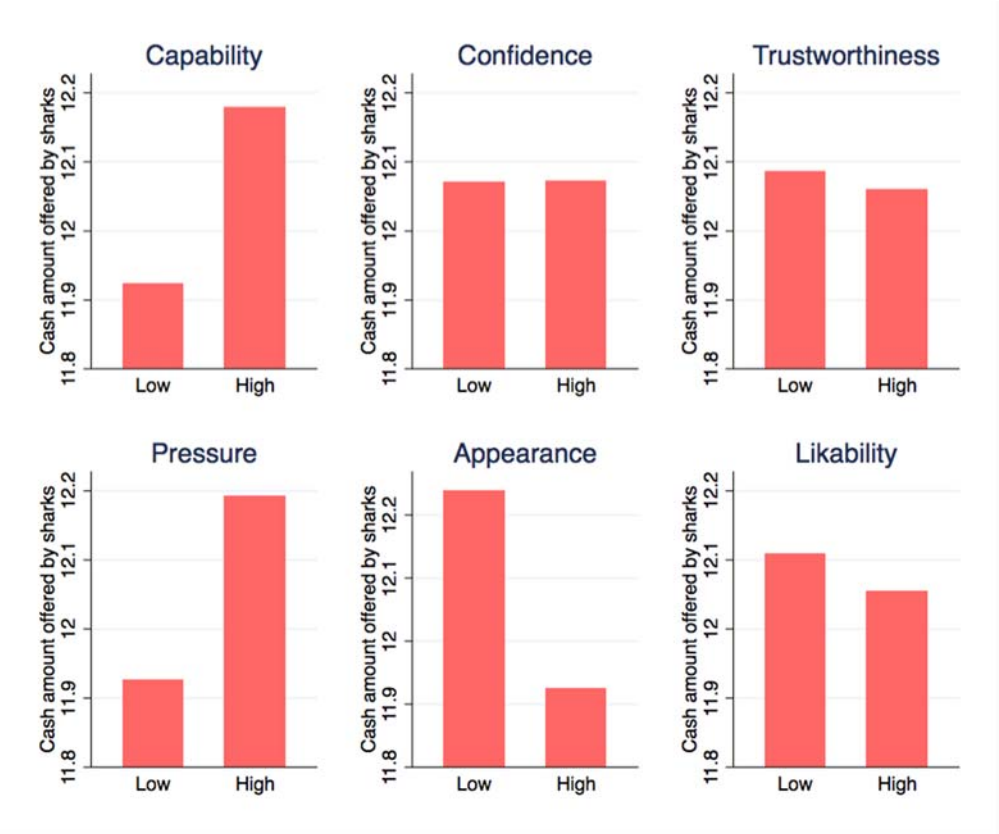

Figure 3: Investor Decision Conditional upon Making an Offer: Cash Amount

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.

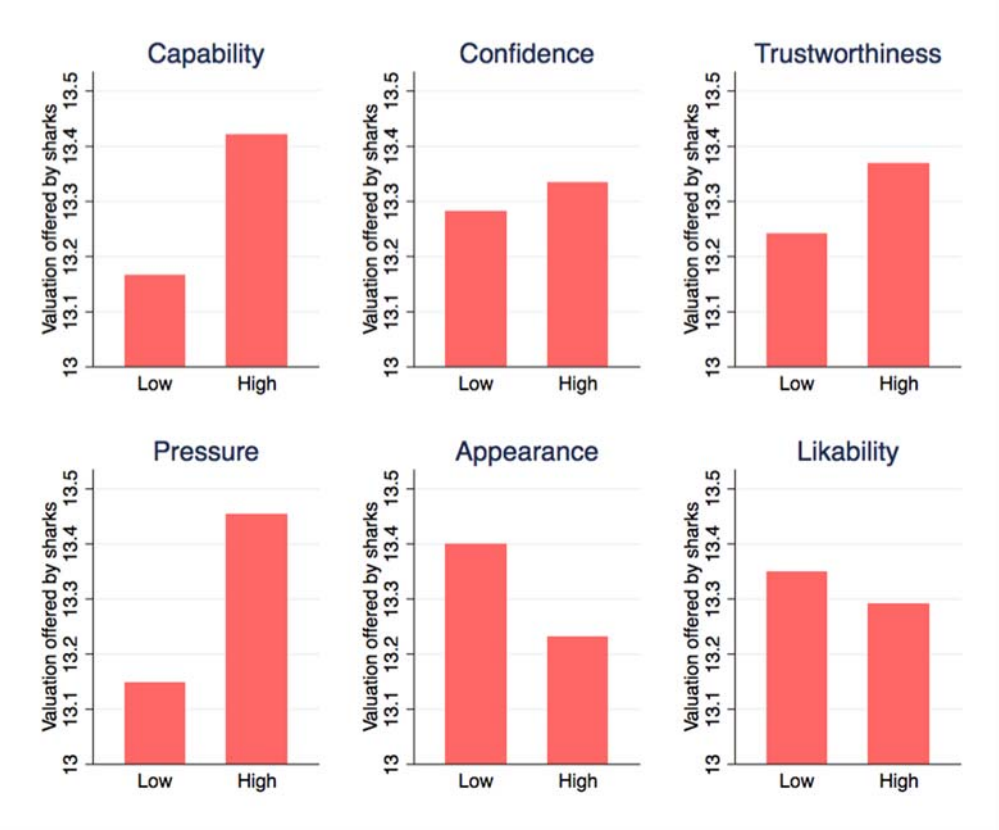

Figure 4: Investor Decision Conditional upon Making an Offer: Valuation

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.

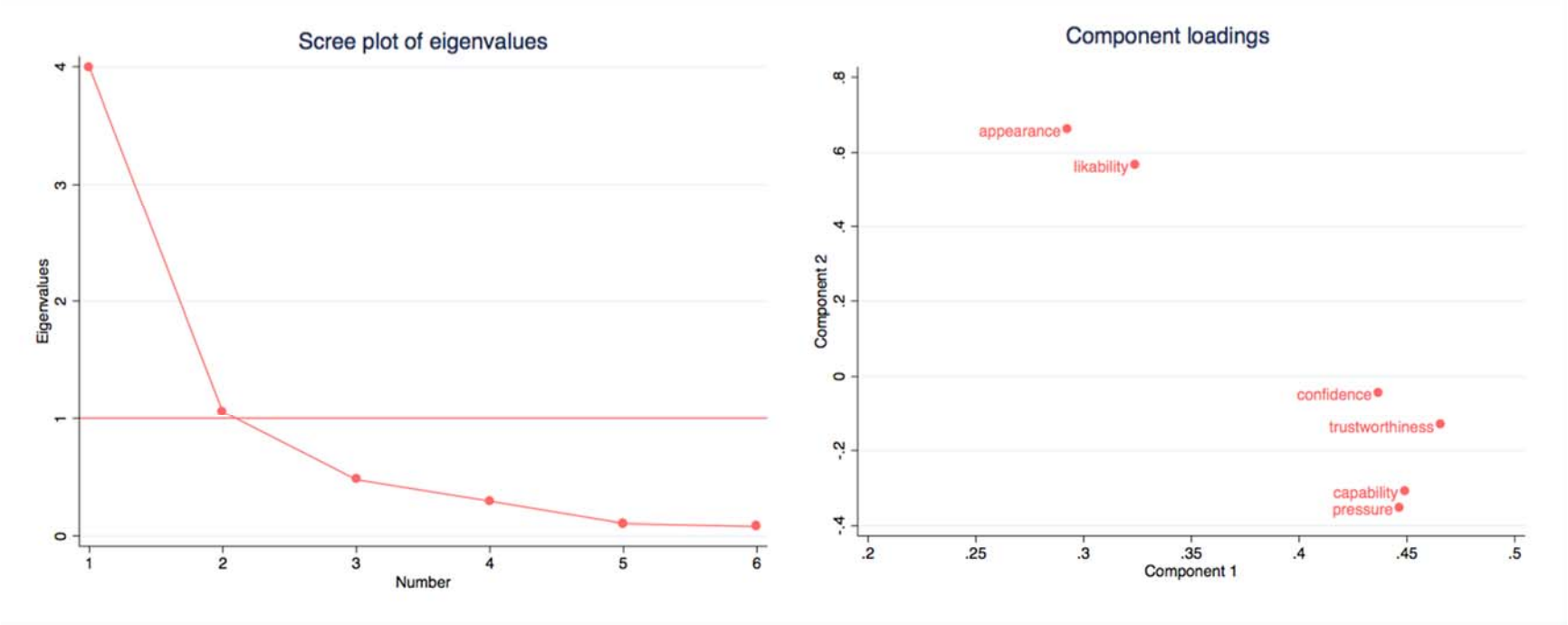

Figure 5: Principal Component Analysis of the Entrepreneurs' Six Characteristics.

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?

A.3 Illustration of a conceptual framework

Consider an entrepreneur contestant c who presents a project to a shark investor. The shark's perceived valuation of the project, $\hat{v}_c = v_c + \mu_c$, consists of v_c, the underlying value of the project perceived by the shark investor, and μ_c, the misvaluation, that is, bias in shark's project valuation. The underlying value of the project follows a normal distribution with mean v and variance σ^2, that is, $v_c \sim N(v, \sigma^2)$. The mean of the underlying value v may be correlated with the information contained in the shark's impression of the entrepreneur contestant. For example, there could be a positive relation between the shark's perception of the underlying value of the project and the shark's (first) impression about the entrepreneur contestant. Put simply, the higher the first impression score, call it *FI*, the higher the mean of the distribution of the underlying project value (Hypothesis 1: $\frac{\partial v}{\partial FI} > 0$). There could also be a positive relation between the shark's bias and the shark's (first) impression about the entrepreneur contestant (Hypothesis 2: $\frac{\partial \mu_c}{\partial FI} > 0$).

First, we consider a shark investor who decides whether to make an offer based on the comparison between the shark's perceived ***project value*** and a threshold $\underline{v}$, making an offer only if the perceived project value is greater than the threshold ($\hat{v}_c = v_c + \mu_c > \underline{v}$), with the bidding investment value $i_c = \hat{v}_c - \delta_c$, where $\delta_c \sim N(\delta, \eta^2)$ is independent from v_c and represents the rent extracted by the shark investor. The threshold applied by the shark investor may be affected by first impression, so that the shark investor may relax the threshold for projects presented by entrepreneurs with higher first impression scores (Hypothesis 3: $\frac{\partial \underline{v}}{\partial FI} < 0$). Under these circumstances, we have:

(1) The probability of making an offer is

$$\Pr\left(v_c + \mu_c > \underline{v}\right) = 1 - \Phi\left(\frac{\underline{v} - v - \mu_c}{\sigma}\right) = \Phi\left(-\frac{\underline{v} - v - \mu_c}{\sigma}\right),$$

where $\Phi(\cdot)$ is the standard normal cumulative distribution function

(2) The average bidding investment value given making an offer is

$$\mathrm{E}\left(i_c | v_c + \mu_c > \underline{v}\right) = E\left(v_c + \mu_c \middle| v_c + \mu_c > \underline{v}\right) - \delta = v + \mu_c + \sigma \frac{\phi\left(\frac{\underline{v} - v - \mu_c}{\sigma}\right)}{1 - \Phi\left(\frac{\underline{v} - v - \mu_c}{\sigma}\right)} - \delta$$

$$= v + \mu_c + \sigma\lambda\left(-\frac{\underline{v} - v - \mu_c}{\sigma}\right) - \delta,$$

where $\phi(\cdot)$ is the standard normal density function, and $\lambda(x) = \frac{\phi(x)}{\Phi(x)}$ is the inverse Mills ratio (with the property that $-1 < \lambda'(x) < 0$)

(3) The average value of projects receiving offers is

$$\mathrm{E}\left(v_c | v_c + \mu_c > \underline{v}\right) = E\left(v_c \middle| v_c + \mu_c > \underline{v}\right) = v + \sigma \cdot \lambda\left(-\frac{\underline{v} - v - \mu_c}{\sigma}\right)$$

Alternatively, we consider a shark investor who decides whether to make an offer based on the comparison between the ***extracted rent*** and a threshold $\underline{\delta}$, making an offer only if it is possible to extract rent higher than the threshold ($\delta_c > \underline{\delta}$). Similarly, this threshold may relate to first impression scores and shark investors may apply a lower threshold if the first impression scores are higher (Hypothesis 4: $\frac{\partial \underline{\delta}}{\partial FI} < 0$). In addition, investors may expropriate higher rents from entrepreneurs with higher first impression scores (Hypothesis 5: $\frac{\partial \delta}{\partial FI} > 0$). Under these alternative circumstances, we have:

(1) The probability of making an offer is

$$\Pr\left(\delta_c > \underline{\delta}\right) = 1 - \Phi\left(\frac{\underline{\delta} - \delta}{\eta}\right) = \Phi\left(-\frac{\underline{\delta} - \delta}{\eta}\right),$$

where $\Phi(\cdot)$ is the standard normal cumulative distribution function

(2) The average bidding investment value given an offer was made is

$$\mathrm{E}\left(i_c | \delta_c > \underline{\delta}\right) = v + \mu_c - E\left(\delta_c \middle| \delta_c > \underline{\delta}\right) = v + \mu_c - \left(\delta + \eta \frac{\phi\left(\frac{\underline{\delta} - \delta}{\eta}\right)}{1 - \Phi\left(\frac{\underline{\delta} - \delta}{\eta}\right)}\right)$$

$$= v + \mu_c - (\delta + \eta \cdot \lambda\left(-\frac{\underline{\delta} - \delta}{\eta}\right)),$$

where $\phi(\cdot)$ is the standard normal density function, and $\lambda(x) = \frac{\phi(x)}{\Phi(x)}$ is the inverse Mills ratio (with the property that $-1 < \lambda'(x) < 0$)

(3) The average value of projects receiving offers is $\mathrm{E}\left(v_c | \delta_c > \underline{\delta}\right) = v$

Under both sets of hypotheses, we consider how the probability of making an offer, the bidding investment value given making an offer, and the underlying value of projects that receive offers vary with the first impression scores. The comparative statics are summarized in Table A.II.

Table A.I

Project Examples 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 workout
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

Table A.II
Summary of Results and Predictions

		Assumption: Investors make an offer if the perceived value of a project exceeds a cutoff $(\mu_c + v_c > \underline{v})$			**Assumption:** Investors make an offer if the perceived profit exceeds a cutoff $(\delta_c > \underline{\delta})$		**Findings for first impression scores**	
		Hypothesis 1: (Information channel) Positive association between the underlying value of the project and the first impression $(\frac{\partial v}{\partial FI} > 0)$	**Hypothesis 2: (Premium channel)** Positive association between the bias in the perception of the project value and the first impression $(\frac{\partial \mu}{\partial FI} > 0)$	**Hypothesis 3: (Valuation threshold relaxation channel)** Negative association between the valuation cutoff for making an offer and the first impression $(\frac{\partial \underline{v}}{\partial FI} < 0)$	**Hypothesis 4: (Rent-extraction threshold relaxation channel)** Negative association between the profit cutoff for making an offer and the first impression $(\frac{\partial \underline{\delta}}{\partial FI} < 0)$	**Hypothesis 5: (Rent expropriation channel)** Positive association between discounts in the bidding investment value and the first impression $(\frac{\partial \delta}{\partial FI} > 0)$	**Confidence /capability** **Conclusion:** Consistent with **Hypothesis 1**	**Appearance /likability** **Conclusion:** Consistent with **Hypothesis 5**
	Interpretation							
$\frac{\partial Pr(\text{making an offer})]}{\partial FI}$	How does the probability of making an offer vary with the first impression?	Positive	Positive	Positive	Positive	Positive	Positive (Table V)	Positive (Table V)
$\frac{\partial E[i_c \vert \text{making an offer}]}{\partial FI}$	How does the bidding investment value vary with the first impression?	Positive	Positive	Negative	Positive	Negative	Positive (Tables VI, VII)	Negative (Tables VI, VII)
$\frac{\partial E[v_c \vert \text{making an offer}]}{\partial FI}$	How does the value of the projects receiving offers vary with the first impression?	Positive	Negative	Negative	0	0	Positive (Table VIII)	Insignificant (Table VIII)

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
○	○	○	○	○	○	○	○	○

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

1 - Not at all	2	3	4	5	6	7	8	9 - Extremely
○	○	○	○	○	○	○	○	○

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
○	○	○	○	○	○	○	○	○

Figure A.1: Sample Qualtrics Survey