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ABSTRACT

Gender Match and the Gender Gap in Venture Capital Financing: Evidence from Shark Tank*

Although the gender gap in entrepreneurs' success rates to secure funding is staggering, we know little about its causes. This is because observing both sides of investor-entrepreneur interactions (especially for unsuccessful pitches) is difficult in reality, and the associated extraordinary stakes complicate appropriate simulations in the laboratory. Using comprehensive data of 4,893 interactions from the popular US television show Shark Tank, we test whether gender match with entrepreneurs can explain investors' likelihood to extend funding offers. We find female investors are 30% more likely to engage with female (rather than male) entrepreneurs, while no systematic gender preferences emerge for male investors. This result is exclusive to entrepreneurs in non-male-dominated product categories but disappears in male-dominated products. Estimates are robust to the inclusion of a comprehensive set of control variables (such as asking valuation, investor-, and season-fixed effects) and a range of alternative specifications. These findings from a field setting with large, real-life stakes provide empirical support for the industry representation hypothesis regarding the gender gap in venture capital funding. While results should be interpreted with caution, our findings suggest increased numbers of women in key venture capital positions could facilitate access to funds for female entrepreneurs. Nevertheless, our setting is not suited to fully explore associated efficiency considerations.

JEL Classification: D91, G11, G24, G41, J16

Keywords: gender interaction effects, gender differences, venture capital financing, field data, high stakes bargaining

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1 Introduction

Substantial gender inequities in various economic outcomes persist in our societies and receive much scholarly attention, such as the gender wage gap or the glass ceiling phenomenon (Bertrand, 2011; Blau and Kahn, 2017). However, one area in which we know less about potential gender differentials relates to two-way interactions between entrepreneurs and potential investors (Garrett, 2020; Recalde and Vesterlund, 2020). The corresponding industry is so male-dominated that 90% of US-based venture capital firms do not feature *any* women on their investment team (Brush et al., 2018). Despite comprising 40% of entrepreneurs, women receive only 3% of venture capital funding (Brush et al., 2018; Clark, 2019; Balachandra, 2020) – a tiny segment in an industry worth ≈US$100b yearly. Why is that? Sometimes labeled the 'second glass ceiling' (Bosse and Taylor III, 2012), this disparity is important to understand in its own right, not least because further gender differences – e.g., related to wages, hiring decisions, and promotions – may well be related to these substantial gender gaps in securing funding.

Most related empirical research focuses on horizontal gender differences (e.g., those between employees), rather than vertical interactions between agents of the same or opposite gender, such as those between entrepreneurs and potential investors.[1] This is likely because a researcher needs to observe comprehensive and objective data from both sides of the negotiation table – something that is not easily measurable in real life. For example, we rarely observe *unsuccessful* interactions between entrepreneurs and investors.[2] As a consequence, studies are usually confined to the laboratory, where researchers can cleanly design, isolate, and measure participants' decisions. Caveats of such explorations relate to external validity concerns and the difficulty to credibly mimic the substantial stakes reflective of real-life situations in which entrepreneurs and potential investors usually negotiate over six-, seven-, or eight-figure sums.[3] Few existing field studies, such as Hernandez-Arenaz and Iriberri (2018), are able to elevate stakes to a few hundred US$ or Euros but still remain far from reaching representative sums. Overall, the confidential nature of entrepreneur-investor negotiations, combined with the substantial, difficult-to-

[1] Even those studies that do explore both sides of negotiations usually focus on the labor market and rarely on investment decisions (see Recalde and Vesterlund, 2020, for a summary of that literature).

[2] Hernandez-Arenaz and Iriberri (2018) summarize that "[e]xisting studies based on field data do not study gender interaction effects, either because the gender of the person in one role is not known or because there is not enough variation."

[3] For example, Antonovics et al. (2009) conclude that insights derived from laboratory and field studies in general are only comparable when stakes in laboratory studies are high.

replicate stakes in such interactions, complicate our understanding of whether and, if so, how gender combinations may be able to explain funding decisions – and thereby the associated large gender gaps in entrepreneurial funding.

In the following pages, we present findings from studying 4,893 entrepreneur-investor interactions in *Shark Tank*, a popular US television show in which entrepreneurs pitch their product to five potential investors (Sharks) to obtain funding. Our study spans 246 episodes over 11 seasons and features two main advantages: (i) Stakes are sizeable, with entrepreneurs seeking an average of US$303,370 in funding in exchange for an average 15% of their respective company; and (ii) we observe decisions from a *comprehensive* set of five potential investors for each presented pitch.[4] Thus, we not only capture successful but also unsuccessful pitches, alleviating selection issues when considering the scarce real-life data on observed funding decisions.

Of course, this setting is not without disadvantages. First, although Sharks are not informed beforehand about the upcoming entrepreneurs or products, social desirability bias may inform their actions. For example, investors holding a particular gender bias may try to conceal such characteristics in front of millions of TV viewers. As stakes are substantial, however, it is difficult to believe an investor would systematically make costly and consequential decisions that are inconsistent with their true preferences. Second, the show's producers may select particular types of entrepreneurs (perhaps those who are more interesting for a TV audience), i.e., the composition of entrepreneurs featured on *Shark Tank* may not reflect the real-life universe of entrepreneurs. This caveat, however, is shared by most laboratory-based studies, as it is difficult to exactly mimic the population of interest. Third, the 27 Sharks (19 male, 8 female; see Table A1 for a full list) may not necessarily be representative of the average potential investor. For instance, some Sharks are well-known celebrities, such as Mark Cuban (890 observations), Alex Rodriguez (16), Charles Barkley (8), or Maria Sharapova (4). Our estimations employ Shark-fixed effects to alleviate such concerns. Nevertheless, all interpretations of our results should keep these attributes in mind.

Our estimations reveal two main insights. First, male Sharks do not differentiate between female

[4]The nature of *Shark Tank* also allows for a better approximation of flexible real-life bargaining scenarios, owing to the free bargaining framework which allows for greater creativity in reaching mutually beneficial outcomes, compared to laboratory-based studies that often feature relatively rigid decision steps.

and male entrepreneurs when deciding to make an offer. This result emerges in univariate settings and when accounting for our comprehensive set of potential confounders, including product category, the ask value of the respective entrepreneurs, season-fixed effects, and Shark-fixed effects. We only see a marginal preference of male Sharks for male (rather than female) entrepreneurs in funding proposal that feature valuations just below the median value of US$1.44m. However, our second finding reveals gender matters systematically for the average female Shark, as their probability to enter into negotiation with female (as opposed to male) entrepreneurs rises by approximately 8.6 percentage points or 30%. This result is robust in statistical and quantitative terms to (i) accounting for all observable, potentially confounding factors, (ii) applying alternative empirical specifications, and (iii) allowing for potential peer effects (i.e., the behavior of other Sharks). Finally, this relationship between female investors and female entrepreneurs is particularly prevalent in product valuations below the median of US$1.44m and in product categories in which female entrepreneurs are less under-represented, such as those categorized as related to beauty, health, children, or fashion.

The paper contributes to two main streams of research. First, we provide evidence to suggest gender *interactions* matter in explaining substantial gender gaps in real life. Since it remains difficult to cleanly measure both sides of interactions in wage- and funding-related decisions, we hope our analysis of *Shark Tank* can provide a novel angle and complementary source of data in that regard. Our findings indicate that, if society wanted to facilitate the access to funding for female entrepreneurs, then female investors could be one part of the solution. Importantly, we highlight that we cannot consistently and comprehensively measure entrepreneurs' success rates, so we remain silent on broad efficiency considerations of such a proposal. Of course, external validity considerations would also have to be taken into account.

Second, our findings contribute to our understanding of how investment decisions are made. We find that a gender match between investor and entrepreneur can explain some portion of funding decisions, in particular for female investors and products valued up to US$1.44m in our estimations. Independent of gender equity considerations, these insights may inform our understanding of how funding decisions are made.

Finally, our results may hold another potential interpretation relevant for practical considerations: transparency matters (also see Recalde and Vesterlund, 2020). If our results were explainable by social

desirability bias alone, i.e., perhaps male Sharks do not discriminate by gender because of the public nature of the negotiation process, then policy endeavors to provide transparency in such situations may be able to alleviate the substantial gender gap in the ability to secure investment funding. Similarly, *if* female Sharks particularly promote women entrepreneurs on the show because it may provide them with positive publicity, then more transparency and public accessibility of investors' funding decisions may elicit similar results. Nevertheless, such equity considerations pertaining to closing the gender gap in investments would have to carefully be weighed against efficiency considerations – an aspect where our paper reaches its natural limits.

2 Theoretical and Empirical Background

2.1 Gender Interactions vs. Gender Differences

Most research to understand business decisions and outcomes focuses on gender *differences* (Stuhlmacher and Walters, 1999; Babcock et al., 2003; Bowles et al., 2007; Tinsley et al., 2009; Mazei et al., 2015; Leibbrandt and List, 2015; Säve-Söderbergh, 2019; Andersen et al., 2020), rather than *interactions* (see Recalde and Vesterlund, 2020, for a summary of the research on gender differences in negotiations, mostly related to wages). For example, a vast literature studies gender wage gaps among employees – but we know less about the characteristics (such as gender) of the bargaining partner, i.e., the employer's manager responsible for negotiating these wages. This is typically because that side of the bargaining table remains unobservable (e.g., see Hernandez-Arenaz and Iriberri, 2018).

However, the gender of the negotiation partner can matter when exploring outcomes, such as wages, promotions, or funding decisions. For instance, homophily along gender lines would suggest that a shared gender between bargaining parties may affect behaviour due to this point of similarity.[5] Put simply, a (fe)male employer or investor may find it easier to relate to a (fe)male employee or entrepreneur, either consciously or subconsciously, which could affect outcomes. Conversely, mixed-gender negotiations can increase the salience of gender roles and their associated behaviors, increasing congruity or incon-

[5]More generally, individual characteristics (such as gender, race, age, or geographical background) and their degree of similarity between bargaining partners may affect behavior and be able to influence negotiation outcomes (McPherson et al., 2001). For example, Hegde and Tumlinson (2014) find that "U.S. venture capitalists (VCs) are more likely to select start-ups with coethnic executives for investment."

gruity with the necessary negotiation behaviors and impacting outcomes (Stuhlmacher and Linnabery, 2013). The limited empirical evidence produces results that are consistent with that hypothesis (e.g., see Eriksson and Sandberg, 2012, Dittrich et al., 2014, or Hernandez-Arenaz and Iriberri, 2018), although evidence from real life remains scarce.

Similarly, gender discrimination may express itself in a person's judgement and bargaining behavior related to employees, customers, or entrepreneurs of the opposite gender (e.g., see Castillo et al., 2013). If one side held stereotypical beliefs about the general capability of women or men to differentially perform in the respective role, then bargaining behavior and outcomes would differ systematically by gender. Thus, everything else equal, it may matter whether a female or male entrepreneur pitches their concept to a female or male investor.

2.2 Gender and Venture Capital Funding

Although gender gaps prevail throughout a range of economic outcomes, gender differentials in securing venture capital funding are particularly pronounced. In the US, only 3% of all project funding is allocated to female entrepreneurs, even though 40% of all entrepreneurs are female (Brush et al., 2018; Balachandra, 2020; Clark, 2019). Although these basic differences are not evidence of discrimination *per se*, since a number of other factors beyond gender can influence the probability to get funded, it has been suggested that entrepreneur gender does not impact performance using appropriate measures (e.g., see Robb and Watson, 2012, Lins and Lutz, 2016, or Hebert, 2020). As early-stage funding is essential for quickly growing a business (Becker-Blease and Sohl, 2007; Alsos and Ljunggren, 2017), this disparity presents a significant hurdle for female entrepreneurs.

One hypothesis to explain these disparities comes from role congruity theory. If characteristics typically associated with successful entrepreneurship are in apparent conflict with the female gender role and more aligned with male gender roles, role congruity theory posits that differences in outcomes along gender lines would occur. Investors may prefer investing in male entrepreneurs as this role congruity would lead to the belief that male entrepreneurs enjoy greater probabilities of success. For example, entrepreneurship is often characterized as a masculine endeavor (Ahl, 2006; Gupta et al., 2009), and some investors may view the ideal entrepreneur as male (Thébaud, 2015; Malmström et al., 2017; Balachandra

et al., 2019). Other studies indicate that gender bias is more pronounced in the absence of other qualifying factors which would reduce role incongruity, such as lacking a technical degree or prior connections to venture capital (Tinkler et al., 2015).

One avenue of research focuses on the entrepreneurs' side – a narrative sometimes labeled as 'fix-the-women' (Recalde and Vesterlund, 2020). For instance, Roper and Scott (2009) show female entrepreneurs perceive greater barriers to accessing finance, which may discourage them from seeking funding. Both Eddleston and Powell (2008) and Guzman and Kacperczyk (2019) suggest the difference may be due to differing levels of business growth orientation. Eddleston and Powell (2008) in particular show female business owners value employee relationships and social contributions over economic growth in their business, which affects funding potential and outcomes.

Other lines of research consider the investor (or employer) side, sometimes labeled as a 'fix-the-institution' narrative (see Recalde and Vesterlund, 2020), to seek explanations for the stark gender gap in funding. For example, Kanze et al. (2018) explore interactions between investors and entrepreneurs at pitch competitions to find female entrepreneurs are often asked prevention-focused questions (concerned with the return of capital), while male entrepreneurs receive promotion-focused questions (concerned with the growth of the venture; also see Becker-Blease and Sohl, 2007, and Gupta and Turban, 2012). This distinction has been shown to affect funding (Brockner et al., 2004; Lanaj et al., 2012) and could explain biases against female entrepreneurs.

A consistent theme that appears in these analyses is the industry representation hypothesis. As the venture capital space is heavily male-dominated (Greenberg and Mollick, 2017; Balachandra, 2020), this theory posits that by increasing the number of women making investment decisions in venture capital firms, female entrepreneurs will have better access to funding. While some studies suggest this mechanism as a policy intervention (Greene et al., 2001; Balachandra, 2020), other research remains skeptical (Kanze et al., 2018). However, this literature is rarely able to examine both sides of the interaction due to lacking transparency and as such typically focuses on the gender of entrepreneurs. The scarce two-sided literature sometimes considers homophily, exploring shared characteristics between investor and entrepreneur, although often not as the main focus (Becker-Blease and Sohl, 2007; Boulton et al., 2019). Very little research examines gender interaction effects in their entirety in the venture capital space from

the investor's perspective (Harrison and Mason, 2007; Balachandra, 2020).

3 *Shark Tank*

3.1 Background and Format

Shark Tank is a US reality TV program that debuted in 2009 and recently completed its 11^{th} season on the *ABC* network. The show is a derivation of *Dragon's Den*, popular in the UK and Canada, which itself derives from the original Japanese format called *Tigers of Money*. The show focuses on entrepreneurship and venture capital, presenting "the drama of pitch meetings and the interactions between entrepreneurs and tycoons" (Lewis, 2009).

A typical *Shark Tank* episode includes four pitches that are presented and concluded subsequently. An entrepreneur or team of entrepreneurs enters the 'tank' to face a panel of five independent investors, known as Sharks, to pitch their product, hoping to receive an investment. The show maintains a cast of six regular Sharks with business backgrounds in a variety of product categories. These are (by number of appearances; also see Table A1 for a full list): Kevin O'Leary, notable for the US$4.2b software company 'The Learning Company'; Mark Cuban, co-founder of online media and streaming website 'Broadcast.com' and perhaps best known as the owner of the NBA's Dallas Mavericks; Robert Herjavec, founder of internet security company 'The Herjavec Group'; Lori Greiner, serial entrepreneur with hundreds of launched products best known for her role on the home shopping channel 'QVC'; Daymond John, founder of the clothing brand 'FUBU'; and Barbara Corcoran, best known for her US$5 billion real estate business in New York (ABC, 2020). The show also frequently uses guests who are either successful entrepreneurs or famous individuals with investment backgrounds.

The entrepreneurs begin by introducing themselves and their product, stating both the amount of cash they are requesting and the percentage stake in their company they are offering in return. This request is important as the entrepreneur must be able to convince the investors to invest the amount of cash they ask for at minimum, or they cannot receive a deal, according to the show's rules (Burnett, 2009). They then pitch their product, and the Sharks are invited to ask questions to inform their investment decision. A Shark then typically either provides a counteroffer to the entrepreneurs or indicates they are 'out'. This

is our primary point of research: Whether a Shark makes an offer to the entrepreneurs or not. In further estimations, we also consider whether an agreement is eventually made, but results are consistent with our main estimates from predicting the likelihood to make an offer. After the Shark's (or Sharks') offer, a negotiation process typically ensues. In practice, a range of combinations are possible as outcomes: (i) Entrepreneurs may leave without a deal, either because no Shark made an offer or there was no agreement; (ii) entrepreneurs agree to a deal with one Shark; (iii) entrepreneurs agree to a deal from multiple Sharks who combine forces and present a joint offer.

To illustrate the process, consider the case of Rebecca Rescate and her product *CitiKitty*, a toilet training seat for pet cats (see Figure A1). In episode 23 of season 2 (May 2011), Rescate asked for US$100k, offering 15% of her venture in return. She then pitched her product and fielded questions from the investors (including a line of questioning about potential liability concerns of toilet-training cats). At the end of the pitch, Kevin O'Leary, Robert Herjavec, and Daymond John announced they are 'out'. We code these two observations as the entrepreneur not receiving an offer. Kevin Harrington offers the requested $100k for 40% of the company, while Barbara Corcoran offers the exact deal Rescate requested – both these observations are coded as the entrepreneur receiving an offer. Eventually, Rescate agreed to a deal with Harrington, receiving $100k for 20% of her business. (Today, Rescate has earned millions from *CitiKitty*; see Wells, 2020, and CitiKitty, 2020.) After each pitch is concluded, ending either in a deal or not, the next team of entrepreneurs appears.

3.2 Game Shows and Empirical Research

Data from game shows has been used to study a range of behavioral patterns, often complementing insights from laboratory studies. The advantages usually come from higher, more realistic stakes (van den Assem et al., 2012), intense pressure (which often better reflects the respective real-life situation), and large samples. Early studies to better understand risk-taking and decision-making under uncertainty have used data from *Card Sharks* (Gertner, 1993), *Jeopardy!* (Metrick, 1995; Lindquist and Säve-Söderbergh, 2011; Säve-Söderbergh and Sjögren Lindquist, 2017; Jetter and Walker, 2017, 2018, 2020b,a), the *Weakest Link* (Levitt, 2004; Antonovics et al., 2005), *Deal or No Deal* (Post et al., 2008; De Roos and Sarafidis, 2010), and *Cash Cab* (Kelley and Lemke, 2013, 2015). Notably, Boulton et al. (2019) provide a descrip-

tive analysis of *Shark Tank*, featuring fewer episodes than our explorations and not explicitly focusing on gender interactions.

As far as we are aware, only Hernandez-Arenaz and Iriberri (2018) explicitly explore gender interactions in bargaining with game show data, finding that female participants in Spain are more likely to make reduced requests in bargaining, but only from men. These results suggest interaction effects are relevant when studying negotiation settings in general. The corresponding stakes are slightly greater than 400 Euros, which is larger than in most laboratory settings but remains substantially lower than those of most entrepreneurs seeking investment in their products.

3.3 Advantages and Disadvantages of *Shark Tank* Data

The downsides of game show settings often relate to potential audience effects or social desirability biases, whereby show participants may act differently because they know they are being observed by an audience (van den Assem et al., 2012). Further, selection issues remain a concern as a game show participant may not necessarily be representative of the respective group in society. In our case, entrepreneurs applying for *Shark Tank* may not feature the same characteristics as the average US entrepreneur. In addition, out of those who do apply, show organizers likely select what they believe are the most interesting products and entrepreneurs to be on TV.[6]

The corresponding advantages of studying *Shark Tank*, in addition to high monetary stakes that are likely to elicit actions consistent with both sides' preferences, also concern personal aspects. Entrepreneurs negotiate over the fate of their own businesses, which often significantly determines economic returns for them and their families. From the Shark side, the invested money comes from their own funds rather than a pool of money the show allocates. Experimental research has shown that behavioral differences arise between money that has been *earned* – such as the funds and business equity *Shark Tank* deals with – and money that has been *endowed* (Cherry et al., 2002; Reinstein and Riener, 2012; Danková and Servátka, 2015). The fact that the bargaining process is more personal than an experimental setting or a different game show setting, where the money is provided to the bargaining parties, allows for the possibility of real losses on behalf of both bargaining parties and avoids potential 'house money'

[6] *Shark Tank* receives over 40,000 applicants per season, of which approximately 100 make it to air on TV (John, 2014).

or 'windfall' effects that may arise in situations where bargaining occurs with money endowed by a third party.

Another benefit of *Shark Tank* data comes from the flexible show format. Laboratory studies typically use fixed negotiation pies and structured bargaining frameworks (see Dittrich et al., 2014, where participants only communicate via a predetermined written form). Hernandez-Arenaz and Iriberri's (2018) field study is freer from a behavioral perspective but still uses a fixed pie negotiation framework. The only condition imposed on the Shark Tank bargaining framework is that entrepreneurs must, at minimum, receive the amount of cash they request at the beginning. There are no restrictions on the equity amount that can be exchanged. For example, in one pitch from season 9, the clothing company *Birddogs* offered just 1.5% equity. Conversely, two entrepreneurs in season 10, pitching their product *The Moki Door Step*, sold 100% of their business for US$3m.

In sum, *Shark Tank* allows us to study true investment decisions in a transparent way, being able to observe the actions of both entrepreneurs and potential investors.

4 Data and Empirical Strategy

4.1 Data

By watching every episode, we construct a unique dataset spanning the entirety of the *Shark Tank* series from inception in 2009, including 977 pitches from 246 episodes.[7] This results in 4,893 individual Shark-entrepreneur interactions over 11 seasons. Of the 977 pitches, 522 saw a single entrepreneur present their product, 421 featured a team of two entrepreneurs, while 33 presented a team of three and one pitch included four entrepreneurs.

The key variables of our analysis are the genders of both the Sharks and the entrepreneur teams. Table 1 reports summary statistics, showing that a Shark made an offer in 28% of all Shark-entrepreneur interactions. Similarly, 28% of all interactions featured female Sharks.[8] Entrepreneurial teams are twice as

[7] Initially, these were 991 pitches, but we omit 14 of them because of irregularities in pitch type or mixed-gender teams that do not fit into a 0%, 50%, or 100% categorization.

[8] This compares positively to the general venture capital market, where approximately 10% of VC investors are female (Clark, 2019).

likely to include males than females. Overall, 243 (588) of the 977 pitches involved no male (female) entrepreneurs, while the remaining 146 pitches saw mixed-gender teams. In half of all Shark-entrepreneur interactions, gender of the Shark fully matches the gender makeup of the entrepreneur(s), i.e., either the Shark is male and all corresponding entrepreneurs are male or the Shark is female and all corresponding entrepreneurs are female. Results are not affected by how we code mixed-gender teams (see Section 5.2).

To capture potential confounders as well as possible, we employ data on the asking valuation of the entrepreneurs (cash requested divided by the stake offered) and product categories (available from `AllSharkTankProducts.com`). These data are consistently available and objectively assessable for all pitches.[9] Our estimations account for the natural logarithm of the asking valuation as a potential predictor of the likelihood to make an offer. Products are categorized in up to two of the 14 categories, and over three quarters of all pitches are categorized as *Home, garden, and tools* (20%), *Food and drink* (17%), *Fashion* (16%), *Kids, toys, and baby* (14%), or *Beauty and health* (13%). Table A2 provides an overview of numbers in each category, as well as category combinations.

Figure 1 visualizes the likelihood of the Shark making an offer, distinguishing between the four possible gender combinations. The male-Shark-male-entrepreneur combination resulted in an offer in 29.9% of all cases – an average that is not quite statistically different from the male-female combination at conventional levels (27.4%; p-value of t-test for difference: 0.116). However, we observe a statistically significant difference for female Sharks who are 8.6 percentage points more likely to make an offer to female, rather than male, entrepreneurs (33.4% versus 24.9%; p-value of t-test for difference: 0.002). Importantly, these basic comparisons of means do not account for potential confounders yet, such as product category, asking valuation, or unobservable differences across Sharks.

4.2 Empirical Strategy

Our main estimations employ a simple linear regression framework to predict whether the corresponding Shark i presents an offer to the team of entrepreneurs j. We employ a linear regression format to facilitate

[9] We also considered including sales data at the time of the pitch, but these data are sometimes not reported by entrepreneurs or stated in different formats (e.g., over different time horizons or geographical areas).

Table 1: Summary statistics for main variables (n=4,893).

Variable	Mean	(Std. Dev.)	Min.	Max.
Offer	0.28	(0.45)	0	1
Female Shark	0.28	(0.45)	0	1
# of male entrepreneurs	1.02	(0.76)	0	4
# of female entrepreneurs	0.48	(0.66)	0	3
Same gender (Shark-entrepreneur)[a]	0.51	(0.50)	0	1
Cash requested (in 2019 thousand US$)[b]	303	(422)	11	5,560
Asking share (%)	14.85	(9.02)	1.50	100
Product categories				
Home, garden, & tools	0.20	(0.40)	0	1
Food & drink	0.17	(0.37)	0	1
Fashion	0.16	(0.37)	0	1
Kids, toys, & baby	0.14	(0.34)	0	1
Beauty & health	0.13	(0.34)	0	1
Sports & outdoors	0.08	(0.26)	0	1
Services	0.07	(0.26)	0	1
Technology	0.07	(0.26)	0	1
Web applications	0.07	(0.26)	0	1
Education & arts	0.05	(0.22)	0	1
Pets	0.04	(0.20)	0	1
Holiday	0.02	(0.13)	0	1
Automotive & industrial	0.02	(0.13)	0	1
Gifts	0.01	(0.10)	0	1

Notes: [a]In our main estimations, we code a Shark-entrepreneur observation with featuring the same gender if *all* entrepreneurs share the same gender as the respective shark. Results are consistent to alternative specifications of mixed-gender teams of entrepreneurs (see Section 5.2). [b]All cash requests are converted to 2019 US$ by using OECD inflation data for the US (see OECD, 2020).

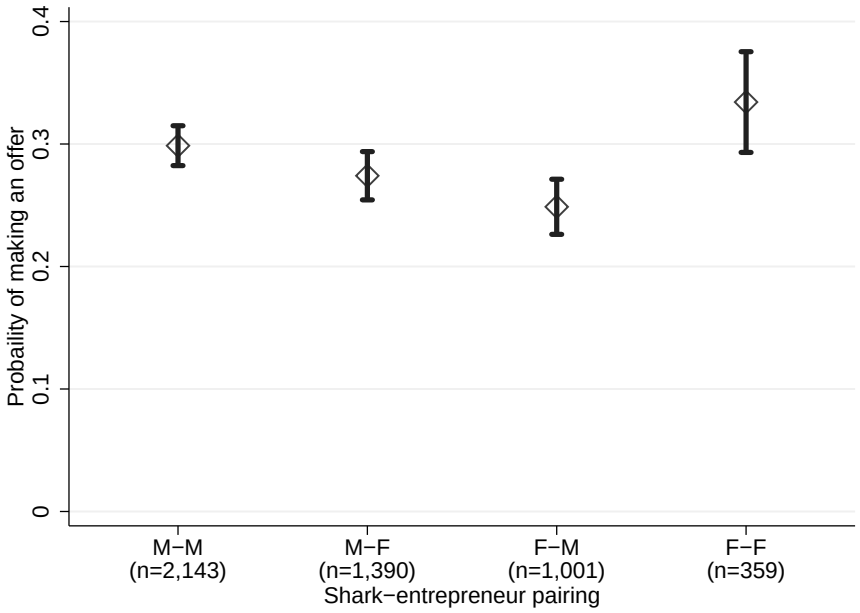

Figure 1: Share of interactions that result in an offer made by the respective Shark.

the interpretation of magnitudes, but all results are virtually identical in statistical terms when considering logit specifications (see Section 5.2).[10] Formally, our estimation becomes

$$\big(Offer\big)_{ij} = \beta_0 + \beta_1 \big(Gender\ match\big)_{ij} + \mathbf{X_{ij}} + \lambda_i + \epsilon_{ij}, \tag{1}$$

where $\big(Gender\ match\big)_{ij}$ constitutes a binary indicator for whether the entire entrepreneurial team shares the same gender as Shark i. β_1 presents our coefficient of interest: If gender played no role in Sharks' actions, we should derive a coefficient that is statistically and quantitatively indistinguishable from zero.

$\mathbf{X_{ij}}$ constitutes a vector of various observable control variables that could independently influence the Shark's likelihood to present an offer. Specifically, we account for binary indicators for each of the 14 product categories, the natural logarithm of the asking valuation (calculated as dividing the requested cash value by the asking share), and season-fixed effects. The inclusion of category-fixed effects ensures

[10] Predicted values from linear regressions all range between zero and one in our estimations, i.e., there is no concern about predicting unrealistic probabilities to make an offer below zero or above one.

the estimation of β_1 remains free of associations between particular product types and the likelihood to receive an offer. Section 5.3 further delineates along those dimensions with category-specific estimations. Accounting for the entrepreneurs' asking valuation ensures the stakes and their individual effect on a Shark's likelihood to make an offer are considered. Asking valuation also serves as a(n albeit subjective) proxy of product quality and market potential. Finally, season-fixed effects account for the national investment climate in the year of filming and minor format changes in the show.[11]

λ_i incorporates Shark-fixed effects to ensure our estimate of β_1 is not driven by unobservable cross-Shark variation that could independently affect their likelihood to produce an offer. For instance, an individual Shark's preferences, beliefs, and also gender perceptions may otherwise bias the estimation of β_1. Finally, we calculate standard errors clustered at the Shark level but also present robust standard errors in our main estimations. After estimating equation (1) for the full sample, we then study subsamples of male and female Sharks independently, as well as other subsamples and interaction effects.

5 Empirical Results

5.1 Main Findings

Table 2 documents our main results. Columns (1) and (2) consider the full sample of all Sharks, columns (3) and (4) turn to male Sharks, and columns (5) and (6) focus on female Sharks. For each sample, we first present results from a basic univariate estimation, followed by estimates derived from including the full set of covariates introduced in equation (1). Standard errors clustered at the Shark level appear in parentheses below the estimates, while robust standard errors are denoted in brackets.

Estimations on the full sample imply some preference for entrepreneurs of the same gender. In the univariate estimation, gender match is indicated to raise the likelihood of the Shark making an offer by four percentage points or approximately 14%. The inclusion of our control variables only marginally decreases that magnitude to 3.5 percentage points. The derived coefficient is statistically significant at the ten (and five) percent level when employing clustered (robust) standard errors. Interestingly, higher

[11] For example, in season 5, *Shark Tank* removed a fee in the form of equity or royalties paid to the show's production company simply for appearing on the show (Yakowicz, 2013).

Table 2: Predicting the probability the entrepreneur receives an offer from respective Shark.

	All Sharks		Male Sharks		Female Sharks	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Probability of receiving offer						
Gender match	0.040	0.035	0.025	-0.000	0.086	0.082
	(0.020)*	(0.020)*	(0.019)	(0.012)	(0.036)**	(0.022)***
	[0.013]***	[0.014]**	[0.016]	[0.016]	[0.028]***	[0.030]***
Ln(asking valuation)		0.030		0.043		0.003
		(0.015)*		(0.016)**		(0.023)
		[0.006]***		[0.007]***		[0.011]
Control variables[a]		✓		✓		✓
Shark-fixed effects		✓		✓		✓
Mean of dep. var.	0.28	0.28	0.29	0.29	0.27	0.27
N	4,893	4,893	3,533	3,533	1,360	1,360

Notes: Standard errors clustered at Shark level are displayed in parentheses, while robust standard errors are displayed in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Genders match if entire entrepreneur team is same gender as Shark.
[a]Control variables include 14 business category controls and fixed effects for season of show.

asking valuations, potentially serving as a proxy of product quality, are positively correlated with the average Shark's probability to propose an offer.

However, once we turn to the gender-specific subsamples of Sharks, substantial heterogeneity emerges. In fact, male Sharks are not more likely to engage with male entrepreneurs – a result that remains statistically and quantitatively indistinguishable from zero with a precisely estimated coefficient of -0.000 once all covariates are accounted for.

Turning to the female subsample produces different conclusions. Without considering potential confounders, female Sharks are 8.6 percentage points more likely to present an offer to female entrepreneurs. This magnitude only changes marginally, to 8.2 percentage points, when considering the independent effects of product category, season, asking valuation, and Shark-fixed effects. Not only is that result meaningful in statistical terms (p-value of 0.008 for clustered standard errors) but also in terms of magnitude, implying an increase by over 30% of a female Shark's average likelihood to present an offer.

This finding corroborates the scarce existing literature. It confirms Boulton et al.'s (2019) broader conclusions regarding homophily among investors – however, our results specify these insights, suggesting this factor to be exclusive to female (not male) investors. It also matches the finding of research summarized in Balachandra (2020) that suggests female investors are more likely to invite women to the pitch stage, as well as the finding in Harrison and Mason (2007) that female investors are more likely to assist female entrepreneurs. This finding also provides large-sample evidence for the industry representation hypothesis regarding closing the gender gap in venture capital funding, supported by research such as Greene et al. (2001) and Balachandra (2020).

5.2 Robustness Checks

Table 3 displays results from several robustness checks and alternative specifications. Columns (1)-(4) focus on male Sharks, while columns (5)-(10) explore female Sharks' behavior. In columns (1) and (5), we predict the likelihood of a deal eventually being reached, rather than simply the likelihood of the Shark making an offer. For example, it is possible that female Sharks are more likely to make an initial offer to female entrepreneurs, but perhaps these offers are so low that a deal is eventually unlikely to materialize. Here again, we derive a statistically and quantitatively significant coefficient for female

Sharks but not for male Sharks. In terms of magnitude, female Sharks are 8.5 percentage points more likely to complete a deal with female entrepreneurs than male entrepreneurs, equivalent to a difference of as much as 47%. In alternative estimations, we also explored whether the implied valuation of a female Shark's offer differs statistically when facing female entrepreneurs. However, that is not the case, as indicated by Figure 2 below. We also conduct balance tests to explore potential gender interaction effects for the likelihood to be offered a non-standard deal by a Shark (e.g., being offered a loan or an agreement with a royalty structure); however, we find no heterogeneity there (see Figure A2).

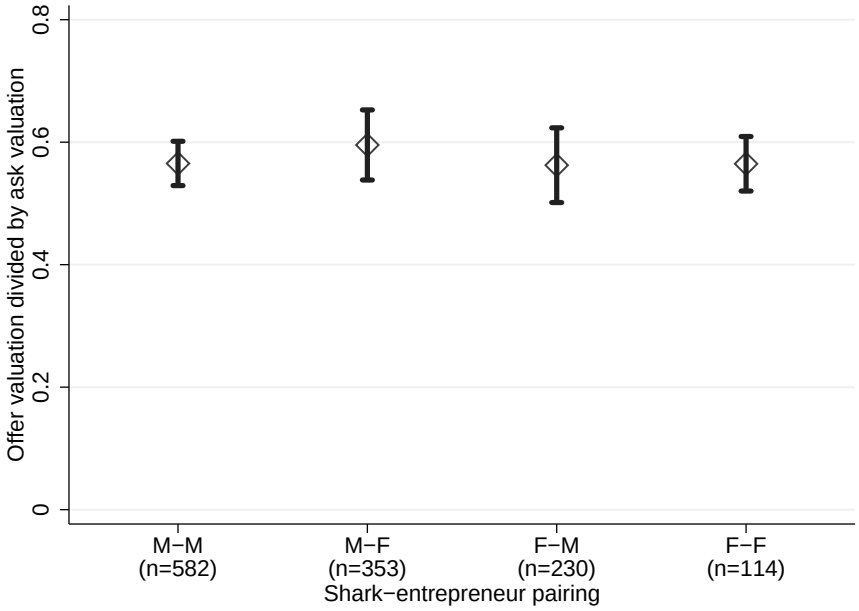

Figure 2: Displaying offer valuation as a share of ask valuations, provided an offer has been made by the respective Shark.

In columns (2) and (6), we employ a logit estimation to better capture the binary nature of the dependent variable. In columns (3) and (7), we alternatively include mixed-gender teams into the gender match category, i.e., any entrepreneurial team that features at least one member of the Shark's gender is coded as a gender match. In columns (4) and (8), we incorporate a binary variable for whether another Shark made an offer to the respective entrepreneurs. Finally, columns (9) and (10) exclude the two female Sharks who appeared in the most episodes to ensure our results are not driven by a single investor. In all corresponding estimations, we derive results that are consistent with those from Table 2.

Table 3: Results from alternative specifications, predicting the likelihood of the respective Shark making an offer (except in columns 1 and 5).

	Male Sharks				Female Sharks					
	Dep. var. Prob(deal)	Logit estimation			Dep. var. Prob(deal)	Logit estimation			Excluding Lori Greiner	Excluding Barbara Corcoran
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Gender match	0.008	-0.002		-0.002	0.085***	0.403***		0.084***	0.122**	0.076*
	(0.005)	(0.064)		(0.013)	(0.014)	(0.102)		(0.022)	(0.038)	(0.034)
Gender match (alternative definition)[a]			0.009				0.063***			
			(0.021)				(0.013)			
Competitive presence[b]				0.730***				0.776***		
				(0.028)				(0.015)		
Control variables[c]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Shark-fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mean of dep. var.	0.13	0.29	0.29	0.29	0.18	0.27	0.27	0.27	0.27	0.28
N	3,533	3,533	3,533	3,533	1,360	1,360	1,360	1,360	604	810

Notes: Standard errors clustered at Shark level are displayed in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. [a]Genders match if at least one member of the entrepreneur team is same gender as Shark. [b]Incorporates a binary indicator for at least one other Shark presenting an offer to the respective entrepreneur(s). [c]Control variables include the natural logarithm of the asking valuation, as well as fixed effects for each of the 14 product categories and 11 seasons.

5.3 Product Categories

Although the full results from Table 2 control for category-fixed effects, thereby isolating within-category variation only (and removing cross-category variation) in the likelihood to make an offer, it is possible that our main finding is specific to some categories. Figure 3 shows that the share of female entrepreneurs differs substantially across categories. For example, when it comes to *Kids, toys, and babies*, 54% of all entrepreneurs on *Shark Tank* are female. On the other end, only 8% of all entrepreneurs featuring products related to the automotive industry are female.

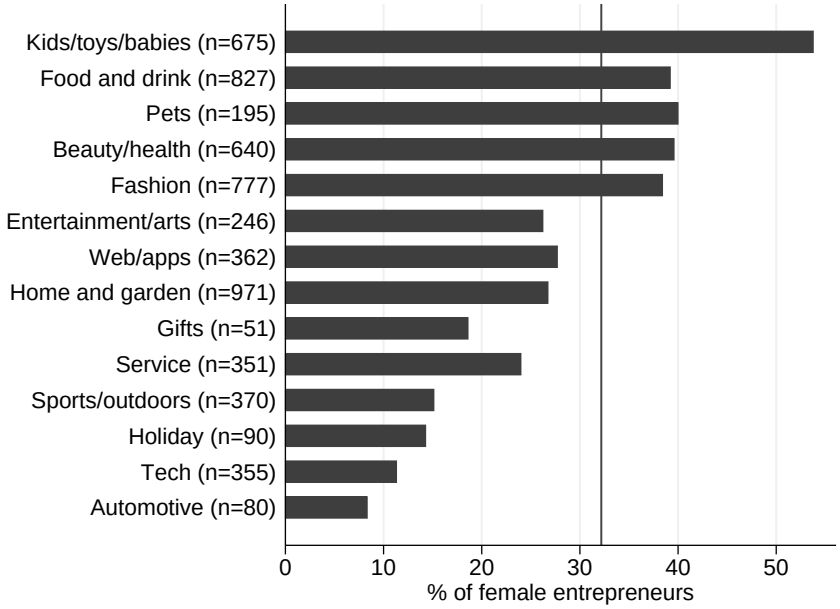

Figure 3: Share of women among entrepreneurs by product category. The vertical line displays the sample mean across all categories. Number of respective observations are displayed in parentheses behind category names.

To explore potential heterogeneity along product categories, Table 4 first documents results from individually studying the five most common product categories. Columns (6) and (7) independently focus on those five non-male dominated categories that feature a higher share of female entrepreneurs than the average (see Figure 3) and then on the remaining, male-dominated categories. Panel A considers male Sharks, while Panel B is dedicated to female Sharks.

As in the general estimations, we cannot identify any statistically meaningful predictive power of

Table 4: Distinguishing by product category. All estimations include the full set of control variables[a] and Shark-fixed effects.

Category:	Kids/toys/ baby	Food & drink	Beauty & health	Fashion	Home & garden	Non-male-dominated[b]	Male-dominated[c]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable: Probability of receiving offer							
Panel A: Male Sharks							
Gender match	0.009	0.056	0.008	-0.004	-0.000	0.010	-0.020
	(0.028)	(0.036)	(0.029)	(0.019)	(0.026)	(0.011)	(0.027)
N	482	590	451	575	698	2,095	1,438
Panel B: Female Sharks							
Gender match	0.110^{***}	0.020	0.158^{*}	0.061^{***}	-0.020	0.103^{***}	-0.045
	(0.020)	(0.099)	(0.079)	(0.001)	(0.049)	(0.023)	(0.026)
N	193	237	189	202	273	819	541

Notes: Standard errors clustered at Shark level are displayed in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Genders match if entire entrepreneur team is same gender as Shark. [a]Control variables include the natural logarithm of the asking valuation, as well as fixed effects for season of show, product categories (only in columns 6 and 7), and investor. [b]Includes the categories in which the overall share of female entrepreneurs is larger than the mean (see Figure 3): *Kids, toys, babies*; *Food and drink*; *Pets*; *Beauty & health*: and *Fashion*. [c]Includes the categories in which the overall share of female entrepreneurs is below the mean (see Figure 3).

entrepreneur gender for male Sharks. For female Sharks, we particularly identify effects in the *Kids, toys, and baby* category, as well as for *Beauty and health* and *Fashion* products. Interestingly, these constitute some of the categories that are most often presented by female entrepreneurs (see Figure 2). This is further highlighted by the results from the final columns, where we distinguish between what we label the non-male-dominated and the male-dominated categories in terms of the average gender distribution of entrepreneurs. We find clear evidence, both in statistical and quantitative terms, that female Sharks are more likely to turn to female entrepreneurs in products that are more often represented by female business leaders. However, that is not the case for products that are typically presented by male entrepreneurs – in fact, we identify a negative coefficient in that final estimation, where we only barely miss statistical significance at conventional levels (p-value of 0.129). Thus, our main result is driven by product categories in which female entrepreneurs are more common, at least on *Shark Tank*.

5.4 Asking Valuation

Our final set of estimates turns to potential heterogeneity along asking valuations. Table 5 delineates pitches by their asking valuation, as it is possible that gender bias in Sharks' investment behavior is more readily expressed in, for example, lower-valued products. Put simply, it might be easier for female Sharks to 'support' female entrepreneurs if the associated cost is lower.

In column (1), we simply include an interaction term between the entrepreneurs' asking value and the binary gender match indicator. If asking valuation did not play any role in offer decisions, we should not derive a statistically meaningful estimate here. Interestingly, we now derive some predictive power of gender matches for *male* Sharks as well, at least at the low end of the asking value distribution (column 1 of Panel A). To properly explore potential nonlinearities along these lines, columns (2)-(5) consider sub-samples of the respective asking valuations, beginning with the first quartile and ending with the fourth quartile. Indeed, for pitches between the 25^{th} and 50^{th} percentile in terms of asking valuation, male Sharks are more likely to select male entrepreneurs. However, no statistically meaningful relationship between gender match and the likelihood to make an offer emerges in the remaining segments.

For female Sharks, as documented in Panel B, a gender match matters for pitches that rank below the median in terms of asking valuation (which corresponds to approximately US$1.44m). Put differently,

Table 5: Distinguishing by asking valuation. All estimations include the full set of control variables.[a]

Sample:	Full	1^{st} quartile	2^{nd} quartile	3^{rd} quartile	4^{th} quartile
	(1)	(2)	(3)	(4)	(5)
Dependent variable: Probability of receiving offer from a given Shark					
Panel A: Male Sharks					
Gender match	0.345**	-0.016	0.075***	-0.004	-0.034
	(0.157)	(0.020)	(0.014)	(0.021)	(0.025)
Ln(asking valuation)	0.059***	0.032	0.102***	0.044	0.018
	(0.018)	(0.024)	(0.022)	(0.043)	(0.034)
Gender match × Ln(asking valuation)	-0.025**				
	(0.011)				
N	3,533	893	926	877	837
Panel B:Female Sharks					
Gender match	0.506**	0.129***	0.115**	0.045	-0.014
	(0.168)	(0.023)	(0.035)	(0.060)	(0.036)
Ln(asking valuation)	0.011	0.002	0.046	-0.086	0.009
	(0.026)	(0.047)	(0.030)	(0.122)	(0.024)
Gender match × Ln(asking valuation)	-0.030*				
	(0.013)				
N	1,360	319	339	354	348

Notes: Standard errors clustered at Shark level are displayed in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Genders match if entire entrepreneur team is same gender as Shark. [a]Control variables include the natural logarithm of the asking valuation, as well as fixed effects for season of show, product categories, and investor.

as investment value rises, entrepreneur gender seizes to matter – but female Sharks appear particularly more likely to invest in female entrepreneurs with more moderate asking valuations.

6 Conclusions

This paper introduces a large and comprehensive database of 4,893 investor-entrepreneur interactions on the popular US game show *Shark Tank*. In reality, researchers rarely (if ever) observe objective information on the behavior of entrepreneurs *and* potential investors – an artefact that substantially complicates our understanding of the sizeable gender gap in venture capital funding. *Shark Tank* offers just that: A transparent database which contains both successful and unsuccessful interactions between entrepreneurs who are seeking funding for their business and potential investors.

We focus on the descriptive power of gender interactions for the likelihood of an investor extending an offer to the respective entrepreneurs. Our estimations produce evidence that is consistent with homophily of female investors, i.e., a female investor's significantly higher likelihood to engage with female entrepreneurs. This result is driven by (i) product categories in which female entrepreneurs are represented with higher frequencies and (ii) products that are valued at less than the median US$1.44m.

These findings are in line with the scarce literature on gender interactions in investment decisions that largely derives from experimental studies, and carries potential consequences for our understanding of both negotiations and investment decisions. Our findings are consistent with the industry representation hypothesis, indicating that increasing the number of women in decision-making positions in venture capital firms might improve access to funds for female entrepreneurs, thereby reducing the gender disparity in venture capital funding. This might be especially the case for products in which the share of female entrepreneurs is larger than in other categories, such as *Kids, toys, and babies*, *Beauty and health*, and *Fashion*. Importantly, these findings indicate that female investors may have a positive bias towards female entrepreneurs, rather than male investors exhibiting a negative bias towards female entrepreneurs. Naturally, we advise caution in readily extrapolating our findings but hope to contribute towards a better understanding of the large gender gap in entrepreneurs' success to secure investment funding.

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A Appendix

Table A1: List of Sharks with their respective number of observations.

Shark	Gender	Observations
Kevin O'Leary	M	937
Mark Cuban	M	890
Robert Herjavec	M	814
Lori Greiner	F	756
Daymond John	M	622
Barbara Corcoran	F	550
Kevin Harrington	M	79
Rohan Oza	M	50
Chris Sacca	M	40
Sara Blakely	F	20
Alex Rodriguez	M	16
Bethenny Frankel	F	15
Daniel Lubetzky	M	15
Matt Higgins	M	10
Ashton Kutcher	M	8
Charles Barkley	M	8
Jamie Siminoff	M	8
Jeff Foxworthy	M	8
Nick Woodman	M	8
Richard Branson	M	8
Anne Wojcicki	F	7
Alli Webb	F	4
John Paul DeJoria	M	4
Katrina Lake	F	4
Maria Sharapova	F	4
Steve Tisch	M	4
Troy Carter	M	4

Figure A1: The *Citikitty* product presented in episode 23 of season 2 by Rebecca Rescate. The top graph shows the product, while the bottom graph illustrates the process (from Amazon, 2020).

Table A2: Grid breakdown of Shark Tank products by primary and secondary category.

		Primary product category of Shark Tank pitch													
		HGT	FaD	CSJ	KTB	BaH	SaO	Tech	WoA	Service	EaA	Pets	Holiday	AaI	Gifts
Secondary product category	HGT	142													
	FaD	1	153												
	CSJ			115											
	KTB	9	4	15	65										
	BaH	2	4	7	9	96									
	SaO	11		4	4	2	40								
	Tech	10		4	5	2	7	31							
	WoA			5	8	2	1	1	24						
	Service	5	2		1	4	1	2	28	22					
	EaA	1	1	1	9		4	4	2	3	21				
	Pets	1		1				2	1	1		33			
	Holiday	9		2	5			1		1					
	AaI	3		1				1			2			9	
	Gifts				1						1				8

Notes: This table records number of pitches rather than individual interactions.

Shorthands: HGT = home, garden and tools, FaD = food and drink, CSJ = fashion (clothing, shoes and jewellery), KTB = kids, toys and babies, BaH = beauty and health, SaO = sports and outdoors, WoA = website or app, EaA = education and arts, and AaI = automotive and industrial.

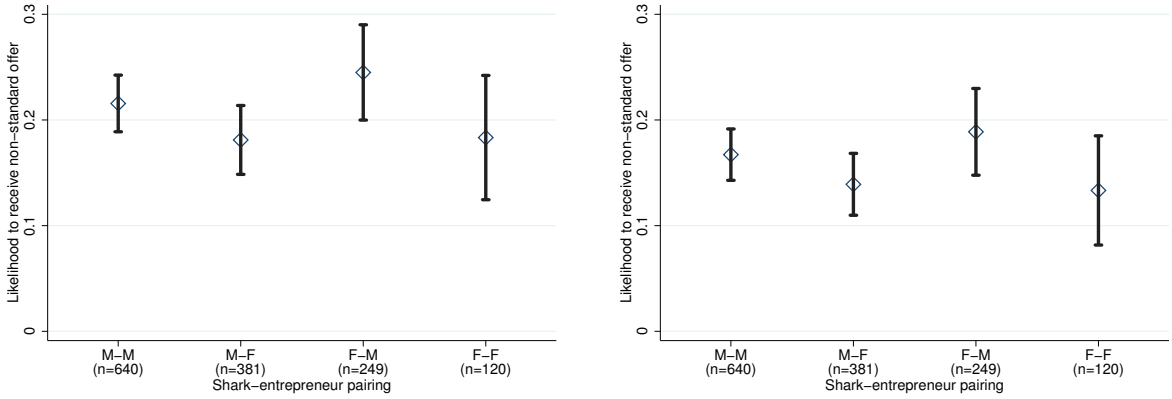

Figure A2: Displaying the likelihood to receive a non-standard offer (left) and the likelihood to receive an offer consisting of a loan or royalty (right), provided an offer has been made by the respective Shark.