Why female entrepreneurs are simultaneously less and more successful in equity crowdfunding!

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Abstract

This paper analyses the gender structure of a sample of 524 ECF initial campaigns on the Crowdcube platform 2012-2018 and finds that female entrepreneurs are simultaneously less and more successful than their male counterparts. They are less successful in that they are underrepresented in ECF campaigns – while one in three entrepreneurs are female, our data reveal that all female (Solo female and female team) entrepreneurs run just one in seven (14.5%) successful ECF campaigns. In this respect, female entrepreneurs are less successful at accessing private equity on ECF platforms, albeit this is much higher than their VC success rate. By contrast, our results also reveal that solo female entrepreneurs running ECF campaigns are more successful than their male counterparts based on three important criteria. They attract significantly more investors, enjoy a significantly higher Amount-to-goal ratio, and have a higher proportion of overfunded campaigns. While this may suggest a positive bias in favour of female founder campaigns, it seems at odds with the low percentage of female founder campaigns overall. It may be possible that the onboarding process - whereby the platforms select the campaigns that can run ECF campaigns – is subconsciously tougher for female founders or that the latter may be less overconfident than males in selling their campaigns.

Keywords: Equity crowdfunding, Gender structure, Female entrepreneur, Founder team

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1. Introduction

In modern economies, startups and young ventures play an essential role in creating jobs, accelerating innovation and productivity, and increasing employment (Block et al., 2018). Yet startups and smaller firms struggle to fund their activities during different stages of their development, and there is a well-recognized funding gap in the form of either credit, debt, or equity due to information asymmetry issues that are a result of entrepreneurs having more information than investors (Wilson et al., 2018). New players have emerged in entrepreneurial finance that provides outside equity to startups and other ventures at various stages of their growth path. It is important to investigate both how and to what degree startups' struggle to fund their activities can be alleviated by these new players, such as equity crowdfunding (ECF) platforms (Mochkabadi and Volkmann, 2020). The difficulties in raising equity are more pronounced for female entrepreneurs seeking to grow their ventures, and these are variously referred to as gender bias, gender gap, or the gender parity gap. Based on the Rose (2019) report, financial difficulties are the number one barrier for women intending to start or grow their businesses. This estimated that if female entrepreneurs start and scale their businesses at the same rate as men, they could add £250 billion new value to the UK economy.

There is a well-established gender-driven difference in capital-raising outcomes in entrepreneurship and females raise almost one-third less than their male peers (Guzman and Kacperczyk, 2019). Smaller ventures may initially use their own (and family and friends) savings, but at later stages, they have to raise outside capital to scale up their ventures. How gender influences the complicated interaction of investors (outside providers of the fund) and entrepreneurs during this process is an open question (Ewens, 2022). Traditional sources of entrepreneurial finance seem to favour male owners, and bank credit is more expensive for women even though there is no evidence they are riskier (Alesina et al., 2013). Although venture capitalists (VC) are important sources of outside equity, female entrepreneurs rarely receive funds from VCs, and less than 1% of funding goes to all female founders (BVCA, 2019). Female entrepreneurs in startups face a double effect of constraints. Smaller ventures are more constrained than medium or larger firms and, at the same time, ventures with majority female ownership experience more financial barriers than firms with minority female ownership (Dutta and Mallick, 2022).

Fortunately, the entrepreneurial finance landscape is dramatically changing due to technological advances and new players such as Equity Crowd Funding (ECF) and angel platforms, are emerging (Block et al., 2018). Practitioners and policymakers identify potentially new disruptive and democratizing attributes within crowdfunding. Equity crowdfunding, which has attributes of both private and public equity (Cumming et al., 2020b), is now one of the most widely used sources of new equity by young ventures in the UK. It is profit-based and highly risky, as investors can potentially lose all their investments (Coakley and Lazos 2021). Interestingly, investment in such platforms is becoming a strategic option for both young ventures and professional investors such as business angels (BA), and venture capital (VC) funds (Coakley et al., 2021a). Venture capital, for instance, prefer funding closely located ventures due to the required screening and due diligence process. The use of online platforms may make the distance less relevant and thus alleviate geography-related discrimination (Mollick and Robb, 2016, Cumming et al., 2021). Coakley and Lazos (2021) highlight that ECF can have a potential democratization role in terms of being accessible to small investors. Cumming et al. (2021) investigate the democratization promise of ECF by comparing the attributes leading informationally opaque firms to choose ECF over an IPO and looking at similar attributes as determinants of campaign outcome. They conclude that geography-related bias is improved in ECF platforms, but ECF has not been able to improve the chance of female entrepreneurs in fundraising. Also, regardless of attracting larger numbers of investors, ECF does not raise minorities' chances of raising the amount of equity they require.

In equity crowdfunding, investment decision-making has shifted from a few professional experts to a combination of the crowd and these investors in coinvestment ECF campaigns. This shift could result in a change in the proportion of investment in female-run ventures as crowds differ from traditional investors in their skills, experience, and perceptions about the gender of a firm owner (Bapna and Ganco, 2021). This innovation-driven change could result in a different attitude towards female entrepreneurs as the perceptions shaping mindsets of traditional investors about female-led firms diverge from those held by the crowd. The crowd tends to follow more of a community-based logic, whereas professional investors are inclined toward the market logic (Cumming et al., 2021). Equity crowdfunding investors consist of both sophisticated and inexperienced individuals seeking profit by investing in high-potential ventures. This mixture contributes to not easily predictable investor behavior. Enjoying the certification effects of

traditional investments and leveraging the wisdom of the crowd leads to a unique investment dynamic in equity crowdfunding campaigns. Equity crowdfunding investors seek financial benefits similar to traditional investors and, at the same time, are less experienced and dominated in terms of numbers by the crowd.

There are several prior studies on gender effects in entrepreneurial finance compared with the few gender studies focusing on crowdfunding platforms. The founder team structure has been examined by comparing the performance of solo founders versus founding teams (Coakley et al., 2021c, Greenberg and Mollick, 2018, Ahlers et al., 2015). Gender effects studies compare the performance of female and male entrepreneurs (Cumming et al., 2021, Gafni et al., 2020, Prokop and Wang, 2021, Bapna and Ganco, 2021, Johnson et al., 2018, Greenberg and Mollick, 2017), to examine whether, after controlling for a number of proxies, there is an underperformance which is explained by the gender of founders. However, there is a prevalent problem in gender studies that is the low presence of female entrepreneurs (Rose, 2019); also, the presence of solo founders and founding teams is not the same across both genders, which makes the comparison of female led firms with male led firms inclined towards the more present type of founder structure. Conceptualizing and testing for gender impact in UK equity crowdfunding is not straightforward due to the diverse nature of ECF founder teams. The quality of human capital is potentially affected by the gender and composition of founder teams (Barbi and Mattioli, 2019). Greenberg and Mollick (2018), using a Kickstarter project sample, postulate that solo founders outperform founder teams. By contrast, Coakley et al. (2021b) employ a sample of 1291 UK ECF campaigns on the three leading platforms UK 2011-2018 to establish that founder teams outperform solo founders. The implication is that differences between female and male led ventures cannot automatically be imputed to gender impact.

The paper makes several contributions to the literature, The first is that it investigates gender effects in initial ECF campaigns for a large and interesting sample of 864 successful and unsuccessful ECF campaigns on the Crowdcube platform. It is considerably larger than the samples used in extant studies and has a greater presence of female entrepreneurs. Hellman et al. (2021) utilized the data of campaigns held in Seedrs from 2012 to 2017, and only 9% of all campaigns had female founders, which is equivalent to 33 campaigns, including both teams and solo founders. The female participation rate is substantially higher on ECF platforms than in UK

VC deals, where only about 4% of all deals go to female founders (Rose, 2019), and in the US, where only 7% of deals have a female founder (Gafni et al., 2020). Still, ECF platforms do not have a female participation rate as high as reward- based crowdfunding platforms. Gafni et al. (2020) establish that on the Kickstarter platform (a reward-based crowdfunding platform), one third of all projects have a female leader. But, in a sample of French ECF campaigns, Andrie et al. (2021), reported that about 9.73% of all campaigns were female led which is much lower than the percentage of newly founded firms by women (39%) in France. Also, this paper pays particular attention to the founder's gender as it can more aptly capture potential obstacles entrepreneurs must confront in raising outside equity.

The second contribution is that it takes account of the founder team structure in testing for gender effects. This is because team structures can vary and Coakley et al. (2021) show that teams outperform solo entrepreneurs on the three major UK ECF platforms. Most extant studies on gender bias (effects) in ECF ignore this factor. Analysis of founder team structure reveals that some 322 (61.5% of the total) ventures have solo founders. The vast majority of these (80%) are solo male founders, and the remaining 20% (64) of them are female founders.[4] This is fortuitous as it facilitates a clean test of gender effects for the majority of our sample that is not contaminated by, for example, team effects. Accordingly, the main analysis focuses on comparing the performance of solo female and solo male founder entrepreneurs.

The final contribution provides insights on the goals set by female founders. Target setting strategy is a contributing factor to entrepreneur success, and studies on gender impact in ECF are divided on the effect of target-setting levels and the success of firms during ECF campaigns (Kleinert and Mochkabadi, 2021, Hellmann et al., 2021, Lin and Pursiainen, 2022, Prokop and Wang, 2021). Although the prior literature suggests that female founders set lower initial goals (Hellmann et al., 2021) and that male founders overestimate their firm's need for funds (Lin and Pursiainen, 2022), our data contradict this for solo founders. They show that the mean and median goals and success of solo male and female entrepreneurs are not significantly different at conventional levels, but when they are compared beyond their targets, our findings reveal that solo female founders are found to enjoy an advantage over their male peers in terms of greater Amount-to-goal and having a higher proportion of campaigns exceeding their goal. Success

[4] Moreover, just 2.29% (12) of all campaigns are run by female founder teams.

dummy is a measure to categorize the firms into two groups based on reaching or not reaching the targets in campaigns. But this binary variable does not provide any information on the extent of success or failure. The extent of success can make a difference in understanding the existing dynamics and contributors. There is a difference between firms barely making their targets, and those exceed much more than their goals. So, as well as Success and Number of funders (an indicator of firms networking with crowd and investors), two more proxies, namely Amount-to-goal and Overfund_d, are used here. The first one is an alternative measure of the Amount raised, and the second one offers information about the proportion of overfunded firms.

Heckman's model is used to account for potential selection bias stemming from considering solo founders only. Our findings reveal that solo female founders enjoy an advantage over their male peers in terms of attracting more investors or better engaging with the crowd, raising higher Amounts-to-goal, and running a higher proportion of campaigns that exceed their goal. Two robustness analysis methods are employed here. The first one uses the whole sample, and a categorical variable, Founder type, is defined for categorizing the ventures based on the founders' gender composition. The categories measure the difference between Solo female founders and Team with respect to Solo male founders. The results of this robustness analysis confirm the overperformance of Solo female founders. The Second robustness analysis method is Propensity Score Matching (PSM). PSM is employed as an identification method for the comparison between female and male Solo founders who are matched based on their education (Advanced degree), team average Age, Premoney valuation, percentage of offered Equity, and Goal (£m).

This paper is structured as follows. Section 2 reviews the existing literature and develops the hypotheses to be tested. Section 3 outlines the methodology adopted and the empirical models employed to test the hypotheses. Section 4 discusses the empirical results. The final section concludes.

2. Literature review and hypotheses

Among different reasons leading to lower access of entrepreneurs to capital, including limited internal funds and difficulty providing collateral for bank loans, information asymmetry is

perhaps the most challenging. This makes access to external equity particularly difficult for startups. Tomboc (2013) stresses that the lemon problem in the ECF market is more acute than in traditional markets for three main reasons. First, entrepreneurs are less willing to pitch their detailed business ideas to the public rather than a few professional investors. Second, the crowd has less expertise in screening firms than professional investors. Third, the average investor is less experienced or professional in investing. This information imbalance makes observable signals more important for startups in an attempt to demonstrate their quality to investors.

Signaling theory proposed by Spence (1987) postulates that financiers can investigate the quality of new firms from observable and costly signals. The crowd of less experienced investors tends to rely on credible quality signals from entrepreneurs, such as their human capital, which is one of the most critical aspects in the evaluation of early stage firms (Coakley et al., 2021c, Barbi and Mattioli, 2019, Colombo and Grilli, 2005). Signals include those related to firm characteristics - internal signals – and those related to outside firm accreditation signals sent by third parties such as angel investors. Researchers fit these into categories of firm, campaign, venture, and entrepreneur-related characteristics (Cumming et al., 2021, Colombo et al., 2019). Higher opportunity exploitation, the skill of the venture team, and better chances of success are indicators of higher human capital capabilities (Ahlers et al., 2015). The rationalization -using signals for quality investigation- stems from the fact that signaling high-quality human capital is both costly, as qualities such as experience and leadership are not easily obtained and are observable through team reports of the firm (Kleinert and Mochkabadi, 2021). Human capital is mainly examined by previous researchers by looking into the educational background and experience of founders (Coakley et al., 2021c, Piva and Rossi-Lamastra, 2018, Barbi and Mattioli, 2019). However, founder gender is another important aspect of the human capital (Barbi and Mattioli, 2019, Hellmann et al., 2021) that has received less attention than other attributes in ECF literature.

The extant literature provides mixed results on gender effect as crowdfunding is a novel form of outside equity. Equity crowdfunding is one of three main pre-IPO entrepreneurial finance options, alongside Venture Capital (VC) and Business Angels (BA), and its investor seeks profit (Coakley and Lazos, 2021). So, it is possible to observe analogous gender bias patterns with institutional investors, which is discrimination again female founders. Based on Gender Role Congruity Theory (GCRT), there is prejudice toward female leaders, which stems from the

incongruity between perceived leadership roles and the gender role of females (Eagly and Karau, 2002). There are assumptions about female management capabilities in spite of their previous working experiences, which leads to their lower success in securing private capital (Amatucci and Sohl, 2004). Drawing on GCRT, Kleinert, and Mochkabadi (2021) found that, even with similar features as their male peers, female entrepreneurs are less successful in signaling a high-quality business. All female founding teams that are active in the technology sector raise about 0.81 of raised capital and have 0.72 of attracted investors when they are compared with their male counterparts. Cumming et al. (2021) conjecture that ECF does not improve women's odds of success even though it is their preferred choice compared with IPO.

On the other hand, based on activist homophily (Greenberg and Mollick, 2017), female founders can enjoy higher support from female investors in a crowd setting such as crowdfunding. Homophily is a fundamental force shaping the structure of social networks suggesting the importance of both individual and group attractions and acting through various underlying mechanisms. Under more specific situations, activists' choice homophily relates to social identity based on a common group social barrier resulting in a wish to help one another to overthrow it (Greenberg and Mollick, 2017). This group-level sense of disadvantage is of more relevance in the context of lower-stake crowdfunding and where female investors are inclined to support peer founders. Interestingly, in reward-based crowdfunding campaigns, gender bias favors women, and gender positively affects the outcome of campaigns (Johnson et al., 2018, Greenberg and Mollick, 2017). Differentiating between ECF and other lower stake crowdfunding methods, Bapna and Ganco (2021) discuss that activist homophily, and the use of heuristics is of more relevance in the context of less experienced investors. More experienced investors demonstrate gender-neutral behavior, which is an improvement compared with similar traditional markets. Equity crowdfunding investors are still considered unsophisticated investors when compared with traditional sources of capital for younger firms (Barbi and Mattioli, 2019), which requires attention when looking into their traits and suggests a possible inclination toward bias alleviation. This positive gender effect is not limited to reward-based platforms. Employing the stereotype content model, Johnson et al. (2018) discuss two types of stereotypes, namely trustworthiness toward female entrepreneurs, and competence toward male entrepreneurs. This sense of trustworthiness is a key element when investors are the crowd with limited or no due diligence and screening possibilities and fear of fraud. Looking into founder data on 416 deals from

Kickstarter (a reward-based platform) and follow-up experiments, Johnson et al. (2018) found that females are advantaged because of stereotypical trustworthiness. A similar effect of trustworthiness in reward based platforms exists in peer lending platforms such as prosper.com, where individuals' photos that look more trustworthy raise more money and receive better credit rating (Duarte et al., 2012).

There is an analogous pattern of possible positive gender effect in favor of female founders in equity crowdfunding platforms. Barbi and Mattioli (2019) employ the data on 521 successfully funded campaigns from Crowdcube and confirm that, as well as education and prior experience, founder team gender composition affects the amount of capital raised and added women to founding teams contributes to higher capital. Vismara et al. (2017) posit that ECF enjoys higher gender diversity compared with other markets offering entrepreneurial finance, and gender is indeed a factor in the demand or supply sides of equity crowdfunding based on their research on a sample of 58 projects in the Seedrs platform. Prokop and Wang (2021) suggest that in seasoned equity crowdfunding female ratio (female managing directors relative to the whole board) is negatively related to the capital and number of investors, in which a higher number of women on the board is associated with a lower success rate but the underperformance does not appear in initial campaigns.

The number of funders is one of the key performance measures in ECF campaigns. The participation of the crowd in campaigns could be a signal of the firm's quality and lower adverse selection problem (Coakley et al., 2021b) or a good networking of ventures with crowd (Vismara, 2018). In ECF, female founders can benefit from the mix of crowd alongside professional investors, and they can attract more funders when compared to their male peers. One contributing factor is the homophily between female investors and female entrepreneurs, and another factor is the stereotyped crowd trust in female entrepreneurs (Johnson et al., 2018), which leads to attracting higher numbers of funders. Prokop and Wang (2021) suggest that a higher female ratio does not affect the number of investors in initial campaigns, which is an improvement considering they attract lower numbers of investors in later offerings when investors know the firm better, and gender becomes of less impact. Zhao et al. (2021) emphasize the role of maximising warm glow, and the utility investors enjoy by investing in female founders. They notice that this leads to female founders' advantage in having more potential investors. As the focus of this paper is initial campaigns, it is possible that Solo female founders also benefit from a similar advantage

in attracting a higher number of investors comprising mainly small investors or the "crowd". This leads to our first hypothesis:

H_1: Startups run by solo female founders attract more investors than their male peers.

The target of venture owners should be based on the evaluated needs, but this is also affected by later strategies for succeeding in the campaign (Cumming et al., 2020a). In a study of Kickstarter Gafni et al. (2020), found that female entrepreneurs do not set lower targets than their male peers, and still, they have a higher success rate. But the targets in reward based platforms are much lower than ECF platforms, and the investors have different motivations. 'Crowd" of less professional investors who make relatively smaller investments in ventures are less affected by stereotypes prevailing among professional investors about the lower competency of female founders, and they have a higher trustworthiness perception about female entrepreneurs, which leads to a higher willingness of investors in funding female led firms (Johnson et al., 2018) and higher success rate (Lin and Pursiainen, 2022). The Success rate in the ECF platform is different from reward based platforms in size, outlook, and motivations and expectations of investors (Vismara, 2019). Even though the Success rate of female founders is higher in reward based crowdfunding platforms, they might have lower success rates in ECF platforms. In most ECF gender studies, Success seems to be at the same level for both genders (Cumming et al., 2021, Hellmann et al., 2021). The primary summary statistic of this article also shows no difference in Success level for Solo female versus Solo male founders in both mean and median tests. This leads to the second hypothesis for the Solo female founders:

H_2: Solo female founders enjoy a similar likelihood of success as their male peers.

Ventures prefer ECF to other forms of external finance when their required target capital is relatively small (Mochkabadi and Volkmann, 2020). The amount raised by successful companies during the campaigns starts from their target and could be much more than what they asked for. The effect of target goal on the outcome of the campaign is controversial. Setting a lower target could signal that it is more feasible to reach the funding goal and so more investors become eager to contribute. On the other hand, it could signal lower confidence of the founders in their firm (Prokop and Wang, 2021). Vulkan et al. (2016) find that setting higher goals in Seedrs campaigns has a negative effect on the outcome of the campaign, namely success in reaching the goal.

The goal setting behavior of male founders is different from female founders. Male firm owners tend to have overconfidence in their products and firms' growth prospects which leads to setting higher goals. For the same over-optimism, they have a lower proportion of exceeding their targets when compared to their female peers (Lin and Pursiainen, 2022). Prokop and Wang (2021) utilized data collected about 483 projects from 22 German platforms and recommended setting a higher funding value, and bolder promotions to benefit female managing directors more than their male peers. Hellmann et al. (2021) postulate that female founders set lower targets, but they wait longer after announcing the end of their campaign; There is no clear reason why female founders set lower targets and if it is rooted in their expectations and they underestimate their firms' growth rate or they believe they cannot raise more in ECF platforms? In another study, Rossi et al. (2021) examine the determinants of success, and a target value and platform effect on US and UK equity crowdfunding campaigns suggest that teams of both genders raise about the same amount of capital. Their results were significant only for the UK platforms, and at the same time, they found a significantly negative relationship between being a female entrepreneur on UK platforms and setting goals implying that female founders set lower initial goals. Finally, literature suggests that female founders set lower goals compared to male founders, who overestimate their firm's needs; and at the same time, they both have a similar success rate (previous hypothesis). These two factors contribute to a higher proportion of female founders receiving more than what they asked for. This leads to our third and fourth hypotheses:

H_3: Solo female founders set a higher Amount/Goal than their male peers.

H_4: Solo female founders are more likely to enjoy overfunded campaigns than their male counterparts.

3. Methodology and hypotheses

Dependent variables This paper employs four outcome proxies to investigate gender effects in ECF campaigns and examine the hypotheses. The first Success proxy is the number of funders, as the aim of ECF campaigns is to attract as many funders as possible. However, this ignores the amount contributed by each investor, as a higher mean amount contributed makes reaching the goal easier. Ln(Funders) or the natural logarithm of the number of investors, is used to control for

right skewness (Coakley et al., 2021c, Hellmann et al., 2021, Prokop and Wang, 2021). The second proxy is Success which is a dummy variable that take one if the campaign reach the initial target. The third proxy is the Amount/Goal ratio. This includes both unsuccessful campaigns that fail to reach the goal and successful campaigns that meet and/or exceed the goal. It also specifies the extent of the failure of unsuccessful campaigns and the degree of success of successful campaigns. The *Overfunding* dummy takes the value one for those campaigns meeting or exceeding the goal and is zero otherwise (Coakley et al., 2018). This clearly differentiates between successful campaigns that meet and/or exceed the goal and unsuccessful campaigns that fail to reach the goal (and the extent of failure).

Explanatory variables: Solo_ female is a dummy taking the value of one for solo female founders and zero for solo male founders. Founder type is a categorical variable that takes 1 for Solo male founders (reference category) and 2 for Solo female founders and 3 for Teams and is used for the robustness analysis.

Control Variables: Our models include several control variables to take account of variation among entrepreneurs seeking funds in ECF campaigns. Two control variables are used to account for the effect of experience on ECF success: Advanced degree and team age (years). Advanced degree is a dummy that takes one for firms if their owners have higher education (Dr. or Professor) and zero otherwise. Team age (years) refers to the average age of the founding team. The percentage of equity offered by small firms is another important signal to investors, and it is captured by the variable *Equity(%)*. Entrepreneurs signal higher quality of their firm by retaining a higher equity percentage for themselves (Ahlers et al., 2015). We control for the age of the firm by considering Firm Age (years) variable in our model to capture the exact (early) stage of the firm. Pre_money valuation (£m) refers to the firm's value just prior to its campaign.

To study the gender effect, three methods are used here (Heckman method plus two robustness check methods). The first method is employed to study Solo founders. Heckman's method (Heckman 1979) is used to account for the nonrandom intentional bias of focusing on the Solo founders only. In the first hypothesis, the dependent variable is Ln(funders) which is a continuous variable. The Stata Heckman routine is employed for coefficient estimation (StataCorp, 2019). The Heckman selection estimation method assumes that there is an underlying regression as follows:

$$y_j = X_j\beta + u_{1j}$$

The dependent variable is observed in observation j if only:

$$Z_j\gamma + u_{2j} > 0 \qquad \text{(selection equation)}$$

where,

$$u_1 \sim N(0,1), u_2 \sim N(0,1) \;\&\; corr(u_{1j}, u_{2j}) = \rho$$

The regression equation estimates the determinants of Ln(funders) and is observed only when founders are Solo. X_j includes the explanatory variables for Solo_female and the control variables. Z_j, includes the control variables plus the industry dummy (identification variable). The Heckman routine employs the Maximum Likelihood Estimation (MLE) method and instead of reporting ρ, it reports this transformed version of ρ:

$$atrho = \frac{1}{2}\ln\left(\frac{1+\rho}{1-\rho}\right)$$

If the χ^2statistic is highly significant (at 1%), the null of ρ=0 is rejected, and because of the correlation between the error term in the main and selection equations, the Heckman selection model is employed here instead of OLS.

The dependent variable for testing the second hypothesis is a Success dummy. Therefore, to account for the sample selection bias of focusing on Solo founders and estimating unbiased consistent coefficients, the Heckprobit routine of Stata is employed (StataCorp, 2019). This routine is used for Probit models with sample selection following Van de Ven and Van Praag (1981). This method assumes an underlying relationship as follows:

$$y_j^* = x_j\beta + u_{1j} \quad \text{(latent equation)},$$

such that we observe only a binary outcome (conducting a successful campaign)

$$y_j^{probit} = (y_j^* > 0)$$

The dependent variable in observation j is only observed if the selection equation (Solo founder versus Team) satisfies

$$y_j^{select} = (z_j\gamma + u_{2j} > 0)$$

where we assume:

$$u_1 \sim N(0,1),\ u_2 \sim N(0,1) \;\&\; corr(u_{1j}, u_{2j}) = \rho$$

When ρ is equal to zero, and or the error terms of the first and second equations are uncorrelated,

the standard Probit model can be used instead of Heckprobit. But when it is non-zero, employing the standard Probit leads to biased estimation. In addition, the model setup should be such that the selection model has at least one more variable than the outcome model. In this paper, Industry dummies are considered in the selection model. The standard errors are clustered at the industry level for possible between-cluster correlation. Therefore, Wald test results are reported. Here the null hypothesis is that the selection and outcome equations are independent or that ρ is equal to zero. The Heckprobit routine employs the Maximum Likelihood Estimation (MLE) method, and $atrho = \frac{1}{2}\ln\left(\frac{1+\rho}{1-\rho}\right)$ is reported. The χ^2statistic is not significant, and the null of ρ=0 cannot be rejected. The correlation between the latent regression and selection equation can be neglected, and Probit can be employed. Here the Heckman results are compared with Probit model and they are similar.

For our third hypothesis test, the dependent variable is Amount/Goal, and similar to the first test, the Heckman routine is implemented. The Heckman selection estimation method assumes that there is an underlying regression as follow:

$$y_j = X_j\beta + u_{1j}$$

The dependent variable (Amount/Goal) is observed in observation j if only:

$$Z_j\gamma + u_{2j} > 0$$

where,

$$u_1 \sim N(0,1), u_2 \sim N(0,1) \;\&\; corr(u_{1j}, u_{2j}) = \rho$$

The regression equation estimates the determinants of Amount/Goal, and it is observed only when founders are Solo (Selection equation: Solo founders versus Teams)

In our fourth hypothesis test, the dependent variable is an Overfunding dummy. Therefore, a similar method to the second hypothesis is employed to estimate unbiased consistent coefficients using the Heckprobit routine of Stata (StataCorp, 2019). This method assumes an underlying relationship as follows:

$$y_j^* = x_j\beta + u_{1j} \quad \text{(latent equation)},$$

such that we observe only the binary outcome (conducting an overfunded campaign)

$$y_j^{probit} = (y_j^* > 0)$$

The dependent variable in observation j is only observed if (Selection equation: Solo founder versus Team)

$$y_j^{select} = (z_j\gamma + u_{2j} > 0)$$

And we assume:

$$u_1 \sim N(0,1),\ u_2 \sim N(0,1)\ \&\ corr(u_{1j}, u_{2j}) = \rho$$

The χ^2 statistic is not significant, and the null of ρ=0 cannot be rejected. The correlation between the latent regression and selection equation can be neglected, and Probit can be employed.

Two robustness methods are employed in addition to the Heckman method to examine gender effects. To utilize data from all campaigns and avoid the explicit non-random selection bias of focusing on Solo founders, a categorical variable name Founder type has been constructed, and the performance of Solo founders and Teams is compared to Solo male founders.

$$Ln(Funders) = \alpha_1 + \beta_1 Founder\_type + \Gamma_1 Controls + \varepsilon_1 \quad (1)$$

$$\Pr(Success) = \alpha_2 + \beta_2 Founder\_type + \Gamma_2 Controls + \varepsilon_2 \quad (2)$$

$$Amtount/goal = \alpha_3 + \beta_3 Founder\_type + \Gamma_3 Controls + \varepsilon_3 \quad (3)$$

$$\Pr(Overfund_d) = \alpha_4 + \beta_4 Founder\_type + \Gamma_4 Controls + \varepsilon_4 \quad (4)$$

The coefficients of the first and third models are computed by OLS estimation method while a Probit model is employed for the second and fourth models. Founder team size is added to above list of controls as the focus here is not the Solo founders and the whole sample has been employed.

The second robustness check method is the Propensity Score Matching technique. Endogeneity is an important concern in any study in management and business research. Our primary data include both successful and unsuccessful ECF campaigns (564 successful and 300 unsuccessful campaigns) that should help ameliorate sample selection bias concerns. However, while we control for a rich set of covariates to explain crowdfunding outcomes, the existence of unobservable characteristics that may still bias the gender effect cannot be completely ruled out. Here we aim to answer the following question: Are solo female entrepreneurs, ceteris paribus, less (more) likely to succeed (using four success proxies) compared with their male peers with comparable characteristics? A potential selection bias emerges as the decision to be a female entrepreneur is likely to be endogenous and related to various other observable and unobservable characteristics. As such, we follow Rosenbaum and Rubin (1983) in using Propensity Score Matching (PSM) as a means of addressing such concerns. This method has been successfully

employed in other ECF studies to confront endogeneity (Walthoff-Borm et al., 2018, Vismara, 2019).

4. Data and empirical analysis

In the empirical analysis, the paper employs a dataset of 864 ECF campaigns on Crowdcube, a leading UK equity crowdfunding platform, from 2011 to 2018. Our data about firms' founders is extracted via a self-written program for scraping data based on information provided on the Crowdcube platform. Wherever data cannot be extracted by web scraping, we have checked manually for information in both Crowdcube and available LinkedIn profiles of founders or other publicly available data on their websites. For gender detection, the data are matched against gender information in a well-recognized source http://genderize.io/ which is a common tool in the best practices (Geiger and Oranburg, 2018, Mohammadi and Shafi, 2018, Greenberg and Mollick, 2017). This source checks the given first name against its comprehensive name library (over one hundred million names and gender from different countries) and returns the gender and the likelihood of it. Wherever there was a lower probability or results were inconclusive, the image of owners in their LinkedIn profile has been used for verification. Finally, our sample, including the founders' gender information, covers 524 campaigns on the Crowdcube platform.

4.1 Descriptive statistics

Table 1 reports the name and description of all variables used in our empirical models.

[Tables 1 around here]

Table 2 presents the descriptive statistics for our sample. Table 2 provides summary statistics of all variables in our models, including the number of observations, mean, median, standard deviation, as well as minimum and maximum values.

[Table 2 around here]

This shows that the data are right skewed (mean>median) in variables such as Number of funders, Amount-to-goal, or Goal because of the impact of large campaigns. For instance, the maximum number of funders is 3.5k which implies that the mean value of 0.35k is close to double that of the median of 0.19k. The average Amount-to-goal ratio is an impressive 1.43 (median 1.28). About 20 percent of all solo founders are female solo founders. Only 6 percent of all ventures have a

founder with a Dr. or Professor title. Ventures raising capital offer about 15.08% (median 14.12) of their Equity in exchange for funds. The mean pre-campaign Valuation is almost £4.05m (median £1.3m), and the mean venture Age is 3.2 years (median 2.31). The founder team's mean and median Age exceed 42 years. Finally, the average initial Goal is £330k (median £170k).

Table 3 presents the founder structure of the teams by gender category.

[Table 3 around here]

Three features stand out from Table 3. First, the dominant founder structure in terms of initial ECF campaigns is Solo male entrepreneurs, who account for virtually half the sample or 49.2%. Given this, the category Solo male entrepreneurs is used as a baseline against which to analyse both Solo female entrepreneurs and teams. The next largest category is Male teams (2 or more cofounders) who make up over a quarter of the sample (26.3%). Together, Male only (Solo and teams) conducted over three quarters of all campaigns. Second, Female only (Solo and teams) conducted just one in seven or 14.5% of all campaigns. In this respect, female entrepreneurs are heavily underrepresented on ECF initial campaigns and so are less successful than their male counterparts. Even if one adds Mixed (gender) teams that conducted 52 initial campaigns (10%), the total female representation on ECF initial campaigns is just 22%. Vismara et al., (2017) also report that more than 83% of Seedrs platform deals have male CEOs and about one-fourth of TMT are female managers.

Tables 4 and 5 present equality of means and medians (nonparametric Pearson Chi-square) test results, respectively, for Solo male founders versus Solo female founders.

[Tables 4 and 5 around here]

The tables show that ECF data are typically right skewed driven by a handful of very large campaigns and that these inflate the mean values of important variables. For instance, the mean Solo male (female) Amount raised at £0.39m (£0.4m) and Number of funders at 0.28k (0.29k) in Table 4 are both large and virtually identical. By contrast, the corresponding median results are considerably smaller – indicating that the data are right skewed - and more varied. For example, the median Number of funders for Solo male founders at 0.144k is smaller than the corresponding Number for Solo female founder at 0.214k and this is significant at the 5% level. The equality of median results also show that the Amount/goal is lower for Solo male founders and that Solo male

teams are older than Solo female founders, albeit both are significant at the 10% level only.[5] The median values of the other variables for Solo male and Solo female campaigns are overwhelmingly similar.

Table 6 is the pairwise correlation matrix which reports the Pearson product-moment correlation coefficient between all variables of the study to test the presence of multicollinearity.

[Tables 6 around here]

The table shows no evidence of significantly high correlations between variables to suggest multicollinearity.

4.2 Regression analysis

Table 7 reports the regression results for testing hypotheses one to four by implementing the Heckman method.

[Tables 7 around here]

To test the first hypothesis, the results of Model(1) are examined. This model has two parts. The first part is the selection equation of the Heckman method, and the marginal effects are reported here. The industry dummies are significant, suggesting the relevance of extra independent variable (IV) for the selection equation (observing Solo founders versus Teams) with respect to the outcome model. In the outcome equation of Model (1), Ln(Funders) is the dependent variable. The effect of the explanatory variable of interest or Solo_female on the natural logarithm of the number of Funders is positive and highly significant. The coefficient is 0.298, and it is significant at a 1% level, suggesting that Solo female founders attract a higher number of investors in ECF campaigns than their male peers. The estimated athrho is -1.378 and is highly significant (p-value <0.01), which implies that there is selection bias and that not using the Heckman method could lead to biased coefficients. In addition, higher offered equity is positively correlated with the number of investors, and younger entrepreneurs have more funders. Higher Premoney valuation and Goal lead to more funders. Their coefficient is 0.0418 and 1.677, respectively, and they both are highly significant at a 1% level.

[5] Our findings for Amount and Goal differ from those of Hellmann et al. (2019) for the Seedrs platform. They find that female teams ask for less and raise less but our findings on Success are comparable. The differences may be explained the fact that Hellmann et al. (2019) base their analysis on the Females (%) variables that in turn is disaggregated into Female Only teams (including solo female) and Female Mixed teams.

Model (2) results are related to the second hypothesis. The first column is the Heckman equation, and the effect of control variables plus the industry dummies on being Solo founder versus a Team is examined. The reported coefficients in both selection and outcome (Success) equations are marginal effects as the dependent variable is Solo founder and Success dummy, and the models are Probit models. The outcome equation or second column in Model(2) includes the effect of Solo_female founder binary on the probability of Success. The coefficient is insignificant, with a very low t-statistic (0.030), implying no difference between Solo female and male founders in their Success rate. The estimate athrho is 0.986 and is insignificant (p-value > 0.1), suggesting that there is no selection bias of focusing on Solo founders when Success is investigated, and the results of Heckman are comparable with the simple probit model.

Model (3) is for testing the third hypothesis. The first equation is the selection equation (Solo versus Team) of the Heckman method and the second equation provides the effect of variable of interest (Solo_female) on the Amount/Goal (Regression equation). Again most of the industry dummies are highly significant in the selection model. The Solo female coefficient is 0.159 and highly significant (p-value < 0.01). Solo female is a binary, and its coefficient is the changes in outcome when the type of Solo founder is changed from Solo male to Solo female. Therefore, the results of this model strongly suggest that Solo female founders have a higher Amount/Goal ratio than their male peers. Ventures' valuation prior to the campaign (Premoney valuation) is positively associated with having a higher Amount/Goal ratio. The estimated athrho is equal to -0.267 and is significant at a 5% level. This means that not using the Heckman method could result in biased coefficient estimates.

Model (4) results are related to testing the fourth hypothesis. The first column or the selection equation, includes both control variables and industry dummies which are highly significant. The second column is the probit model or the outcome equation that is of interest here. In both equations, the models are probit, and the marginal effect is reported. The estimated athrho is 0.559 and it is not significant, which implies that there is no selection bias of focusing on Solo founders when Overfund_d is investigated, and the results of Heckman are comparable with simple probit model. The coefficient of Solo_female in the outcome equation (dependent variable = Overfund_d) is 0.135, and this is highly significant at a 1% level. It implies that Solo female founders have a higher proportion of overfunded campaigns than their male counterparts.

Overall, results of comparing Solo female founders with Solo male founders imply that

Solo female founders attract a higher number of investors, get more than what they primarily asked for and have a higher proportion of campaigns that exceed their goal, but there is no significant difference between them and their male peers in term of Success. This overperformance of Solo female founders with respect to their targets and also attracting a higher number of investors, which are mainly crowds, is consistent with Bapna and Ganco's (2020) postulation that gender gaps prevailing in traditional markets are decreasing in the ECF context where the investors have a different mindset from traditional investors. Zhao et al. (2021), find that capital raising outcome is indeed in favor of female firm owners in ECF's initial campaign. From their point of view, one of the main contributing reasons is that people are inclined to assume that women are more trustworthy than men (Du Rietz and Henrekson, 2000). Trustworthiness is a key factor in a first offering when investors do not know startups yet, and the level of uncertainty is high. These results are also comparable with Prokop and Wang's (2021) study that firms with a higher number of female founders do not underachieve during ECF initial campaigns, and the underperformance appears in later offerings. Therefore, in initial campaigns female founders seem to have an advantage over their male counterparts.

These results are in line with Rossi et al. (2020) and (Cumming et al., 2021) in that both of them found no significant difference between female and male founders in Succeeding in ECF campaigns. However, Rossi et al. (2020) have some reservations about the initial targets of female founders in the UK and mention that they set lower goals. They found that with similar Success rates, females set lower targets. (Cumming et al., 2021) also reported that there is no significant relationship between female leadership and success. Hellman et al. (2021), states that female founders set lower goals which leads to a lower Amount raised, but their Success is the same for both genders.

The regressions in Table 7 include Goal as one of the control variables which, one might argue, is affected by gender. Thus, regressions have been rerun for all models without Goal and the results are similar.

4.3 Robustness analysis

Two methods are employed to perform the robustness analysis of results presented in previous section. In the first method, a categorical variable (Founder_type) divides all campaigns into three

gender compositions of Solo male founders (1), Solo female founders (2) and Teams (3) and the concern for selection bias of focusing on Solo founders becomes irrelevant.

Table 8 reports the results with t-statistics in parentheses for various ECF campaign outcome variables regressed on founder team characteristics and a set of controls.

[Table 8 around here]

All models include two gender variables (Founder_type = Solo female, and Founder type = Teams) to capture gender effects. The coefficient of Solo_female gives the changes in dependent variables when Solo females are compared to Solo male founders. Teams give the analogous response of Teams relative to Solo male founders. The Model (1) results reveal that the Teams coefficient is positive and significant at the 5% level. This suggests that Teams – 94% of Teams are majority male-led firms - raise a larger Amount than Solo male founders. By contrast, the Solo_female coefficient is insignificant. The Model (2) results show that both Solo_female founders and Teams attract significantly more investors than Solo male founders at the 5% and 1% levels, respectively. The former result is interesting in that it demonstrates that Solo_female founders are more successful at attracting more investors than their Solo_male counterparts. The model (3) results indicate that the Success dummy is insignificant in all cases.

In Model (4), the coefficient on Solo female is 0.155 and is significant at the 5% level. This implies that Solo_female founders enjoy a 15.5% higher Amount-to-goal ratio than Solo male founders. The regression estimation method is Probit in model (5), and for ease of interpretation, marginal effects are reported. Now the coefficient on Solo female founders is significantly positive and implies that these founders have an 11.4% higher proportion of exceeding their targets relative to their male counterparts. Teams also enjoy a significantly higher probability of overfunding than Solo male founders.

The second robustness analysis method is Propensity Score matching. This method has been employed in other ECF studies (Coakley et al., 2021c, Vismara, 2019, Zhao et al., 2021) to deal with endogeneity concerns. Table 9 reports the Propensity Score Matching (PSM) results.

[Table 9 around here]

Propensity Score Matching suggests Solo female founders attract a significantly higher number of investors (Model (2)). There is no significant difference in Success between Solo female and male founders (Model(3)). Solo female owners enjoy higher Amount-to-goal ratios and have a greater proportion of campaigns that exceed their goals based on the Models (4) and (5) results,

respectively. Results are reported for one, three, and five matches per observation. For all three matching scenarios, the effect of being a Solo female founder is positive and significant, whereas Success remains indifferent to the matching method and is insignificant for one, three, or three matches per observation.

[Table A1 around here]

Following the suggestion of Rosenbaum and Rubin (1985), all covariates have a bias percentage of less than 5% after the matching is performed. Here bias refers to the average value of the treated and control group. The overall mean bias in the Unmatched group is 13.1% which has reduced to 3.2% after the matching (Table. A1). Figure. A1 illustrates the Propensity scores overlap before and after matching for Treated and Untreated/Control groups (Solo female vs. Solo male) for visual inspection of common support assumption in PSM method.

[Fig A1 here]

Propensity Score Matching results confirm our primary regressions, implementing the Heckman method and the first robustness analysis method, utilizing the data of the whole sample by defining the categorical variable of Founder_type.

5. Conclusions

This study contributes to the existing literature by considering the founder gender heterogeneity and using a unique set of data that not only points out the noticeable presence of Solo founders (both genders) in the ECF campaigns but also the rich data set makes the comparison of Solo female founders with their male counterparts possible albeit after correcting for selection bias. Results are robust, as not only the Heckman method has been implemented in our regressions, but also two more methods are used for robustness analysis methods.

The gender impact on firms' performance in ECF campaigns requires a clean comparison, which is not affected by the existing dynamic of the team or the gender composition of founders. Differentiating between different founders' compositions, this article focuses on Solo founders. In addition, the performance of firms is largely affected by their targets. Target setting behavior of founders differs, and male founders tend to overestimate firms capital requirement in their first offerings on ECF platforms (Lin and Pursiainen, 2022). This paper takes account of this difference and compares the performance of both genders based on the Amount/Goal and

proportion of Overfunding. These two additional proxies are helpful in shedding light on the question of the extent of success.

In comparing the performance of startups in ECF campaigns, Solo female founders attract more investors, enjoy a higher Amount-to-goal ratio and have a higher probability of raising more than what they asked for. But they have the same odds of succeeding in their campaign. This implies that considering the strategies set by both firms and platforms that influence the campaign characteristics so that more firms succeed (Cumming et al., 2020a), gender impact is insignificant in the Success of firms. However, gender impact becomes more evident when the extent of Success is investigated. Solo female founders have a clear advantage over their male peers when their Success is relative to their goals.

It is worth noting that despite the advantage of Solo female founders compared to their male counterparts, female entrepreneurs have a lower share of all campaigns on the Crowdcube platform, and male-led firms comprise 75.58% of total deals. Also, there are almost four times more Solo male founders than Solo female founders. The lower presence of female founder teams is consistent with the Rose Review (2019), which points out that female entrepreneurs are less likely to pursue entrepreneurship compared with their male peers at almost every stage. Still, it requires further investigation into factors contributing to this under-presence.

Similar to all studies, this study has limitations. All female founder teams were not compared with their male counterparts, as they comprise only 2.29% of our sample of 524 campaigns. Based on the summary statistics, All female teams attract the lowest capital and number of funders. This requires further examination, as the overall team effect is positive (Coakley et al., 2021c), but it seems to be different when male or female teams are compared.

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Table 1: Variables and definitions

Variable name	Description
Dependent variables	
Ln(Funders)	Natural logarithm of the number of investors at the end of the campaign
Success	A dummy variable that takes 1 for those campaigns that reach their target and zero otherwise
Amount-to-goal	Amount raised divided by target amount
Overfund_d	A dummy variable that takes 1 for those campaigns raising money over the target value and is zero otherwise
Explanatory variables	
Solo_female	A dummy variable that takes value 1 for solo female founder and 0 for solo male founders
Founder type	A categorical variable that takes 1 for Solo male founders (reference category) and 2 for Solo female founders and 3 for Teams
Solo_founder	A dummy variable that takes value 1 for solo female founder and 0 for Teams
Control variables	
Advanced Degree	A dummy variable that takes value 1 if at least 1 member holds the title Dr or Professor, zero otherwise
Equity (%)	Equity issued during the campaign in percentage
Firm age (year)	The age of the firm on public launch date in year
Pre_money Valuation (£m)	Firm valuation (£m) prior to the crowdfunding campaign.
Team Age (year)	The average age of team members in year
Team Size (number)	The number of founders
Goal (£m)	Target goal (£m) of firms at the beginning of a campaign

Table 2: Descriptive statistics

Variable	N	Mean	SD	Median	Min	Max
Number of funders (k)	524	0.35	0.48	0.19	0	3.5
Success	524	0.94	0.24	1	0	1
Amount/goal	524	1.43	0.55	1.28	0.04	6.2
Overfunding dummy (%)	524	0.84	0.37	1	0	1
Solo_female	322	0.2	0.4	0	0	1
Founders type	524	1.89	0.93	2	1	3
Advanced degree	524	0.06	0.24	0	0	1
Equity (%)	494	15.08	7.85	14.12	0.39	54.27
Firm Age (years)	524	3.2	3.01	2.31	0.02	18.28
Pre-money Valuation(£m)	484	4.05	8.79	1.3	0	68.6
Team age (years)	524	42.24	9.71	42.99	20.34	70.19
Team size(number)	524	2.46	1.5	2	1	7
Goal(£m)	524	0.33	0.52	0.17	0.01	5

Table 3: ECF founder structure

Founder gender structure	Campaigns	Share (%)
Solo female	64	12.2
All female teams	12	2.3
Solo + All female	***76***	***14.5***
Solo male	258	49.2
All male teams	138	26.3
Solo + All male	***396***	***75.6***
Mixed teams	52	9.9
Total	524	

Note: This table reports the founder gender structure for the 524 ECF campaigns conducted on Crowdcube. Just one of the 52 mixed gender mixed campaigns had a majority of female founders.

Table 4. Equality of means test (Solo female versus Solo male founders)

Variables	Solo Male	Solo Female	Difference
Number of funders(k)	0.28	0.29	-0.01
Success[6]	0.94	0.94	0.00
Amount/goal	1.37	1.5	-0.13**
Overfunding_d (%)	0.79	0.89	-0.10*
Advanced degree	0.05	0.02	0.03
Equity (%)	15	14.22	0.78
Firm Age (years)	3.1	3	0.11
Pre-money Valuation(£m)	3.4	2.16	1.23
Team age (years)	43.22	40.85	2.37*
Goal(£m)	0.27	0.26	0.01

Note: This table presents equality of means test results for Solo female founders versus Solo male founders.

Table 5. Equality of medians test (Solo female versus Solo male founders)

	Solo Male	Solo Female	Difference
Number of funders (k)	0.144	0.214	-0.071**
Success	1.00	1.00	0.00
Amount/goal	1.260	1.381	-0.121*
Overfunding dummy (%)	1.000	1.000	0.00
Advanced degree	0.000	0.000	0.00
Equity (%)	14.000	13.595	0.405
Firm Age (years)	2.301	2.175	0.126
Pre-money Valuation(£m)	0.975	1.077	-0.102
Team age (years)	44.497	41.093	3.404*
Goal(£m)	0.150	0.150	0.00

Note: This table presents equality medians (nonparametric Pearson Chi-square) test results for Solo female founders versus Solo male founders.

[6] For binary variables of Success and Overfund_d the proportion test was also employed to compare the proportion of Successful/overfunded Solo female founders (equal to one) with their male peers. Results are the same as those from the equality of means test.

Table 6. Correlation Matrix

Variables													
Ln(funders)	1.000												
Success	0.164*	1.000											
Amount/goal	0.485*	0.271*	1.000										
Overfund_d (%)	0.403*	0.566*	0.395*	1.000									
Solo_female	0.103*	-0.001	0.113*	0.102*	1.000								
Founders type	0.214*	0.015	0.101*	0.110*	1.000*	1.000							
Advanced degree	0.039	-0.040	0.016	0.002	-0.068	0.064	1.000						
Equity (%)	-0.100*	-0.045	-0.067	-0.002	-0.039	0.026	0.006	1.000					
Firm Age (years)	0.329*	0.117*	0.160*	0.063	-0.014	0.044	0.051	-0.256*	1.000				
Pre-money Valuation (£m)	0.513*	0.014	0.280*	0.056	-0.075	0.110*	0.046	-0.346*	0.346*	1.000			
Team age (years)	0.036	0.027	0.042	-0.013	-0.095*	-0.088*	0.150*	-0.181*	0.328*	0.174*	1.000		
Team size (number)	0.185*	-0.030	0.066	0.037		0.786*	0.127*	0.025	0.056	0.117*	0.004	1.000	
Goal(£m)	0.436*	0.037	0.055	-0.016	-0.014	0.158*	0.058	-0.061	0.220*	0.622*	0.117*	0.145*	1.000

Note: Pairwise correlation method is used to investigate the dependence between all variables in the research. In the pairwise correlation method, the observations with missing data are also considered in the correlation calculation. So, the results are a better representative of the sample. Significance levels are denoted as * when $p < 0.10$, ** when $p < 0.05$ and *** when $p < 0.01$.

Table 7. ECF outcomes and founder team composition (Heckman model)

	Model (1)		Model(2)		Model(3)		Model(4)	
Variables	Selection	Ln(funders)	Selection	Success	Selection	Amount/Goal	Selection	Overfund_d
Solo_female		**0.298*** **		**0.00072**		**0.159*** **		**0.135*** **
		(2.875)		(0.030)		(3.340)		(2.950)
Advanced degree	-0.142**	0.202	-0.146***	0.518**	-0.149***	0.0757	-0.146***	0.156
	(-2.570)	(0.743)	(-4.380)	(4.070)	(-4.380)	(0.666)	(-4.47)	(0.980)
Equity (%)	-0.005**	0.0146**	-0.005**	-0.001	-0.005**	0.00265	-0.005**	0.004
	(-2.070)	(2.306)	(-2.270)	(-0.59)	(-2.260)	(-2.286)	(-2.3)	(-1.54)
Team age (years)	0.006***	-0.0144**	0.006***	0.0002	0.006***	0.000845	0.006**	-0.001
	(3.120)	(-2.218)	(2.620)	(0.210)	(2.640)	(0.380)	(2.580)	(0.600)
Firm Age (years)	-0.002	0.0371	-0.004	0.012	-0.004	0.0146	-0.005	0.007
	(-0.190)	(1.206)	(-0.370)	(1.270)	(-0.330)	(1.247)	(-0.43)	(0.640)
Pre-money Valuation(£m)	-0.005	0.0418***	-0.004	-0.004*	-0.004	0.0143***	-0.004	0.001
	(-1.370)	(8.036)	(-1.060)	(-1.510)	(-1.100)	(5.274)	(-1.113)	(0.580)
Goal(£m)	-0.164	1.677***	-0.198**	0.015	-0.198**	0.00608	-0.191**	-0.001
	(-1.600)	(5.126)	(-2.590)	(-0.340)	(-2.560)	(0.039)	(-2.5)	(-0.09)
Industry = Consumer Services	-0.121***		-0.177**		-0.232***		-0.224***	
	(-3.150)		(-2.410)		(-19.860)		(-10.97)	
Industry = Food & Staples Retailing	0.146***		0.143***		0.138***		0.113***	
	(10.100)		(7.170)		(14.220)		(9.940)	
Industry = Health Care Equipment & Services	-0.023		-0.105***		-0.099***		-0.093***	
	(-0.870)		(-5.520)		(-8.550)		(-3.86)	
Industry = Media	0.055***		0.031		0.0125		-0.002	
	(2.980)		(1.160)		(0.840)		(-0.13)	
Industry = Other	-0.013		0.014		-0.061***		-0.035	
	(-0.530)		(0.250)		(-4.580)		(-1.5)	
Industry = Real Estate	-0.132***		-0.037		-0.064***		-0.049**	
	(-3.560)		(-0.890)		(-3.800)		(-2.07)	
Industry = Technology Hardware & Equipment	-0.061		-0.079**		-0.097***		-0.111***	
	(-3.460)		(-2.230)		(-7.890)		(-9.26)	
atrho		-1.378***		0.986		-0.267**	0.549	
		(-4.39)		(1.37)		(-2.29)	(1.55)	
Observations	481	302	481	302	481	302	481	302
Log pseudolikelihood	-624.57	-624.57	-356.62	-356.62	-482.84	-482.84	-436.94	-436.94

Note: The reported coefficients in selection models are marginal effects (dy/dx). The dependent variable in model(1) and (3) are Ln(Funders), and Amount/Goal, respectively, and Heckman is employed. In Models 2 and 4 the dependent variable is Success and Overfund_d. The heckprobit is used here, and marginal effects are reported. Significance levels are denoted as * when $p < 0.10$, ** when $p < 0.05$, and *** when $p < 0.01$. The standard errors are clustered at the industry level.

Table 8. ECF outcome and founder team composition (Robustness Analysis_1)

Variables	Model (1) Ln(Funders)	Model (2) Success	Model (3) Amount/Goal	Model (4) Overfund_d
Founder_type: Solo_female	0.299**	-0.00932	0.155**	0.114***
	(2.569)	(-0.277)	(2.944)	(4.160)
Founder_type: Teams	0.293***	0.00279	0.0708	0.0816**
	(5.873)	(0.094)	(1.006)	(1.964)
Advanced degree	-0.0899	-0.0413**	0.00451	-0.00992
	(-0.665)	(-2.312)	(0.033)	(-0.201)
Equity (%)	0.003	-0.00191	0.00345*	0.00118
	(0.757)	(-0.888)	(1.947)	(0.897)
Firm Age (years)	0.0468***	0.0159*	0.0172**	0.00917
	(3.543)	(1.921)	(2.552)	(0.924)
Pre-money Valuation(£m)	0.0308**	-0.0022	0.0233***	0.00527**
	(3.151)	(-1.060)	(4.100)	(2.175)
Team age (years)	-0.0102**	-0.00014	-0.000832	-0.00057
	(-2.498)	(-0.298)	(-0.480)	(-0.466)
Goal(£m)	0.958**	0.0239	-0.304**	-0.091
	(2.779)	(1.015)	(-3.165)	(-1.185)
Team size(number)	0.0484	-0.000537	0.0355	0.0125
	(1.852)	(-0.0616)	(1.511)	(1.289)
Constant	4.878***		1.242***	
	(23.830)		(12.530)	
Observations	481	418	481	481
R-squared	0.429		0.14	
Pseudo R-squared		0.0847		0.048
Industry dummies	Yes	Yes	Yes	Yes

Note: This table reports the results with t-statistics in parentheses for various ECF campaign outcome variables regressed on founder team characteristics and a set of controls. Models (1), (2) and (4) employ OLS. The dependent variables in Models (3) and (5) are a Success and an Overfund(ing) dummy, respectively, and the Probit estimation method is employed. All variables are winsorized at the 1% level except for Ln(Amount) which is winsorized at the 5% level. Significance levels are denoted as * when $p < 0.10$, ** when $p < 0.05$ and *** when $p < 0.01$. The standard errors are clustered at the industry level.

Table 9: Propensity score matching (Robustness Analysis_2)

	Ln(Funders)	Success	Amount/Goal	Overfund_d
One match per observation				
ATET	0.41**	0.065	0.23**	0.145*
	(2.31)	(1.13)	(2.29)	(1.91)
N	302	302	302	302
Three match per observation				
ATET	0.36**	0.043	0.201**	0.145**
	(2.56)	(1.07)	(2.32)	(2.35)
N	302	302	302	302
Five match per observation				
ATET	0.32**	0.032	0.163*	0.116**
	(2.39)	(0.86)	(1.95)	(2.07)
N	302	302	302	302

Note: This table reports the Average Treatment Effect on Treated (ATET), along with the t-statistics in parentheses. The matching method is the nearest neighbor match method, and the Solo female firms have been matched with 1, 3, and 5 counterfactuals based on their propensity score. The treatment and control groups are matched based on Advanced degree, Equity (%), Premoney Valuation, Team Age, and Goal.

Appendices

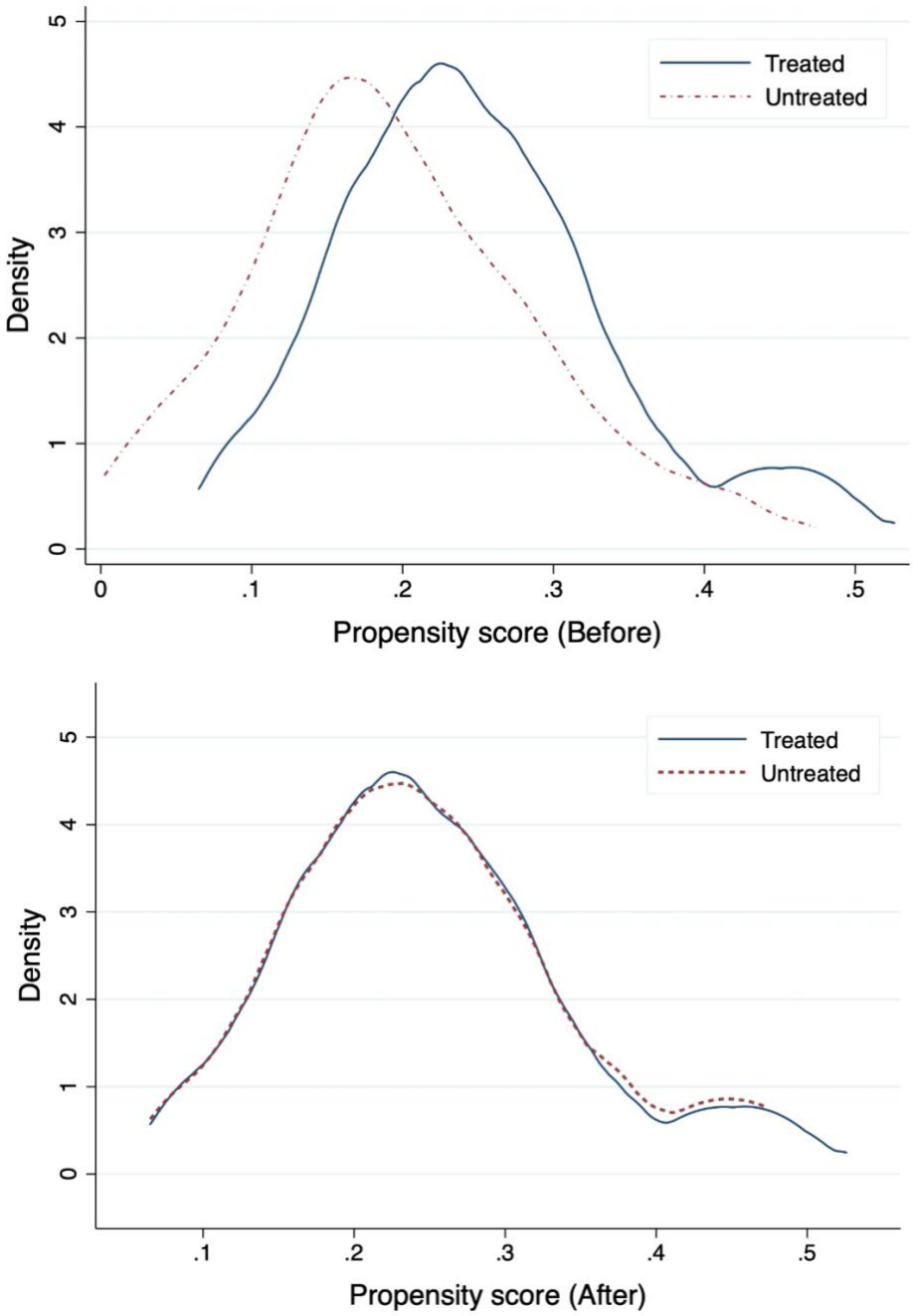
Table A1 : ttest before and after matching

Variable	Unmatched Matched	Treated (Mean)	Control (Mean)	% Bias	% Bias reduction	t-statistics	p-value
Advanced degree	U	0.0161	0.05	-19.0		-1.17	0.243
	M	0.0161	0.023	-3.6	81	-0.26	0.796
Premoney_valuation	U	2.164	3.412	-22.6		-1.31	0.191
	M	2.164	2.021	2.6	88.5	0.30	0.765
Equity (%)	U	14.219	14.73	-7.4		-0.47	0.637
	M	14.219	14.58	-5.2	29.3	-0.32	0.746
Team Age (years)	U	40.75	43.253	-27.2		-1.80	0.073
	M	40.75	40.665	0.9	96.6	0.05	0.959
Firm Age (years)	U	3.04	3.029	0.4		0.03	0.979
	M	3.04	3.140	-3.5	-815.8	-0.20	0.842
Goal(£m)	U	0.253	0.259	-2.1		-0.14	0.886
	M	0.253	0.243	3.5	-70.5	0.22	0.829

Sample	Pseudo R^2	LR χ^2	P - value	Mean bias %	Median bias %
Unmatched	0.045	13.78	0.032	13.1	13.2
Matched	0.002	0.35	0.999	3.2	3.5

Note: this table reports the t-statistics and p-value for the difference of mean between treated and control groups before and after matching. Bias percentage is reported to examine the covariate imbalance prior and after matching.

Figure A1: Propensity Score of Treated and Untreated



Note: The figure at the top is the Propensity Score of Treated (Solo female founders) vs. Untreated (Solo male founders) before matching, whereas the figure at the bottom is After matching. The propensity Score refers to the probability of a firm being in the Treated group (Solo female founders) or Untreated (Solo female founders) given the covariates calculated based on Advanced degree, Equity (%), Premoney Valuation, Team Age, and Goal.