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Gender bias in lending-based crowdfunding: the case of technology development projects

Victoria Eriksson^a, Kristina Ek^a, Ewa Lazarczyk Carlson^b and Patrik Söderholm^a

^aEconomics Unit, Luleå University of Technology, Luleå, Sweden; ^bDepartment of Business and Economics, Reykjavik University, Reykjavik, Iceland

ABSTRACT

The purpose of the paper is to investigate whether lending crowdfunding offers equal opportunities for female and male entrepreneurs in the context of a technology demonstration project. The analysis recognises the potential role of signalling, i.e. suggesting that any success in attracting funding may not only be contingent on gender per se, but also on how signals from women and men concerning the various project attributes will be interpreted. We design a split-sample discrete choice experiment that, apart from financial factors, consider two quality signals: private co-funding and downstream actor collaboration. Data are collected through a survey of over 2000 Swedish individuals and analysed using mixed logit models. Overall, the results indicate little gender bias against women in the case of a (characteristically) male-dominated technological development project. We find very limited evidence suggesting that any of the two project quality signals are perceived differently based on the project owner's gender. Still, the results show that male lenders place a larger premium on actor collaboration when the project owner is female. On the whole, our findings indicate that lending crowdfunding could potentially help democratize the access to capital and reduce any existing funding obstacles for women.

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1. Introduction

This paper investigates the potential presence of gender bias in crowdfunding, i.e. a funding vehicle that leverages various Internet platforms to raise funds from many investors or donors to support new ventures.

Research shows that women regularly face larger financial constraints than men when applying for funding for their ventures in traditional funding schemes, such as venture capital and bank loans (e.g. OECD/European Commission 2023). These constraints could be attributed to either so-called taste-based discrimination, where the lenders discriminate based on personal biases (e.g. dislike) (Becker 1957), or statistical discrimination,

CONTACT Patrik Söderholm  patrik.soderholm@ltu.se  Luleå University of Technology, Luleå 971 87, Sweden
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where they instead behave rationally and free from prejudices, but discriminate because of imperfect information (Arrow 1973). Regardless of which, such hurdles may set in motion a self-reinforcing process because many investors tend to fund individuals with which they can identify, as a result leading to a continued bias in favour of male entrepreneurs (Ewens and Townsend 2020).

However, in this context, crowdfunding could potentially change the present situation. Incorporating a more diverse crowd of backers can lead to more democratized access to project funding than in many traditional funding vehicles. For instance, Gafni et al. (2021) note that the 'Internet enables practically barrier-free entry to [crowdfunding] platforms, thus there are fewer gatekeepers who may be biased against women' (239). Moreover, crowdfunding could also help increase gender diversity on the supply side, since it enables individuals who own little capital to invest, and women typically control less capital than men (Lusardi and Mitchell 2011). As remarked below, though, the empirical literature reveals ambiguous results regarding the presence of gender bias in the capital market in general, and limited attention has been devoted to such bias in the case of different types of funding schemes.

The purpose of this paper is to investigate whether crowdfunding offers equal opportunities to female and male project owners and entrepreneurs. The focus is on lending crowdfunding¹ in the empirical context of a (hypothetical) energy technology demonstration project. The analysis departs from the following research questions:

- (1) Does the gender of the project owner affect the probability of securing funding?
- (2) Are investment attributes perceived differently depending on the gender of the project owner?
- (3) Do the perceptions of the investment attributes for male and female project owners differ depending on the gender of the backer (lender)?

The paper contributes to existing literature by building on a technology development project, and testing whether various (quality) attributes of this project tend to be gendered in a lending crowdfunding context.

First, we introduce a technology project involving the early-stage production of bio-based car batteries in a dedicated pilot plant. Technology development and demonstration projects are most often associated with male project owners. Such projects involve a substantial amount of technical and economic risk-taking (Hellsmark et al. 2016), and in several studies, women are portrayed as more risk-averse, primarily launching projects in, for instance, the retail and service sectors (Reuben, Sapienza, and Zingales 2010). Furthermore, in male-dominated sectors, female investors have been found to promote female-led projects based on so-called activist choice homophily, i.e. where the bond between women is linked to perceptions of shared structural barriers stemming from a common social identity (Greenberg and Mollick 2017). The above makes technology development projects a relevant empirical context in which to study gender biases in lending crowdfunding decisions (see also Brush et al. 2018), including a focus on the gender of both the project owners and the potential lenders.

Second, in line with Kleinert and Mochkabadi (2022), the analysis focuses on the role of signalling (e.g. Spence 1973), i.e. recognizing that success in generating funding may not only be contingent on gender as such but also on how signals from women versus men concerning, for

instance, the project and the qualifications of the project owner are interpreted. In the paper, we focus on signals in the form of: (a) the project owners' willingness to invest own private funding in the project; and (b) whether the project owner has established cooperation with end users of the technology being developed (see Section 3.3 for further motivations).

The empirical analysis builds on choice experiment methodology and survey data from 2029 Swedish individuals. This allows an analysis of the influence of project characteristics on the choice probabilities for the hypothetical lending crowdfunding project. Moreover, we also rely on a split-sample approach in which half of the respondents were presented with a survey featuring a female project owner while the other half received a version featuring a male one. The use of a hypothetical stated, rather than a revealed, preference approach is motivated since it allows for a semi-experimental evaluation of an identical technology demonstration project with different categories of project owners (see also Brooks et al. (2014) and Thébaud (2015)). This approach can also be used to effectively investigate the role of signalling effects, i.e. by measuring the interaction between the gender of the project owner and the two project quality attributes, as well as whether the gender of the backers (lenders) appears to lead to varying perceptions of the project attributes across male and female project owners.

The remainder of this paper is structured as follows. Section 2 provides an overview of the literature on the presence of gender biases in traditional funding and lending crowdfunding, respectively, also elaborating further on the contribution of the paper. The methods are outlined in Section 3, presenting the survey design, the crowdfunding project, the chosen attributes, the data collection process, and the econometric framework. Section 4 displays the empirical results, which are then discussed in Section 5. Section 6 concludes the paper and provides some avenues for future research.

2. Literature review

Expected utility theory posits that individuals act rationally when deciding between uncertain investments, seeking to maximize their expected utility (von Neumann and Morgenstern 1944). Accordingly, investors are assumed to have well-defined preferences, weighing the risks and returns of all available investments and choosing projects that maximize expected utility. This approach has, however, been criticized since empirical studies have demonstrated systematic violations of such rationality. For instance, individuals tend to put more weight on losses than gains, as well as give a disproportionate weight to extreme outcomes (Kahneman and Tversky 1979; Tversky and Kahneman 1992). In addition, and with direct relevance to the issue of gender bias, there is research illustrating how funding decisions may be affected by stereotyped perceptions and irrelevant, non-business-related information, such as the gender of investors. In this section, we outline the literature on such biases, first briefly in the context of traditional financing and then with an emphasis on crowdfunding. The section ends by providing a more comprehensive elaboration on the contributions of the paper.

2.1 Traditional funding vehicles

Research has shown that women generally encounter larger financial constraints than men when applying for loans for their business ventures. For example, compared to

men, women are less likely to obtain credit (Bellucci, Borisov, and Zazzaro 2010), forced larger loan down-sizing (Agier and Szafarz 2013) and imposed higher costs of borrowing (Alesina, Lotti, and Mistrulli 2013; Coleman 2000; Wu and Chua 2012). While some studies have argued that the financial gap for women can be explained by a lack of business-related human capital (e.g. Fairlie and Robb 2009; Menzies, Diochon, and Gasse 2004) and less start-up capital (e.g. Fairlie and Robb 2009), such explanations are inconclusive in the literature.

Brush et al. (2004) found that women with high degrees of human and financial capital still met larger obstacles in securing funds, and Alesina, Lotti, and Mistrulli (2013) showed that even after controlling for various personal and business characteristics and risk factors, women still obtained worse loan conditions than men. Brush et al. (2018) could not find any clear differences between the performances of male-led versus female-led businesses, thus implying that performance could not explain the funding bias against women in the USA. Malmström et al. (2018) argue that the financial gender gap can be the outcome of stereotypical notions of the entrepreneur's gender conveyed by the lender, in turn influencing lenders' risk and profitability evaluations. These authors showed that the general belief among Swedish lenders was that female-led businesses were less profitable, and women were more risk-averse, as well as having less ambition and means to scale their company than men. Still, these beliefs were shown not to be supported by empirical data.

These findings show that the funding gap for women cannot solely be explained by either a lack of human or financial capital. Instead, it could in many instances be attributed to taste-based discrimination where the prospective funders are affected by stereotypes and personal biases, which negatively impact female-led businesses. As noted above, crowdfunding could have the potential to help democratize funding opportunities for female entrepreneurs (e.g. Wang et al. 2019). Below, we review existing literature on whether gender biases appear to be present also in the case of alternative funding vehicles, and with particular emphasis on the case of lending-based crowdfunding.

2.2 Crowdfunding

There is a growing literature on the potential for alternative funding vehicles to offer groups, which tend to be underrepresented in the traditional credit market, better opportunities to raise funds. This research is methodologically diverse, e.g. including various experimental studies, and involves work on equity-based crowdfunding, i.e. where investors receive an ownership stake in the project. For instance, Bapna and Ganco (2021) adopt a randomized field experiment and provide some evidence of activist choice homophily, but only among inexperienced female funders. In a study using data from a major UK crowdfunding platform, the authors cannot find any evidence of women having a higher chance of raising capital through equity crowdfunding relative to the traditional funding vehicles (Cumming, Meoli, and Vismara 2021).

In contrast, research suggests that in reward-based crowdfunding, i.e. where backers receive non-financial rewards (e.g. early access to products) for participation, women have tended to be more successful in raising funds than in the case of the traditional funding vehicles (Johnson, Stevenson, and Letwin 2018), in part since women are often

perceived more trustworthy. This is also confirmed in the experimental study by Fellnhöfer and Deng (2024).²

Lending crowdfunding allows individuals to raise capital earlier available only to professional investors by incorporating a more diverse crowd of financiers (Fenwick, McCahery, and Vermeulen 2018). While potential investors evaluate projects' tangible financial cues, e.g. the offered interest rate (e.g. Dorfleitner and Oswald 2016) and hold times (Jenq, Pan, and Theseira 2015; Lee and Lee 2012), it is worth noting that lending crowdfunding is characterized by a high degree of uncertainty. Three key challenges, which in part apply also to other crowdfunding models, can be pointed out.

First, the lending crowdfunding model suffers from information asymmetries that favour project owners over investors (Ley and Weaven 2011). This is because such crowdfunding projects are often run by first-time entrepreneurs (Vismara 2018), are small and typically lack track records (Armour and Enriques 2018). Even though the project owners present financial information, much of this cannot always be verified (Hoegen, Steininger, and Veit 2018). In turn, many crowdfunding investors may have limited financial literacy (Greiner and Wang 2010; Vismara 2018). Second, lending crowdfunding could suffer from adverse selection, i.e. where projects unable to sustain funding from traditional sources, because of their risk or lower quality, seek financing, in turn increasing the risk of a 'lemons' market (Armour and Enriques 2018). Third, there is a risk of moral hazard, as there is no guarantee the project owner will invest the collected funds in a way that benefits the lender (Lambert, Ralcheva, and Roosenboom 2018).

The high degree of uncertainty in lending crowdfunding could make it difficult for investors to correctly evaluate project quality and risk (e.g. Armour and Enriques 2018; Greiner and Wang 2010; Vismara 2018). For this reason, investors may use the project owner's physical traits as proxies for important considerations, such as trustworthiness and competence (Hoegen, Steininger, and Veit 2018). Barasinska and Schäfer (2014) state that 'because lenders do not observe applicants' probability of default, they may use applicants' gender as a screening device if they believe that gender is correlated with the probability of default' (446).

Previous results on the effects of gender in lending crowdfunding settings are inconclusive. The majority of research has been centred around the Chinese (Chen, Huang, and Ye 2020; Chen, Li, and Lai 2017; Jiang, Fang, and Wang 2024; Lingnan 2019) and the U.S. markets (Duarte, Siegel, and Young 2012; Pope and Sydnor 2011; Ravina 2019), thus with limited attention devoted to the situations in various European countries (see, however, Barasinska and Schäfer 2014; Dorfleitner et al. 2016).

Chen, Li, and Lai (2017) analysed data from an unnamed Chinese platform, and reported that women were more likely to secure funding for their loans. However, they also found evidence of taste-based discrimination against women: men could offer lower interest rates despite being more likely to default on their loan payments. Furthermore, by investigating projects launched on the Chinese platform RenRendDai, Chen, Huang, and Ye (2020) concluded that even if female project owners offered higher interest rates and were less likely to default on their payments, their success rates in securing funding were not higher than those of men. These findings indicate the presence of taste-based discrimination against female project owners. However, using data from the same platform as Chen, Huang, and Ye (2020), Jiang, Fang, and Wang (2024) reported some contradicting results. While these authors confirmed that women were less likely to

default on their loan payments, they also concluded that women had been more successful in securing funding during certain periods.

By analysing data from Prosper, an American lending crowdfunding platform, Pope and Sydnor (2011) found that the probability of a project reaching its funding target was higher for female-led projects than for male-led projects. This result could not be explained by higher interest rates or better loan performance since female project owners were equally likely to default on their payments as male ones. This thus suggests taste-based discrimination against men, a result that was later corroborated by Duarte, Siegel, and Young (2012) and partly by Ravina (2019).

Finally, Barasinska and Schäfer (2014) employed data from a German lending crowdfunding platform to investigate whether the gender of the project owner had affected the probability of a project reaching its funding targets. They found that when controlling for loan terms, i.e. loan duration and interest rates, the gender of the project owner did not affect funding outcomes. However, this result was not supported by Dorfleitner and Oswald (2016), who also built on data from the same platform along with data from another one. They reported that compared to men, women were more likely to secure funding.

In brief, while there is partial evidence of the presence of gender bias in the case of lending-based crowdfunding, there are also quite a few studies failing to reveal any such bias.

2.3 Contributions of the paper

In this paper, we add to the existing literature in three main ways. First, although there are some experimental studies, previous empirical work on lending crowdfunding has typically relied on revealed preference data. Even if such an approach has its merits, it could be difficult to separate gender effects from other project-specific factors unrelated to loan terms that can potentially skew the results. Moreover, in principle, it would be possible to design an experiment with a performance-related incentivization that induces respondents to revalue their true preferences. In this study, though, we rely on a choice experiment approach, which offers a straightforward and well-established way to systematically vary project characteristics, such as the gender of the project owner, while maintaining control over other factors that could also influence backers' lending decisions.

Brooks et al. (2014) and Thébaud (2015) represent earlier examples. In the first of these studies, a group of individuals listened to the same project pitch, but this was delivered with either a male or a female voice. The results suggest the presence of a gender bias against women. Thébaud (2015) conducted a similar type of experiment based on written information. In this case, the results illustrated a bias against women, although attempts (within the experiment) to signal an innovative business model led to more positive impacts on the female entrepreneurs.

Second, unlike much previous empirical research, which has focused on the funding of a wide range of crowdfunding projects without acknowledging differences across various industries and business ventures, we focus on a technology development project involving the early-stage production of bio-based car batteries after the construction of a pilot plant (see also Section 3.1). The development of novel technologies and products,

not least in the climate and energy domain, could often be confronted with considerable funding gaps. For instance, the lack of an established market and mature products may make the funding situation difficult since lenders and financial investors normally have better knowledge about traditional projects in mature industries (e.g. Neuhoﬀ 2005).

As noted above, male-dominated technology development represents a relevant case in which to explore gender bias in crowdfunding. For instance, Gafni et al. (2021) report on the level of female participation as project owners on the well-known crowdfunding platform Kickstarter, and conclude that during the time-period 2009–2012, the share of female entrepreneurs was close to zero in the case of technology start-ups. The authors also note that the backers of Kickstarter projects in the technology domain were predominantly men. Thus, when addressing the role of gender bias in crowdfunding, it is important to investigate not only how female project owners generally perform in raising such funding, but also specifically, their success rates in the male-dominated technology sectors.

Third, and finally, we build on Kleinert and Mochkabadi (2022) and address the importance of signalling, thus recognizing that potential backers do not simply prefer male over female project owners but may instead (unconsciously) interpret information based on the gender of the project owner (Vismara 2016). Signalling might play an important role in crowdfunding decisions. As noted above, crowdfunding investors could be particularly prone to information asymmetries. For this reason, it is reasonable to assume that they then devote particular attention to various observable and easy-to-evaluate factors to reduce uncertainty and convey project quality.

In the paper, we focus on two quality signals, and then test whether these appear to be gendered in a lending-based crowdfunding context. First, the willingness of the entrepreneur to invest their own private funds in the project will constitute a signal of a project's technical and economic viability (Vismara 2016). Second, pilot and demonstration projects that involve close cooperation with relevant actors along the value chain, not least customers, will typically be more successful (e.g. Nemet, Zipperer, and Kraus 2018). These two quality signals are further discussed and motivated in Section 3.1.

In brief, it is worth noting that the choice of these signals is motivated both by the empirical context (technology pilot project) (e.g. Hart 2018; Nemet, Zipperer, and Kraus 2018), as well as by the fact that business connections and private financial commitment have been emphasized as important quality signals both in the traditional finance literature (Baum and Silverman 2004) and in the crowdfunding literature (Vismara 2016). Furthermore, previous research also suggests that the relative importance of these signals could diﬀer across the various crowdfunding models. For instance, actor collaborations have been found to have played a rather limited role in the case of equity-based crowdfunding (Ahlers et al. 2015). Instead, the funders may primarily signal quality through the structure of the equity oﬀering, and where personal financial commitment can function as a credibility-enhancing factor.

3. Methodology

3.1 Survey design and project attributes

The empirical analysis builds on stated preference techniques in the form of a discrete choice experiment. This approach allows us to present a specific crowdfunding project

and examine, through a survey of individuals, the extent to which various project attributes tend to influence the willingness of potential backers to invest. We employ a split-sample approach to test for the presence of project owner gender bias, specifically by investigating whether the various project attributes tend to be valued differently depending on the project owner's gender as well as on the gender of the respondents.

The final design of the survey, which is presented in full in the supplementary material, was completed by building on a pre-test group and cognitive debriefing to identify potential issues concerning the clarity and comprehension of the survey, including the relevance of the chosen attributes. In addition, a pilot version of the survey was distributed to 217 respondents to estimate priors and ensure an efficient experimental design. Below, we comment on the outcomes of the pre-test and the pilot survey, respectively.

In the survey, respondents were presented with a hypothetical crowdfunding project to which they could lend money. This project focused on producing innovative and more sustainable bio-based car batteries relying on by-products from the forest industry, specifically by establishing a testing facility (pilot plant) as one step towards large-scale production. It was added that the project owner had already secured SEK 15 million (roughly EUR 1.36 million) from a venture capital firm and was now hoping to use crowdfunding to raise the additional SEK 3 million (EUR 0.27 million) needed to build the testing facility.

The respondents were informed that if the pilot project was to be successful, the project owner would sell the concept, and lenders would then be repaid their loans along with the accumulated interest. Nevertheless, the respondents to the survey were also informed that there would be no guarantee they would get their money back if choosing to invest, since an investment in a novel technology is inherently risky.

To examine the presence of a bias with respect to the gender of the project owner, half of the sample was informed that the battery project owner was named Eva (signalling a woman), while the other half was introduced to Sven (signalling a man). Apart from the project owner's name and the use of pronouns, the description of the project owner was identical across all surveys. Based on the feedback from the pre-test group, some textual information was shortened, but there were also calls for additional background information on the experiences of the project owner for it to be perceived more credibly. For this reason, new supplementary information was added on the competence and experience of the project owner. Specifically, it was stated that the project owner had a Ph.D. degree and that his or her research focused on battery advancement and the sustainable production of batteries. Additionally, it was also stated that he or she had been granted a patent for the bio-based battery. Again, these additions were identical across surveys, i.e. regardless of the gender of the project owner.³

The crowdfunding battery project was associated with three categories of attributes: (a) basic financial attributes; (b) attributes signalling the quality – and therefore the risks – of the testing facility and project; and (c) the geographical location of the plant. [Table 1](#) provides a description of all attributes and the levels selected for each of these.

In terms of financial attributes, we selected three attributes that are hypothesized to influence the perceived returns of the investment: the annual interest rate offered, the hold time and the investment amount asked for in each choice set. First, the levels of the interest rates were chosen to reflect realistic returns, ranging from a rate slightly lower than the average rate of return on Swedish stocks and bonds to higher rates

Table 1. Description of attributes and levels

Attributes	Description	Levels
<i>Financial</i>		
Yearly interest rate	The annual interest rate offered in percent (%). The amount to be paid out at the end of the investment period.	5, 8, 10, and 14
Required investment amount	The amount required to lend in SEK to participate in the crowdfunding project, i.e. a one-time contribution. Note: in the empirical estimations, the amounts are expressed in thousand SEK.	1, 3, 6,000, and 10,000
Hold time	The investment time is the number of years during which the lent money is locked in the crowdfunding project.	3 and 6
<i>Quality signals</i>		
Collaboration with the customer	Whether or not the project owner has established a cooperation with customers, i.e. the car industry.	Customer collaboration was ensured, or no such collaboration was ensured
Own funding	The amount of money (in SEK), and the share of the total (%), that the project owner contributes out of the SEK 3 million remaining for the project to go ahead.	0 (0%), 750 000 (25%), 1 950 000 (65%), and 2 550 000 (85%)
<i>Geographical</i>		
Location	The location of the testing facility (pilot plant) in Sweden	Växjö (county of Småland in the south), or Luleå (county of Norrbotten in the north)

typically observed on lending crowdfunding platforms in Sweden. Second, the required investment amounts presented to respondents (in SEK) were intentionally kept lower than those typically observed on the existing lending crowdfunding platforms. This was done to avoid the respondents overstating their true preferences since they were asked to contribute to a hypothetical project where there is no incentive compatibility. Third, and finally, based on feedback from the pre-test group, who expressed that the hold times first suggested were deemed implausible since it takes time to build the testing facility and conduct the experiments verifying and optimizing the production, we opted for two levels: three years and six years.

Furthermore, Table 1 includes attributes that are hypothesised to affect the perceived risk of the technology demonstration project. As noted above, we focus on two attributes, which will likely signal lower risk and high performance, and then also test whether these appear to be gendered in a lending crowdfunding context.

First, the literature emphasizes that technology testing facilities and projects should engage key actors along the value chain that would need to be involved in fully commercial versions of the technology, not least customers who can provide important learning from using this technology (Hart 2018; Hellsmark et al. 2016). This has also been emphasized in the financing literature, which suggests that investors often rely heavily on signals conveyed by the business partners of the project owners. Downstream alliances indicate that these partners believe in the technical and commercial feasibility of the project (Baum and Silverman 2004).

In the empirical context of bio-based car batteries, this involves interactions with companies producing cars. For this reason, we introduce a project attribute capturing whether the project owner had established such a collaboration or not. The respondents were informed that this would allow the project owner to test, for example, how different materials affect the efficiency of batteries in various electric cars.

Second, when a project owner commits his/her own private funding to their project, it should provide a positive signal about this project's technical and economic viability (e.g. Hart 2018; Nemet, Zipperer, and Kraus 2018). Private 'skin in the game' reduces the risk of moral hazard, and thus the likelihood that the project will, for some reason, be mismanaged. The level (and share) of the project owner's own contribution was therefore included as one project attribute. Table 1 displays that four levels with substantial variation between them were presented in the survey.

Finally, the discrete choice experiment also included a geographical attribute in the form of two alternative locations of the planned testing facility. This is intended to control for beliefs about benefits for the local economy and the presence of 'home bias' (Bergmann, Colombo, and Hanley 2008; Lindvall, Sörqvist, and Barthel 2024). Specifically, two mid-sized Swedish cities of similar population size but located in opposite parts of the country (north versus south) were selected. Both cities are situated in forest-rich counties, also hosting a lot of expertise in the use of forest biomass. The inclusion of this attribute allows for testing the importance of geographical proximity to the project.

Following the pre-test, a pilot survey study was conducted. Given that a full factorial design would yield more than 130,000 possible choice sets, we used the Ngene software to generate an efficient experimental design. Specifically, the choice tasks were generated using a so-called D-efficient design, implying that attribute levels were balanced and orthogonal by construction, and that dominant and/or implausible combinations were avoided. Since no priors were available, economic theory was used to first determine the expected signs of the attribute coefficients.

Furthermore, 20 choice sets were selected and divided into two blocks, thus implying that each respondent answered 10 choice sets. The use of two blocks reflects a relatively common trade-off in experimental design between statistical efficiency and respondent burden (Hensher, Rose, and Greene 2015; Louviere, Hensher, and Swait 2000). For our purposes, 20 choice sets were identified as sufficient to achieve the desired level of design efficiency while we could keep the number of choices per respondent manageable and avoid respondent fatigue by dividing them into two blocks.

Each respondent was randomly assigned to one of the two fixed blocks. Using fixed blocks rather than completely random combinations of choice sets facilitates preserving relative utility balances and orthogonality across the sample. Moreover, since the design was generated using a D-efficient algorithm, the two blocks are balanced in terms of attribute level frequencies and do not differ systematically in their descriptive characteristics. This is also visible in the full set of choice tasks included as supplementary material.

The pilot survey was distributed to 217 respondents (46 percent female and 54 percent male) through the data collection company Norstat. No statistical differences in the demographics were found between the two sub-samples. The results from the pilot were then used to estimate priors for the efficient design of the choice sets in the final survey. The final survey design also consisted of 20 choice sets split into two blocks, and where each respondent was presented with ten choice sets.

Each choice set contained two investment alternatives: Investment A and Investment B. The respondents were asked to consider the project attributes and their respective levels in A and B and then prompted to select their preferred investment alternative or opt out of investing in any of these alternatives. All attributes were presented to the respondents before the choice sets were outlined, and for every choice set, the

respondents could choose to click a link to revisit this information. Since choice set ordering effects due to, for instance, learning and fatigue are relatively common in choice experiments, we adopted the approach to randomize the ordering of the choice sets in each block (e.g. Boxebeld 2024). This should minimize the risk that some choice sets will be more susceptible to ordering effects than others.

Figure 1 shows an example of a choice set presented in the survey. It illustrates that to reduce the hypothetical setting of the discrete choice experiment, each choice set included a reminder that investments are inherently risky, and that (interest) repayment cannot be guaranteed. In addition, since the potential repayment from the investment depends not only on the interest rate but also on the investment amount asked for and the hold time, each choice set provided information on the total repayment (in SEK) in the case of a successful project.

3.2 Data collection

Since lending-based crowdfunding is only available to the public over the age of 18, the final version of the survey was administered to Swedes aged 18 years and older (i.e. no upper age limit). The full survey was distributed via Europe's leading data collection company for market research, Norstat, which uses an existing panel of randomly recruited panellists. The respondents were not informed about the topic of the survey before

Which investment would you choose? Keep in mind that investment always involves risks, and all or part of your investment could be lost.		
	Investment A	Investment B
Location	Växjö, Småland	Luleå, Norrbotten
Sven's/Eva's own financial contribution	2 550 000 SEK (85%)	750 000 SEK (25%)
Collaboration with the car industry	No collaboration in place	Collaboration in place
Yearly interest rate	10%	5%
Investment amount	SEK 6 000	SEK 1 000
Hold time	3 years	6 years
Total repayment after the investment period	7 990 SEK	1 340 SEK
I choose: ☐ Investment A ☐ Investment B ☐ No investment		

Figure 1. Example of a choice set.

participating. However, upon finishing the questionnaire, they obtained rewards in the form of credit that could be used to buy goods from shops promoted by Norstat. This approach is motivated by the desire to reduce the presence of self-selection bias; it incentivises individuals to participate and complete the survey regardless of their preferences for and prior knowledge about the topic covered in the survey.

A total of 2 040 individuals completed the survey, 1 020 for each split-sample. However, after screening the data, 11 individuals were removed from the data set since they consistently chose either Investment A (nine individuals) or Investment B (two individuals) for all 10 choice sets. Therefore, the final sample consisted of 2029 respondents.

Table 2 provides some descriptive statistics of the respondents' characteristics. No statistically significant differences in socio-demographics were found between the two sub-samples, and the descriptive statistics are therefore presented for the full sample. The sample contains a few more women than men but remains reasonably representative of the Swedish population. The ages of the respondents ranged between 18 and 87 years, with an average age of 49 years and a median of 48 years. While this is above the Swedish national average (42 years) and the median (41 years) (Statistics Sweden 2024), it is not surprising since the latter figures include individuals under the age of 18. In addition, according to Statistics Sweden (2024), around 47 per cent of the Swedish population aged 25–64 have a university education. In our sample, the corresponding share is 56 per cent, thus implying that people with a university education are overrepresented in our sample. However, the mean (and median) monthly income interval in our sample is SEK 30 000–39 999, which corresponds to the mean income levels for the total Swedish population.

Finally, almost half of our sample (45 per cent) had heard about crowdfunding before answering the survey, and roughly 28 per cent of those who had heard about crowdfunding before had also contributed financially to at least one project in the past.

3.3 Econometric specification

In a discrete choice experiment, the respondents choose, based on their preferences, between different alternatives defined by varying attribute levels. Based on Lancaster (1966), individuals can be assumed to derive utility from the underlying attributes of the available alternatives rather than the alternatives *per se*. Furthermore, discrete choice experiments are also based on random utility theory (Thurstone 1927), assuming that individuals are rational decision-makers and therefore choose the investment option that maximizes their expected utility. Specifically, the utility (U) that individual i derives from alternative j in choice situation t is unobservable, and is composed of a deterministic (V) and a random element (ε):

$$U_{ijt} = V_{ijt} + \varepsilon_{ijt} \quad (1)$$

Several econometric approaches are employed to evaluate respondents' preferences in choice experiments. While the multinomial logit model is easy to estimate and interpret, it is restrictive. It assumes that each ε_{ij} follows a Gumbel distribution and is independently and identically distributed (i.i.d.). This implies that the multinomial logit model does not

Table 2. Respondent demographics and characteristics.

Respondent characteristics	Category	Count	Proportion (%)
Gender	Woman	1022	50.37
	Man	1004	49.48
	Other	3	0.15
Age (years)	18–29	295	14.54
	30–39	420	20.70
	40–49	366	18.04
	50+	948	46.72
	Elementary school	125	6.16
Education level	High school	799	39.38
	University	1073	52.88
	Other	32	1.58
Monthly income (SEK)	No income	14	0.69
	< 10 000	60	2.96
	10 000–19 999	235	11.58
	20 000–29 999	327	16.12
	30 000–39 999	475	23.41
	40 000–49 999	306	15.08
	50 000–59 999	153	7.54
	60 000–69 999	73	3.60
	70 000–79 999	35	1.72
	80 000 +	50	2.46
	No answer	301	14.83
Heard about crowdfunding before	No	1107	54.65
	Yes	922	45.44
Contributed to crowdfunding before	No	1767	87.09
	Yes	262	12.91

account for taste heterogeneity across individuals and imposes the independence of irrelevant alternatives (IIA) assumption, which is often unrealistic in empirical settings.

Due to these limitations, we employ a panel mixed logit (MXL) approach, which allows for individual-level heterogeneity in preferences by specifying random coefficients. Therefore, the utility function under the MXL model is given by:

$$U_{ijt} = \beta_i' V_{ijt} + \varepsilon_{ijt} \quad (2)$$

where β_i is a vector of individual-specific random parameter coefficients that are allowed to vary across respondents but remain constant within an individual across choice situations. This allows us to account for the correlations between repeated choice situations while capturing unobserved taste heterogeneity. V_{ijt} is a vector of observed project attributes of alternative j in choice situation t (i.e. annual interest rate, required investment amount, hold time, collaboration with customer, own funding, and geographical location). Conditional on the individual-specific taste parameters β_i , the probability that individual i chooses project j is given by the standard multinomial logit expression.

To answer our research questions, we estimated four MXL models using the Apollo software (Hess and Palma 2019). Some estimations are based on the full sample while others focus on the sub-samples comprising male and female respondents, respectively. Several robustness tests are employed, estimating various model specifications and exploring a few additional sub-samples.

All models include a dummy variable controlling for the presence of opt-out responses. The random parameters are assumed to be normally distributed. An important exception

is the coefficient for the interest rate. This is assumed to follow a positive log-normal distribution, i.e. where the estimated parameters refer to the means and the standard deviations of the underlying normal distribution of $\ln(\beta)$. This approach ensures that utility increases with higher offered interest rates; the coefficients for the different attributes reflecting project quality and thus investment risks (i.e. own funding, cooperation) can, however, take any signs.

4. Results

4.1 Main findings

Table 3 shows the results from the two full-sample models. Model 1 captures the average effects of the different attributes on investment choice while accounting for preference heterogeneity. In model 2, we also add interaction variables. This model tests whether the gender of the project owner influences the perceptions of the investment attributes intended to signal project quality. By interacting the opt-out variable with the project owner's gender, we test the corresponding influence on the likelihood of choosing not to invest. Model 2 also includes the interaction between the geographical location of the pilot plant and the home region of the respondent.

The empirical results from the two full-sample models show that the respondents prefer projects signalling less risky investments over projects that lack such quality signals. In other words, the probability of a respondent choosing to invest in a given project increases with the level of the amount of own funding the project owner channels into the investment, as well as if he/she has secured a downstream collaboration with the car industry. The corresponding coefficients are statistically significant at the one per cent level.

Furthermore, the financial attributes of the investment are shown to constitute important factors affecting the hypothetical investment decision. Due to the positive log-normal distribution of the interest rate parameters, the expected values of the corresponding coefficients can be calculated as: $E[\beta_{interest\ rate}] = \exp\left(\mu + \frac{1}{2}\sigma^2\right)$. As noted above, this rests on the assumption of a positive utility change with interest rate increases, and the results show that this impact is statistically significant (at the one per cent level). We also find, in line with previous work (e.g. Jenq, Pan, and Theseira 2015; Lee and Lee 2012), that the respondents prefer investments with short rather than long hold times. Moreover, the results suggest that an increase in the investment amount asked for implies, as expected, a lower probability of investing.

The results from model 1 display that overall, the geographical location of the pilot plant does not appear to affect the likelihood of investing in the project. However, when introducing the interaction with the home regions of the respondents (model 2), there appears to be evidence of home bias. Specifically, the respondents residing in the region of Småland (where the city of Växjö is located) are generally more likely to invest if the planned pilot plant is built in Växjö. In the same manner, the respondents from the Upper Norrland region (hosting the city of Luleå) appear keener to prioritize the location closer to home.

Table 3. Mixed logit estimates: full-sample models without and with interaction effects.

	Full-sample Model 1		Full-sample Model 2	
<i>Variables</i>	Mean	s.d.	Mean	s.d.
Own financing	0.01 *** (0.00)	0.01 *** (0.00)	0.01 *** (0.00)	0.01 *** (0.00)
Collaboration	1.00 *** (0.05)	1.21 *** (0.06)	0.94 *** (0.07)	−1.22 *** (0.06)
Yearly interest rate	−2.39 *** (0.07)	−0.94 *** (0.03)	−2.55 *** (0.11)	−1.08 *** (0.06)
Investment amount	−0.03 *** (0.01)	−0.26 *** (0.01)	−0.02 *** (0.01)	−0.25 *** (0.01)
Hold time	−0.06 *** (0.01)	−0.15 *** (0.03)	−0.05 *** (0.01)	−
Opt-out	2.68 *** (0.20)	−5.97 *** (0.21)	2.63 ** (0.23)	5.97 *** (0.22)
Location (Luleå = 0, Växjö = 1)	−0.01 (0.04)	−0.78 *** (0.06)	0.03 (0.04)	0.70 *** (0.06)
Location * Småland region respondent	−	−	0.41 *** (0.15)	−
Location * Upper Norrland respondent	−	−	−1.41 *** (0.26)	−
Own financing * female project owner	−	−	0.00 (0.00)	−
Collaboration * female project owner	−	−	0.12 (0.10)	−
Yearly interest rate * female project owner	−	−	0.01 (0.01)	−
Opt out * female project owner	−	−	0.01 (0.34)	−
<i>N</i> (respondents)	2029		2029	
Log-Likelihood	−12 926		−12 885	
AIC	25 879		25 808	
BIC	25 990		25 958	

Note: Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the ten, five, and one per cent levels, respectively. In addition, in model 2, the random parameter standard deviation of the hold time was found to be statistically insignificant, thus suggesting that in this case, there is no heterogeneity in individual preferences. For this reason, it is assumed to be fixed in this model.

The MXL estimates show no evidence of a gender bias. In model 2, the interactions between the gender of the project owner and our two quality signals – collaboration and own funding – are both statistically insignificant. In addition, the gender of the project owner does not appear to influence the respondents' likelihood of choosing not to invest (i.e. opt out). Similarly, there is no statistically significant interaction between the project owners' gender and the interest rate offered to investors.

While the gender of the project owner does not appear to influence the respondents' perceptions of the different project attributes in general, there might still exist unobserved heterogeneity across the respondents based on their gender. For this reason, we estimate two additional MXL models, models 3 and 4, based on the sub-samples consisting of male and female respondents, respectively. This allows us to test whether the gender of the respondent tends to imply varying perceptions of the project attributes across female and male project owners.

The results from these sub-sample MXL estimations are displayed in Table 4. Model 3 shows that the female respondents do not perceive the project attributes differently depending on the gender of the project owner. In contrast, as the results from model 4 illustrate, this does appear to be the case for the male respondents. Like the female respondents, the male respondents are more prone to lend money to a bio-based battery pilot plant if the project owner has established a collaboration with the car industry. However, in the case of the male respondents, this impact is stronger if the project owner is a woman. Thus, compared to the female respondents, the male ones appear more sensitive to whether a female project owner has a downstream collaboration or not. Specifically, the male respondents place a larger premium on such collaboration when the project owner is female, but a corresponding effect cannot be detected in the case of female respondents.

Furthermore, the results in Table 4 confirm the previous findings based on the full data sample, indicating that the gender of the project owner does not appear to impact the likelihood of either male or female respondents choosing not to invest (i.e. opting out). Moreover, for both sub-samples (models 3–4), we find no statistically significant interactions between the gender of the project owner and the interest rate offered to investors.

4.2 Robustness checks

Several robustness checks were implemented. In Table A1 in the Appendix, we extend models 1–2 by incorporating additional interaction variables, i.e. the interactions between the project-owner's gender and investment amount as well as hold time, respectively. These results confirm that the gender of the project owner does not appear to influence the respondent's likelihood of opting out. In addition, there are no statistically significant interactions between the project owner's gender and the various financial attributes. Table A2 in the Appendix illustrates that the results from the corresponding sub-sample estimations are also robust to the inclusion of the additional interaction variables, and the added ones come out statistically insignificant at the ten per cent level or lower. Moreover, the result that male respondents are more sensitive than women to whether a female project owner has established cooperation with downstream actors or not remains.⁴

It is plausible to argue that people who invest in crowdfunding campaigns constitute a relatively distinct group of the general population. For this reason, it is useful to repeat the analyses for the sub-sample of respondents who already have some crowdfunding experience. In our case, the group that has contributed to crowdfunding projects in the past is small (see Table 2), and we therefore opted for investigating the sub-sample of those who

Table 4. Mixed logit estimates: sub-sample models with interaction effects.

Variables	Female respondents, Model 3		Male respondents, Model 4	
	Mean	s.d.	Mean	s.d.
Own financing	0.00 ** (0.00)	−0.01 *** (0.00)	0.01 *** (0.00)	−0.02 *** (0.00)
Collaboration	1.15 *** (0.10)	1.11 *** (0.08)	0.77 *** (0.10)	1.32 *** (0.09)
Yearly interest rate	−2.81 *** (0.17)	1.19 *** (0.08)	−2.40 *** (0.14)	−1.04 *** (0.06)
Investment amount	−0.07 *** (0.01)	−0.28 *** (0.02)	0.02 * (0.01)	0.22 *** (0.01)
Hold time	−0.06 *** (0.02)	0.17 *** (0.03)	−0.06 *** (0.02)	−
Opt-out	2.94 *** (0.30)	5.80 *** (0.28)	2.08 *** (0.32)	6.19 *** (0.33)
Location (Luleå = 0, Växjö = 1)	0.12 ** (0.06)	0.62 *** (0.09)	−0.04 (0.06)	−0.79 *** (0.08)
Location * Småland region respondent	0.30 * (0.18)	−	0.53 ** (0.21)	−
Location * Upper Norrland respondent	−1.08 *** (0.32)	−	−1.12 *** (0.36)	−
Own financing * female project owner	0.00 (0.00)	−	0.00 (0.00)	−
Collaboration * female project owner	−0.12 (0.14)	−	0.37 *** (0.13)	−
Yearly interest rate * female project owner	0.02 (0.02)	−	0.02 (0.09)	−
Opt out * female project owner	−0.23 (0.40)	−	0.50 (0.49)	−
N (respondents)	1022		1004	
Log-Likelihood	−6 294		−6 548	
AIC	12 628		13 134	
BIC	12 772		13 271	

Note: Robust standard errors in parentheses. *, **, and *** indicate statistical significance at the ten, five, and one per cent levels, respectively. In addition, in model 4, the random parameter standard deviation of the hold time was found to be statistically insignificant, thus suggesting that in this case, there is no heterogeneity in individual preferences. For this reason, it is assumed to be fixed in this model.

have heard of crowdfunding before (representing 45 percent of the total sample). The results from this robustness check are presented in [Table A3](#) (men and women combined) and [Table A4](#) (men and women separated), and these show that our main findings are robust also to this sub-sample of respondents.

Furthermore, our main findings of whether the effects of different quality signals on funding decisions are conditional on the respondents' gender are based on a female and male sub-sample (such as in [Table 4](#)). [Table A5](#) in the Appendix presents the results from an alternative approach in which we introduce (dummy) variables for female and male respondents, respectively, and include three-way interaction effects in an estimation based on the full sample. This approach allows us to directly examine potential moderating effects of investor gender on the two quality signals. The findings are consistent with those reported above. For instance, compared to the reference category in which male respondents are faced with male project owners, the male respondents are more sensitive to whether the female project owner has established a cooperation or not. At the same time, it is less clear that the female respondents are equally responsive to such a quality signal.

Finally, our survey did include a question addressing the risk preferences of the respondents, i.e. asking these to choose between a generic risky alternative and one safe alternative but with the same expected value.⁵ The answers displayed that the female respondents were overall more risk averse than the male ones; 28 percent of the women chose the risky alternative while the corresponding share for men was 32 percent. Incorporating this risk appetite measure in the estimations allows us to investigate whether our previous results on no gender bias could be influenced by an omitted variable bias related to this factor. However, [Table A6](#) in the Appendix, which reports the results based on both the full sample as well as the two gendered sub-samples, illustrates no statistically significant interaction between the gender of the project owner, the quality signals and this 'risk appetite' variable. Moreover, the overall findings remain robust to this inclusion.

5. Discussion

This paper contributes to the growing literature on gender effects in crowdfunding, and with a special emphasis on the case of lending crowdfunding in a typically male-dominated technology development project. Crowdfunding is frequently believed to help close the funding gap for female entrepreneurs as it allows for a more diverse group of backers than do most traditional funding schemes. Our results are consistent with this notion since we find little evidence that female project owners are less successful in securing funds than their male counterparts. For instance, in the choice experiment the respondents were no more likely to opt out of investing if the project owner was female. This suggests, therefore, that crowdfunding could presumably have the potential to bridge existing funding gaps for female entrepreneurs.

This conclusion is in line with the findings from some previous studies (e.g. Chen, Li, and Lai 2017; Dorfleitner and Oswald 2016; Duarte, Siegel, and Young 2012). Our analysis differs from these, however, in our focus on Sweden, but also in that we rely on the stated preferences towards a hypothetical crowdfunding project. One could argue that in such a setting, potential backers might be less triggered by the project owner's gender, since, in

our case, Eva and Sven are just fictional persons. Still, Brooks et al. (2014) and Thébaud (2015) also used stated preference approaches in a crowdfunding context, and both found evidence of a gender bias against women.

In terms of project attributes, the results suggest that individuals prefer lending crowdfunding projects that are less risky, offer higher interest rates, and have shorter hold times. These results are unsurprising since both risks and returns are key considerations in investment decisions. In addition, the respondents are generally more likely to invest in projects that have attributes that have been argued to characterize successful technology pilot and demonstration projects: own-funding (reducing the problem of moral hazard) and established collaboration downstream in the value chain (reducing the risk of a lack of market demand for the products developed).

Nevertheless, we find no evidence suggesting that these two attributes are gendered in the sense that they are perceived differently based on the gender of the project owner. Thus, the success in accessing crowdfunding appears not to be contingent on how signals from men versus women concerning these quality attributes are interpreted. This applies also to the financial attributes, including interest rate, amount, and hold time, results that contradict the results reported in, for instance, Chen, Li, and Lai (2017) and Chen, Huang, and Ye (2020). The above findings align with the above notion that our data provide little evidence of gender bias.

When accounting also for the gender of the respondents, though, we do find differences between women and men. Specifically, the results suggest that the male respondents are, *ceteris paribus*, more likely to invest in a project in which a female project owner has established a collaboration with the car industry. Still, the results show no evidence of so-called activist choice homophily (Greenberg and Mollick 2017), that is, where women attempt to help female project owners overcome any structural funding barriers.

These results are interesting, not least considering findings from other studies suggesting that the need for professional relationships and collaborations could typically work against women, particularly in the male-dominated sectors of the economy. Professional networks are important (e.g. Gersick, Bartunek, and Dutton 2000), and networking activities are often characterized by gender-based homophily (Contreras, Mateos de Cabo, and Gimeno 2025). Even though women and men have been shown to have the same type of networks and networking formation abilities (Mengel 2020), women, in general, tend to have lower degrees of professional connections than men. They could also be connected to 'less popular contacts' and tend to have fewer key contacts, especially in the social circles of 'old boys' networks' (Contreras, Mateos de Cabo, and Gimeno 2025; McDonald 2011).

The results that male lenders are more likely to invest in projects with female (rather than male) project owners if the former have established such a collaboration could be linked to several factors. One reason could be that – already upfront – men *expect*, perhaps based on research such as that outlined above, that female entrepreneurs will have access to weaker professional networks, and they therefore perceive it as something extra valuable when they learn that the female project owner has established the relevant value chain collaborations. This finding could also be attributed to the fact that men sometimes perceive women as efficient collaborators in business relationships, e.g. bringing in strong communication skills to existing and emerging actor collaborations (e.g. Bear and Williams Woolley 2011).

The above results in part contrast the findings from research focusing on the case of equity-based crowdfunding, where actor collaborations have been found to have played a more limited role (Ahlers et al. 2015). In equity crowdfunding, project owners will instead signal quality through the structure of the equity offering, and where such personal financial commitment can function as a more important quality signal.

Clearly, given our focus on the Swedish context, one should be careful in drawing too strong conclusions on the paper's broader implications. In comparison to most other countries, Sweden stands out when it comes to gender equality as measured by, for instance, the Global Gender Gap Index (World Economic Forum 2024) and the so-called Gender Equality Index focusing on EU Member States (European Institute for Gender Equality (EIGE) 2024). At the same time, though, Sweden is far from an outlier with respect to the presence of gender bias in the case of traditional funding schemes, as evidenced by, for instance, Malmström et al. (2018). In other words, our results showing limited evidence of gender bias in lending crowdfunding schemes may not necessarily be specific to the Swedish population.

For instance, our finding on the gender importance of actor relationships and networks ought to be of interest for an international readership. Moreover, one implication of our results could be that efforts encouraging only women to invest in female-led crowdfunding projects, thus leveraging on any activist choice homophily, might not be effective (see also Snellman and Solal 2023). In cases where there is evidence of a gender bias hurting female entrepreneurs, it can be equally or even more efficient to promote 'inclusive investing', i.e. where both women *and* men are encouraged to invest in projects run by women.

6. Concluding remarks and avenues for future research

The purpose of the paper was to study whether lending crowdfunding offers equal opportunities for female and male entrepreneurs in the context of a technology demonstration project. This was achieved through a choice experiment and survey data from over 2000 Swedish individuals, allowing an analysis of the influence of different project attributes on the choice probabilities for the hypothetical lending crowdfunding project.

Relating to our three research questions, the empirical results suggest that: (a) the probability of gaining access to funding does not appear to be affected by the gender of the project owner; (b) the project attributes, including the two quality signals, are overall not perceived differently depending on the project owner's gender; and (c) the perceptions of the project attributes for male and female project owners differ depending on the gender of the lender, but only in that male lenders tend to be more likely to invest in a project in which a female project owner has established collaborations with the downstream car industry. All in all, the results suggest that lending crowdfunding could have the potential to help democratize access to capital even in male-dominated technology sectors.

While the paper has provided several empirical insights into the potential role of gender bias in lending crowdfunding projects, it also has limitations. One is, of course, the hypothetical nature of the choice experiment, which begs the question whether the results would hold up in a study based on revealed rather than stated behaviour. Still, the overall approach, with its emphasis on the notion that various project attributes

(quality signals) might be gendered in a crowdfunding context (see also Kleinert and Mochkabadi 2022), could inspire future empirical studies based on data from various crowdfunding platforms.

Furthermore, our results are likely to be context-specific, not least with its focus on a particular type of crowdfunding project, but also in terms of its reliance on Swedish data. Future research should therefore devote increased attention to comparisons across countries as well as to investigating gender biases in different types of crowdfunding projects (sectors), including the role that signalling can play in various empirical contexts.

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Notes

1. In lending crowdfunding – also known as peer-to-peer lending – individuals lend money to projects with the expectation of receiving interest as compensation. Other crowdfunding models include equity, reward and donation crowdfunding (Cumming, Meoli, and Vismara 2021).
2. Beyond crowdfunding, blockchain-based entrepreneurial finance has also been investigated through the lens of potential gender bias. For instance, Fisch, Meoli, and Vismara (2022) investigate whether such a funding vehicle could expand the diversity of investors, but find that it does not appear to help close the gender gap.
3. Our semi-experimental approach implies that we can control for various project-owner characteristics, such as prior experience (relevant Ph.D. degree) and familiarity with the technology sector (battery research focus and patenting).
4. It is worth noting that the main findings are robust also in the alternative estimations in which models 1–4 are run without incorporating the location variable (and the associated interaction variables).
5. Specifically, the respondents were asked whether they would prefer a certain (100 percent) gain of SEK 5000 (EUR 450) (indicating risk aversion) or instead an alternative in which there is a 50 percent chance to gain SEK 10 000 (EUR 900) and a 50 percent risk of gaining nothing (0 percent) (risk seeking). See full survey provided in the supplementary material.

Author contributions

CRedit: **Victoria Eriksson:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing; **Kristina Ek:** Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – review & editing; **Ewa Lazarczyk Carlson:** Data curation, Formal analysis, Investigation, Methodology, Writing – review & editing; **Patrik Söderholm:** Conceptualization, Formal analysis, Funding acquisition, Investigation, Supervision, Writing – review & editing.

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Appendix

Table A1. Mixed logit estimates: full-sample models with additional interaction effects.

Variables	Full sample Model A1		Full sample Model A2	
	Mean	s.d.	Mean	s.d.
Own financing	0.01 *** (0.00)	0.01 *** (0.00)	0.01 *** (0.00)	0.01 *** (0.00)
Collaboration	1.00 *** (0.05)	1.21 *** (0.06)	0.93 *** (0.07)	1.23 *** (0.07)
Yearly interest rate	−2.39 *** (0.07)	−0.94 *** (0.03)	−2.56 *** (0.11)	−1.09 *** (0.06)
Investment amount	−0.03 *** (0.01)	−0.26 *** (0.01)	−0.02 *** (0.01)	−0.25 *** (0.01)
Hold time	−0.06 *** (0.01)	−0.15 *** (0.03)	−0.05 *** (0.01)	−0.13 *** (0.05)
Opt-out	2.68 *** (0.20)	−5.97 *** (0.21)	2.63 ** (0.23)	5.97 *** (0.22)
Location (Luleå = 0, Växjö = 1)	−0.01 (0.04)	−0.78 *** (0.06)	0.03 (0.04)	0.70 *** (0.06)
Location * Småland region respondent	-	-	0.41 *** (0.15)	-
Location * Upper Norrland respondent	-	-	−1.42 *** (0.26)	-
Own financing * female project owner	-	-	0.00 (0.00)	-
Collaboration * female project owner	-	-	0.14 (0.10)	-
Yearly interest rate * female project owner	-	-	0.02 (0.01)	-
Investment amount * female project owner	-	-	0.00 (0.02)	-
Hold time * female project owner	-	-	−0.01 (0.03)	-
Opt out * female project owner	-	-	0.01 (0.34)	-
N (respondents)	2029		2029	
Log-Likelihood	−12 926		−12 884	
AIC	25 879		25 812	
BIC	25 990		25 986	

Note: Model A1 is identical to model 1 in Table 3, while model A2 is based on model 2 in Table 3 but with additional interaction variables, i.e. gender of the project owner interacted with investment amount and hold time, respectively. Robust standard errors are in parentheses. *, **, and *** indicate statistical significance at the ten, five, and one percent levels, respectively.

Table A2. Mixed logit estimates: sub-sample models with additional interaction effects.

Variables	Female respondents, Model A3		Male respondents, Model A4	
	Mean	s.d.	Mean	s.d.
Own financing	0.00 ** (0.00)	−0.01 *** (0.00)	0.01 *** (0.00)	0.02 *** (0.00)
Collaboration	1.13 *** (0.10)	−1.11 *** (0.09)	0.78 *** (0.10)	1.33 *** (0.09)
Yearly interest rate	−2.73 *** (0.21)	1.11 *** (0.11)	−2.42 *** (0.14)	1.13 *** (0.06)
Investment amount	−0.07 *** (0.02)	−0.28 *** (0.02)	0.02 (0.02)	−0.23 *** (0.01)
Hold time	−0.07 *** (0.03)	0.14 *** (0.05)	−0.04 * (0.03)	0.15 *** (0.03)
Opt-out	3.01 *** (0.47)	5.80 *** (0.30)	2.49 *** (0.32)	6.05 *** (0.28)
Location (Luleå = 0, Växjö = 1)	0.11 * (0.06)	−0.60 *** (0.09)	−0.04 (0.06)	0.82 *** (0.08)
Location * Småland region respondent	0.33 * (0.19)	-	0.45 ** (0.22)	-
Location * Upper Norrland respondent	−1.74 *** (0.31)	-	−1.28 *** (0.34)	-
Own financing * female project owner	0.00 (0.00)	-	0.00 (0.00)	-
Collaboration * female project owner	−0.11 (0.13)	-	0.38 *** (0.14)	-
Yearly interest rate * female project owner	0.01 (0.02)	-	0.02 (0.02)	-
Investment amount * female project owner	0.00 (0.03)	-	0.00 (0.02)	-
Hold time * female project owner	0.03 (0.04)	-	−0.06 * (0.04)	-
Opt out * female project owner	−0.20 (0.55)	-	0.01 (0.49)	-
N (respondents)	1022		1004	
Log-Likelihood	−6 299		−6 542	
AIC	12 641		13 127	
BIC	12 800		13 286	

Note: Models A3 and A4 are based on models 3 and 4 in Table 4, but with additional interaction variables, i.e. the gender of the project owner interacted with investment amount and hold time, respectively. Robust standard errors are in parentheses, and *, **, and *** indicate statistical significance at the ten, five, and one per cent levels, respectively.

Table A3. Mixed logit estimates: respondents familiar with crowdfunding (all)

<i>Variables</i>	Men and women, Model A5		Men and women, Model A6	
	Mean	s.d.	Mean	s.d.
Own financing	0.01 ***(0.00)	0.01 ***(0.00)	0.01 ***(0.00)	0.01 ***(0.00)
Collaboration	1.12 ***(0.07)	1.18 ***(0.08)	1.00 ***(0.10)	1.17 ***(0.08)
Yearly interest rate	-2.17 ***(0.10)	0.89 ***(0.06)	-2.20 ***(0.13)	0.91 ***(0.06)
Investment amount	-0.05 ***(0.01)	-0.26 ***(0.02)	-0.05 ***(0.01)	-0.26 ***(0.02)
Hold time	-0.06 ***(0.02)	0.11 *(0.06)	-0.06 ***(0.02)	0.12 *(0.07)
Opt-out	1.81 ***(0.23)	5.41 ***(0.28)	1.86 ***(0.33)	5.41 ***(0.29)
Location (Luleå = 0, Växjö = 1)	0.02(0.06)	-0.81 ***(0.08)	0.05(0.05)	-0.71 ***(0.08)
Location * Småland region respondent	-	-	0.60 ***(0.20)	-
Location * Upper Norrland respondent	-	-	-1.46 ***(0.31)	-
Own financing * female project owner	-	-	0.00(0.00)	-
Collaboration * female project owner	-	-	0.25 *(0.13)	-
Yearly interest rate * female project owner	-	-	0.01(0.02)	-
Opt out * female project owner	-	-	-0.14(0.43)	-
<i>N</i> (respondents)	922		922	
Log-Likelihood	-6 354		-6 324	
AIC	12 735		12 688	
BIC	12 835		12 831	

Note: Models A5 and A6 are based on a sub-sample consisting only of the (male and female) respondents that have heard about crowdfunding before taking the survey. Robust standard errors are in parentheses. *, **, and *** indicate statistical significance at the ten, five, and one percent levels, respectively.

Table A4. Mixed logit estimates: respondents familiar with crowdfunding by gender

<i>Variables</i>	Female respondents Model A7		Male respondents Model A8	
	Mean	s.d.	Mean	s.d.
Own financing	0.00 ***(0.00)	0.01 ***(0.00)	0.01 ***(0.00)	-0.02 ***(0.00)
Collaboration	1.28 ***(0.17)	-1.07 ***(0.13)	0.79 ***(0.13)	1.29 ***(0.12)
Yearly interest rate	-2.30 ***(0.21)	0.82 ***(0.08)	-2.11 ***(0.15)	-0.92 ***(0.07)
Investment amount	-0.13 ***(0.02)	-0.32 ***(0.03)	0.00(0.01)	0.22 ***(0.02)
Hold time	-0.04(0.03)	-0.20 *(0.08)	-0.07 ***(0.02)	0.12 *(0.07)
Opt-out	1.85 ***(0.46)	4.53 ***(0.41)	1.70 ***(0.48)	5.68 ***(0.33)
Location (Luleå = 0, Växjö = 1)	0.25 ***(0.09)	0.63 ***(0.14)	-0.05(0.07)	0.77 ***(0.11)
Location * Småland region respondent	0.13(0.34)	-	0.83 ***(0.27)	-
Location * Upper Norrland respondent	-1.76 ***(0.48)	-	-1.33 ***(0.42)	-
Own financing * female project owner	0.00(0.00)	-	0.00(0.00)	-
Collaboration * female project owner	0.06(0.21)	-	0.41 ***(0.17)	-
Yearly interest rate * female project owner	-0.00(0.03)	-	0.02(0.02)	-
Opt out * female project owner	-0.18(0.67)	-	-0.28(0.63)	-
<i>N</i> (respondents)	459		463	
Log-Likelihood	-2 502		-3 793	
AIC	5 044		7 625	
BIC	5 168		7 758	

Note: Models A7 and A8 are based on the male and female sub-samples consisting only of the respondents that have heard about crowdfunding before taking the survey. Robust standard errors are in parentheses, and *, **, and *** indicate statistical significance at the ten, five, and one per cent levels, respectively.

Table A5. Mixed logit estimates: three-way interaction terms.

Variables	Model A9	
	Mean	s.d.
Own financing	0.01 *** (0.00)	0.01 *** (0.00)
Collaboration	0.73 *** (0.10)	−1.23 *** (0.06)
Yearly interest rate	−2.28 *** (0.12)	0.96 *** (0.04)
Investment amount	−0.02 ** (0.01)	−0.25 *** (0.01)
Hold time	−0.06 *** (0.01)	-
Opt-out	1.93 *** (0.34)	−5.89 *** (0.20)
Location (Luleå = 0, Växjö = 1)	0.03 (0.04)	−0.71 *** (0.06)
Location * Småland region respondent	0.40 *** (0.14)	-
Location * Upper Norrland respondent	−1.42 *** (0.24)	-
Own financing * female project owner * male respondent	0.00 (0.00)	-
Own financing * female project owner * female respondent	−0.00 (0.00)	-
Own financing * male project owner * female respondent	−0.00 (0.00)	-
Collaboration * female project owner * male respondent	0.30 *** (0.13)	-
Collaboration * female project owner * female respondent	0.31 *** (0.14)	-
Collaboration * male project owner * female respondent	0.42 *** (0.14)	-
Yearly interest rate * female project owner * male respondent	−0.01 (0.03)	-
Yearly interest rate * female project owner * female respondent	−0.02 (0.02)	-
Yearly interest rate * male project owner * female respondent	−0.05 *** (0.02)	-
Opt-out * female project owner * male respondent	0.35 (0.51)	-
Opt-out * female project owner * female respondent	0.89 (0.52)	-
Opt-out * male project owner * female respondent	1.26 * (0.46)	-
N (respondents)	2029	
Log-Likelihood	−12 987	
AIC	26 031	
BIC	26 252	

Note: Model A9 is based on the full sample, i.e. the one used in models 1 and 2 in Table 3. The random parameter standard deviation of the hold time was found to be statistically insignificant, thus suggesting that in this case, there is no heterogeneity in individual preferences. For this reason, it is assumed to be fixed. Robust standard errors are in parentheses, and *, **, and *** indicate statistical significance at the ten, five, and one per cent levels, respectively.

Table A6. Mixed logit estimates: full sample incorporating individual risk preferences.

Variables	All respondents: Model A10		Female respondents, Model A11		Male respondents, Model A12	
	Mean	s.d.	Mean	s.d.	Mean	s.d.
Own financing	0.01 *** (0.00)	−0.02 *** (0.00)	0.00 *** (0.00)	−0.01 *** (0.00)	0.01 *** (0.00)	−0.01 *** (0.00)
Collaboration	1.00 *** (0.09)	−1.22 *** (0.06)	1.14 *** (0.12)	−1.10 *** (0.09)	0.84 *** (0.12)	1.30 *** (0.09)
Yearly interest rate	−2.73 *** (0.16)	−1.20 *** (0.10)	−3.04 *** (0.35)	1.25 *** (0.21)	−2.30 *** (0.14)	−0.93 *** (0.04)
Investment amount	−0.02 ** (0.01)	0.25 *** (0.01)	−0.07 *** (0.01)	−0.27 *** (0.02)	0.01 (0.01)	0.22 *** (0.01)
Hold time	−0.06 *** (0.01)	−0.15 *** (0.03)	−0.06 *** (0.02)	0.14 *** (0.05)	−0.07 *** (0.02)	−0.14 *** (0.03)
Opt-out	2.64 *** (0.22)	6.02 *** (0.24)	2.68 *** (0.40)	−5.85 *** (0.32)	2.40 *** (0.53)	−6.32 *** (0.32)
Location (Luleå = 0, Växjö = 1)	−0.02 (0.04)	0.76 *** (0.05)	0.04 (0.06)	0.67 *** (0.09)	−0.07 (0.05)	0.83 *** (0.09)
Location * Småland region respondent	0.43 *** (0.16)	-	0.53 ** (0.25)	-	0.29 (0.20)	-
Location * Upper Norrland respondent	−0.58 ** (0.23)	-	−0.87 *** (0.27)	-	−0.28 (0.35)	-
Own financing * female project owner	0.00 (0.00)	-	0.00 (0.00)	-	0.00 (0.00)	-
Collaboration * female project owner	0.10 (0.11)	-	−0.10 (0.15)	-	0.33 ** (0.16)	-
Yearly interest rate * female project owner	0.02 (0.02)	-	0.03 (0.02)	-	0.01 (0.02)	-
Opt out * female project owner	0.17 (0.39)	-	−0.06 (0.50)	-	−0.72 (0.66)	-
Own financing * risk-taker	−0.00 * (0.00)	-	−0.00 (0.00)	-	−0.00 (0.00)	-
Collaboration * risk-taker	−0.22 (0.15)	-	−0.10 (0.21)	-	−0.29 (0.19)	-
Yearly interest rate * risk taker	0.04 ** (0.02)	-	0.08 *** (0.03)	-	0.00 (0.03)	-
Opt out * risk taker	−0.22 (0.56)	-	0.61 (0.70)	-	−0.65 (0.86)	-
Own financing * female project owner * risk-taker	−0.00 (0.00)	-	−0.00 (0.00)	-	−0.00 (0.00)	-
Collaboration * female project owner * risk-taker	0.05 (0.22)	-	−0.08 (0.34)	-	0.10 (0.28)	-
Yearly interest rate * female project owner * risk taker	−0.03 (0.03)	-	−0.07 (0.05)	-	0.02 (0.05)	-
Opt out * female project owner * risk taker	−0.11 (0.76)	-	0.51 (1.02)	-	−0.45 (1.12)	-
N (respondents)Log-likelihood	2029 −12 898		1022 −6 310		1004 −6 551	
AIC	25 852		12 675		13 158	
BIC	26 074		12 878		13 360	

Note: Models A10-A12 are based on the full sample and the gender sub-samples, respectively, now incorporating the individual risk preferences. The risk variable is a dummy variable taking the value of one (1) if the respondent is risk-seeking, and zero (0) otherwise. Robust standard errors are in parentheses, and *, **, and *** indicate statistical significance at the ten, five, and one per cent levels, respectively.