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# What drives solo and team startups at European universities? The interactive role of entrepreneurial climate, gender, and entrepreneurship course participation

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**ABSTRACT**
Student entrepreneurship can take the form of solo or team efforts. While a positive and supportive university context is likely to increase entrepreneurial activities in general, it is unclear whether this effect is equally strong on both forms of entrepreneurship and for all types of students. Focusing on students embedded in universities, we study the entrepreneurial climate of universities and its combined effects with gender and entrepreneurship education on solo and team entrepreneurship. Drawing from organizational theory and team formation literature, we hypothesize that a positive entrepreneurial climate stimulates both, solo and team entrepreneurship. Yet, we argue that this effect is contingent on individuals' intrinsic preferences for independence or growth which may differ by gender and entrepreneurship course participation. We test our hypotheses by means of a multilevel and longitudinal research design, using a large international dataset on student entrepreneurs (GUESSS). We find that a positive entrepreneurial climate indeed fosters solo and team startups of students, with gender and entrepreneurship education having an interactive effect. Our results suggest that a positive climate leads to more solo startups of women and more team startups of men. We contribute to a better understanding of student entrepreneurship and, specifically, the formation of solo and team startups. Our results elucidate the hitherto overlooked person-context dynamics and help explain why a supportive university context can unintentionally widen the gender gap in team startups.

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## 1. Introduction

In recent decades, higher education institutions have taken substantial measures to stimulate ambitious entrepreneurial activities among students because of their effect on technology transfer, innovation, and job creation (Åstebro, Bazzazian, and Braguinsky 2012; Etzkowitz et al. 2000; Hahn, Brumana, and Minola 2022). What is of particular importance in this respect are team startups as a large share of new ventures, particularly ambitious, growth-oriented ones, are started by more

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than one founder (Clarysse, Mustar, and Dedeyne 2022; Klotz et al. 2014). But what exactly stimulates solo and team startups in the organizational context of higher education institutions? And is this effect the same for every type of student?

Research indicates that the organizational context, e.g. in the form of stimulating peer and social identity effects, often shapes the decision to start a new business and the subsequent entrepreneurial process (Åstebro, Bazzazian, and Braguinsky 2012; Obschonka et al. 2012). Increasingly, universities undertake substantial efforts to foster entrepreneurial activities of students by advancing entrepreneurship education, offering startup support and other measures, making universities to entrepreneurial ecosystems of their own (Wright, Siegel, and Mustar 2017). The different degree to what students perceive this ecosystem as supportive of developing new business ideas and of engaging in entrepreneurial activities can be measured in terms of the entrepreneurial climate (Bergmann et al. 2018), which deserves particular attention because it is an overarching construct that captures how people experience an organization and how they are affected by it (Schneider 2000). Thus, entrepreneurial climate does not measure the specific level of support in an organization as such but how people perceive it, which is important for explaining how they behave. In general, the entrepreneurial climate is likely to affect students' propensity to start a new business. However, theory is unclear about whether and in what way the entrepreneurial climate affects the *type* of business. While a positive entrepreneurial climate will probably not only foster individual but also team efforts, it can also be assumed to appeal differently to people with different personal preferences, goals, and ambitions. As starting a business is typically not part of students' university studies but a contextual activity, a positive entrepreneurial climate is likely to trigger startups which are in line with such own preferences (Ryan and Deci 2000). A positive climate might stimulate people to start an ambitious, growth-oriented team business, but it might also trigger people to start a business on their own, as it appears feasible to do so in such a supportive context. Hence, the effect of the entrepreneurial climate on entrepreneurial activity is not as clearcut as it might seem a priori.

One important individual factor which is likely to affect the type of business started is the preference for growth compared to independence: seeking a co-founder strengthens the resource base of a venture, thereby increasing the chances for growth and value creation. Yet, when founders take co-founders onboard, they also have to partly give up decision-making power, which may prevent them from taking this step (Wasserman 2017). Gender is one of the most frequently discussed personal characteristics in entrepreneurship research, specifically concerning growth-oriented ventures. In the early stage of entrepreneurial activity, women have been found more likely to be solopreneurs compared to men, who have a higher likelihood to start with co-founders or employees (GEM (Global Entrepreneurship Monitor) 2022, 53), suggesting that women may have a relatively high preference for independence. In recent years, gender-related questions have also become a growing focus of university policies and strategies. By providing a supportive context for entrepreneurial activity, the aim is to reduce the so-called gender gap in entrepreneurial activity (Piva and Rovelli 2022; Scott and Shu 2017). At the same time, there is also growing recognition that entrepreneurial ecosystems may affect women differently than men (Brush et al. 2018; Minniti 2009).

In addition, in the university context, the participation in entrepreneurship education can be assumed to shape the preferences concerning growth and independence, as such courses do not only impart knowledge but also have an emotional side and – ideally – inspire students for an entrepreneurial career (Souitaris, Zerbinati, and Al-Laham 2007). Entrepreneurship education programs are widely regarded a key strategy of universities to promote entrepreneurship and train future entrepreneurs. Importantly, when offering such courses, universities do not only aim at increasing the number but also the quality of student startups, including team startups (Martin, McNally, and Kay 2013; Nabi et al. 2017). Concerning both characteristics – gender and the participation in entrepreneurship courses – it is unclear if respective people are affected in the same way by a supportive university context. To address these issues, the present study is devoted to answering the following

two question: *How does the entrepreneurial climate of universities affect the emergence of solo and team entrepreneurship? And how are these relationships moderated by gender and entrepreneurship course participation?*

To answer these questions, we adopt the concept of organizational climate from organizational psychology (Schneider 2000; Schneider, White, and Paul 1998) and apply it to students at universities. In addition, we draw on team formation literature where we specifically consult the resource seeking approach, stressing the intentional search for human capital as driver of team formation (Ucbasaran et al. 2003; Wasserman 2017). We test our model by studying the very early stage of entrepreneurial team formation, as a particularly important phase. Specifically, we investigate the effect of the entrepreneurial climate in university contexts on students' propensity to start a solo or a team business. We argue that a positive entrepreneurial climate encourages students to start a business in line with their preferences, resulting in differentiated effects for men and women and entrepreneurship course participants and non-participants. Largely supporting our hypotheses, we find that such a climate indeed has differentiated effects. While men are in general more likely to start a team business than women, a positive entrepreneurial climate encourages women more strongly than men to start a solo business. A strong climate therefore appears to widen the gender gap in team entrepreneurship. We also find differentiated effects concerning course participation. Our research contributes to a better understanding of person-context interactions in the formation of entrepreneurial teams and, specifically, enhances our understanding of gender differences in startup teams in the university context, particularly the overrepresentation of men.

## 2. Conceptual framework

### *2.1. The entrepreneurial climate at universities*

Organizational climate is a construct from organizational psychology that has been described as 'the shared perceptions (…) concerning the practices, procedures, and kinds of behaviours that get rewarded and supported in a particular setting' (Schneider, White, and Paul 1998). An organizational climate can arise if members of an organization are exposed to the same organizational rules, procedures, and routines. Social interactions can then lead to a shared meaning among organizational members (Hunter, Perry, and Currall 2011). The organizational climate affects how shared sensemaking takes place and, subsequently, how people behave. Perceptions of organizational climate have been shown to relate to a variety of important outcomes at the individual, group, and organizational levels (Patterson et al. 2005). For example, Kang et al. (2016) found a positive relationship between the organizational innovative climate and employee innovative behavior in small companies. Hunter, Perry, and Currall (2011) show that, in engineering research centers, an organizational climate characterized by support for commercialization predicted invention disclosures of researcher one year later.

Universities can be considered as entrepreneurial ecosystems, containing elements such as talent, support, finance, and infrastructure (Padilla-Meléndez and del-Aguila-Obra 2022; Wright, Siegel, and Mustar 2017). The prevalence and interplay of these different factors lead to the emergence of a more or less supportive context for entrepreneurship. Referring to Schneider, White, and Paul (1998) and Patterson et al. (2005), we define the entrepreneurial climate as student's shared perceptions of whether entrepreneurial behavior is encouraged and supported in their university context. We argue that the entrepreneurial climate is important for students because it captures how they perceive the university context in which they are active on a daily basis and, subsequently, how they behave (Schneider 2000). So far, empirical research on this topic is rare. While previous research has investigated the drivers of entrepreneurial climate perceptions (Bergmann et al. 2018), there is hardly any empirical research on its effects on startup activities in a comparative perspective, apart from studies on university faculty (Hunter, Perry, and Currall 2011; Kenney and Richard Goe 2004).

Bergmann, Hundt, and Sternberg (2016) suggest that the climate for entrepreneurship mediates the relationship between organizational measures and individual behavior without having been able to test this proposition directly.

Students most frequently interact with students from their university faculty studying the same or related subjects (Becher 1994). The entrepreneurial climate is likely to differ among academic subject groups because academic disciplines provide students in different ways with the knowledge, skills, and motivation to start a business. Thus, in the empirical part of our paper, we measure the entrepreneurial climate for different subject groups at respective universities and not for whole universities.

### 2.2. Mechanisms of entrepreneurial team formation

While there is a broad literature on the effects of team characteristics on startup performance (Dai, Byun, and Ding 2019; Fiorentino et al. 2022; Klotz et al. 2014), surprisingly little research has looked at *why* people start on their own or in a team in the first place (Lazar et al. 2020). There are two broad streams of literature explaining the formation of entrepreneurial teams (Ben-Hafaiedh 2010; Forbes et al. 2006), the resource-seeking (or strategic) view and the social psychological view.

The resource seeking view stresses the economic rationality of team formation: following resource dependence theory, a firm is considered as a bundle of resources (Pfeffer and Salancik 1978). Considering a specific business idea, the entrepreneur analyses what knowledge, experience, and resources are required to start such a business and, if there are gaps, engages in an open search for one or more co-founders to fill them efficiently (Wasserman 2012) which is likely to lead to a diverse founding team (Ucbasaran et al. 2003). While the focus in this approach is on the complementary fit of co-founders, i.e. the explanation of team composition (Lazar et al. 2020), it also allows to explain *why* people start on their own or in a team. Again, this is framed as a strategic decision, depending on how big the entrepreneur deems the business to become and how much resources will be necessary. If the founder him – or herself possessed all the skills and knowledge required to start the new venture, there is no need for a co-founder, resulting in a solo business (Forbes et al. 2006). Wasserman (2017) points to the potential negative effects of adding a cofounder. He describes the situation for founders as a trade-off between attracting the resources required to build company value and being able to retain control of decision making. For being able to grow and create value, new ventures need resources in the form of human, social, and financial capital. Yet, attracting these resources is typically only possible at the cost of ownership stakes and decision-making control. Overall, the two options founders face can be described as keeping control vs. being able to grow. Founders of solo businesses might also aim at a successful and profitable business. Yet, by taking decisions that allow them to keep control and maintain all the equity and profits of the business, they are likely to build less value than in the case of a team business (Wasserman 2012).

While the strategic approach provides a solid explanation of why founders may opt for a solo or a team business, it has been criticized concerning the explanation of the choice of co-founders. Regarding the actual team composition, there is more empirical support for the social psychological view of entrepreneurial team formation which considers the phenomenon as a result of interpersonal attraction and trust, based on similar values and characteristics, especially gender (Ben-Hafaiedh 2010; Forbes et al. 2006; Ruef 2010; Ruef, Aldrich, and Carter 2003). Because the focus of our analysis is on the factors that lead to solo and team startups rather than the composition of teams, our hypothesizing mainly builds on the strategic view. We acknowledge the arguments from the social-psychological view when discussing our results.

## 3. Hypotheses

In the following, we develop a set of five hypotheses describing the potential effect of the entrepreneurial climate in the university context on students' likelihood to start a solo or a team business,

compared to not being entrepreneurially active, respectively. We consider different effects depending on gender and the participation in entrepreneurship courses.

### 3.1. The direct effect of the entrepreneurial climate on entrepreneurial behavior

A positive entrepreneurial climate emerges if students jointly perceive the university context – including prevailing organizational rules, regulations, procedures and how they are implemented – as supportive of starting a new business (Schneider and Reichers 1983). Such positive perceptions can result from intentional entrepreneurship measures like faculty entrepreneurship officers, business plan competitions and entrepreneurship courses; but general university characteristics like size and reputation also play an important role (Bergmann et al. 2018). Positive perceptions of the entrepreneurial climate are likely to lead to a higher probability of entrepreneurial behavior, irrespective of whether solo or in a team. While students are not likely to constantly think about their future career, the shared experience of a supportive entrepreneurial climate will enhance their perception of the desirability and feasibility of starting a business (Geissler, Jahn, and Haefner 2010). In organizational behavior research it is common to distinguish between task performance, referring to activities that contribute directly to the core of the organization, and contextual performance, relating to activities that are not formally required but still support the organization in a broader sense (Goodman and Svyantek 1999). Starting a business is not an activity that students are usually expected to perform as part of their studies and is thus a contextual activity. Different types of determinants are considered relevant for these two types of performances: knowledge, skills and abilities are important for task performance whereas predisposition, volition, and situational characteristics, like organizational climate, are more important for contextual performance (Svyantek and Bott 2006). Thus, as a contextual activity, the entrepreneurial propensity of students is likely to be particularly affected by climate perceptions. When the entrepreneurial climate is perceived as positive in a university context and students feel encouraged to start a new business, it seems reasonable to assume that this will indeed lead to a higher share of people who will consider an entrepreneurial career and conduct first activities for starting a new business while studying.

Overall, our baseline hypothesis is as follows:

**H1:** Controlling for individual-level characteristics, the entrepreneurial climate in a university context has a positive impact on students' propensity to start a business (solo or team).

### 3.2. The interaction of gender and entrepreneurial climate

The previous hypothesis H1 postulates a uniform effect of the entrepreneurial climate on students' propensity to start a solo or team business, in line with related sociological theories which implicitly assume that individuals, when exposed to the same context, will be collectively influenced in a similar way (Freeman 1986; Roach and Sauermann 2015). Yet, we argue in the following that this effect is more complex, triggering different behaviors for people with different characteristics.

One of the fundamental paradigms in modern applied psychology research is the person-context interaction focus – highlighting that behavioral outcomes can be often best understood by considering the specific person-context interplay. This has been a guiding principle in key frameworks such as person-organization fit theory (Kristof 1996), social cognitive theory (Wood and Bandura 1989), and applied personality theory (John, Robins, and Pervin 2010; Tett, Toich, and Burak Ozkum 2021). Also in education research, the person-context interaction perspective figures prominently (Lau and Nie 2008; Marsh et al. 2008). Regarding an interaction between a person and organizational climate, previous research suggests that the effect of an organizational climate on behavior depends on individual characteristics of the members of that organization (Svyantek and Bott 2006). In other words, the same stimulating context can lead to very different behaviors in different types of people who share this context. This effect is also known as contextual triggering (Roberts, Caspi, and Moffitt

2003) and trait activation (Tett, Toich, and Burak Ozkum 2021). Here we argue that such a contextual triggering phenomenon is likely to hold for the entrepreneurial climate at universities.

Specifically, we hypothesize that an entrepreneurial climate has a gender-specific effect on the formation of team and single-founder startups for the following reasons. Stimulating and acting out work-related *intrinsic* motivation is often seen as major goal for individuals and organizations alike (Gagné and Deci 2005). Such an intrinsic motivation in an individual is, in turn, linked to his or her personal preferences, goals, and ambitions, and a stimulating context plays a particularly important role. Specifically, people often develop and seek better intrinsic motivation if they are put in a context where they are enabled to follow own desires and preferences (Ryan and Deci 2000). Such an interaction between preferences and context has also been suggested for other entrepreneurial phenomena, such that contextual factors might affect only people with a certain predisposition (Roach and Sauermann 2015). Highlighting that men vs. women on average report different patterns of desires and preferences, we argue that a supportive entrepreneurial climate could enable men and women *differently* to materialize intrinsically motivated types of entrepreneurial activity.

A myriad of entrepreneurship studies revealed systematic gender differences in relevant personal preferences, goals and ambitions, which may result, for example, from prevalent gender stereotypes or an unequal access to resources in entrepreneurial ecosystems (Brush et al. 2018). Concerning entrepreneurial work values of young adults, research found that men tend to place a higher importance on extrinsic rewards and a lower importance on security compared to women (Lechner et al. 2018). Other studies found that women often rank family-related goals (e.g. having flexibility for family related matters) higher than men do when it comes to the decision of what type of entrepreneurial activity and settings one would prefer (Cliff 1998; Minniti 2009). In line with the arguments of Wasserman (2017), female entrepreneurs have been found to have a clear sense of the costs and benefits of entrepreneurial growth, and to make careful trade-off decisions (Morris et al. 2006). Overall, as a result, men may have a higher likelihood to strive for ambitious and growth-oriented businesses, while women may tend to prefer less risky and ambitious projects (Charness and Gneezy 2012; Cliff 1998). We have to acknowledge that such findings do not answer the question whether such gender differences are due to interindividual differences or due to the external opportunity structure and constraints, but here we draw from the assumption that there are gender differences in intrinsic motives and values, driving entrepreneurial career decisions (e.g. starting solo vs. a team) (Lechner et al. 2018).

In a nutshell, assuming that a stimulating entrepreneurial climate really leads to the behavioral manifestation of intrinsically motivated preferences, goals, and ambitions, we could expect that a positive entrepreneurial climate activates, and even amplifies, gender differences in such intrinsically-motivated preferences, goals, and ambitions, consistent with trait activation theory (Tett, Toich, and Burak Ozkum 2021). Specifically, for men we would expect that a positive climate leads them to be particularly attracted to entrepreneurial activities and settings that entail the most intrinsic motivation capital for them, and this would be related to team startups, which, compared to solo startups, are often more ambitious and require more resources (e.g. technology startups). Thus, male founders might be more likely than female founders to see the advantages of bringing additional human resources into the new venture. In contrast, women who have been encouraged to start a new venture by a positive entrepreneurial climate might prefer to take this plunge via a solo endeavor. Solo startups might help them to achieve a higher intrinsic motivation compared to team startups due to better alignments with personal values and flexibility needs (Morris et al. 2006) and personal preferences for less risky entrepreneurial behavior and better personal control over their own projects and occupational career (Cliff 1998). Moreover, a solo startup might have more appeal to women as a less 'costly' option in terms of anticipated personal sacrificing of own needs and life plans (Holding et al. 2020).

Overall, we thus assume that the entrepreneurial climate has characteristic gender-specific effects as follows:

**H2:** The positive effect of the entrepreneurial climate on starting …

**(a)** … *a solo business is weaker for men than for women.*

**(b)** … *a team business is stronger for men than for women.*

### 3.3. The interaction of entrepreneurship course participation and entrepreneurial climate

As argued in our baseline hypothesis H1, a positive entrepreneurial climate can be assumed to encourage entrepreneurial activities of students in the form of solo and team startups. We argue that the participation in an entrepreneurship course has an interactive effect on these relationships, similar to the contextual triggering effect described above. In general, meta-analyses indicate a significant positive relationship between entrepreneurship education and participants' knowledge and skills as well as entrepreneurship outcomes (Martin, McNally, and Kay 2013; Nabi et al. 2017). Entrepreneurship education has been found to raise entrepreneurial attitudes and intentions, specifically by inspiring students about an entrepreneurial career and less so by imparting knowledge about how to start a new business (Souitaris, Zerbinati, and Al-Laham 2007). Such an inspiration might be particularly strong if it takes place in a credible context where entrepreneurship is also generally supported and encouraged. Thus, when students take an entrepreneurship course at universities with a positive entrepreneurial climate, they might be more eager to learn and to increase their entrepreneurial skills (Hahn, Brumana, and Minola 2022). In such a context, the participation in an entrepreneurship course is likely to inspire them for aiming at a truly entrepreneurial firm, requiring additional resources, and not only self-employment. Additionally, course participants are likely to obtain knowledge about starting a business and might be able to assess the resource requirements of starting a business more realistically (Oosterbeek, van Praag, and Ijsselstein 2010). Thus, they might be more likely to see the need for one or more co-founders to bring in additional human, social, and financial resources (Wasserman 2017). Regarding different types of entrepreneurship courses, participants of elective entrepreneurship courses and students of specific entrepreneurship programs can be considered to have a somewhat clear understanding of the respective requirement and their own skills before taking a course. This applies to a lesser extent to participants of compulsory courses where a course participation might have a stronger effect on their learning, potentially leading to a greater change in respective perceptions and attitudes (Cascavilla, Hahn, and Minola 2022; Hahn et al. 2020). Specifically, for participants of compulsory courses, the sorting effect has been found to play a prominent role, fostering the sorting of students into two groups: In such a course, students receive informative signals and learn about their own entrepreneurial aptitude. As a result, some students will have a higher intention to become an entrepreneur, others will have a lower intention than before (von Graevenitz, Harhoff, and Weber 2010).

In contrast, students who have been encouraged to become entrepreneurially active and who, for whatever reasons, do *not* take an entrepreneurship course, will be more likely to aim at a solo startup when studying at a university with a positive entrepreneurial climate. These students might have a stronger preference for independence rather than growth, because, first, they were not inspired to start a growth-oriented, resource-intensive business by taking a course and, secondly, they might not understand all the requirements and challenges when deciding about starting a business (von Graevenitz, Harhoff, and Weber 2010; Nabi et al. 2017). In this case, a positive entrepreneurial climate and the respective perception that the university context is very supportive for starting a business might lead them to believe that they already have access to all the necessary resources and can achieve a successful business on their own (Wasserman 2012).

Overall, we assume that, in combination with the participation in an entrepreneurship course, a positive entrepreneurial climate is likely to have a stronger effect on the propensity to aim for a team business than in the case of no course participation.

**H3:** The positive effect of the entrepreneurial climate on starting …

**(a)** … a solo business is weaker for participants of an entrepreneurship course.

**(b)** … a team business is stronger for participants of an entrepreneurship course.

Our full hypotheses model is shown in Figure 1.

## 4. Data and methods

Consistent with our theoretical framework, we test our hypotheses using a multilevel and longitudinal research design.

### *4.1. Data*

We use data from the *Global University* Entrepreneurial Spirit *Students' Survey* (GUESSS), which is an international research project that investigates entrepreneurial intentions and activities of students by means of a comprehensive online-survey.[1] In our analysis, we use data from two subsequent studies from the years 2013/14 and 2016 which allow the investigation of our research questions. To do so, we focus on European universities which have taken part in both GUESSS studies and where all students had the same chance to participate (i.e. where the survey was sent to all students and not only to a non-random subgroup), as one condition for a representative survey. We measure our main independent variable (entrepreneurial climate) on the context level using 2013/14 data and combine it with individual data, including the dependent variable, from 2016 (see Table 1). Specifically, we use the respondents from the 2013/14 survey to compute aggregate climate perceptions for subject groups at 58 universities in nine European countries: Austria, Germany, Hungary, Italy, Luxemburg, Poland, Portugal, Spain, and Switzerland.[2] Because we measure the entrepreneurial climate at the level of subject groups at universities rather than whole universities, we have 178 values for entrepreneurial climate in our study, as outlined below. We take the individual data, including the dependent variable, from the participants of the 2016 survey at exactly the same 58 universities. Excluding cases with missing data and students who are already self-employed, this gives us a sample of 16,832 respondents, including 1291 nascent entrepreneurs (see Section 4.2). By taking the main independent variable from a previous survey, we ensure that climate perceptions are not influenced by individual characteristics, which helps avoid potential endogeneity issues (Manski 1993).

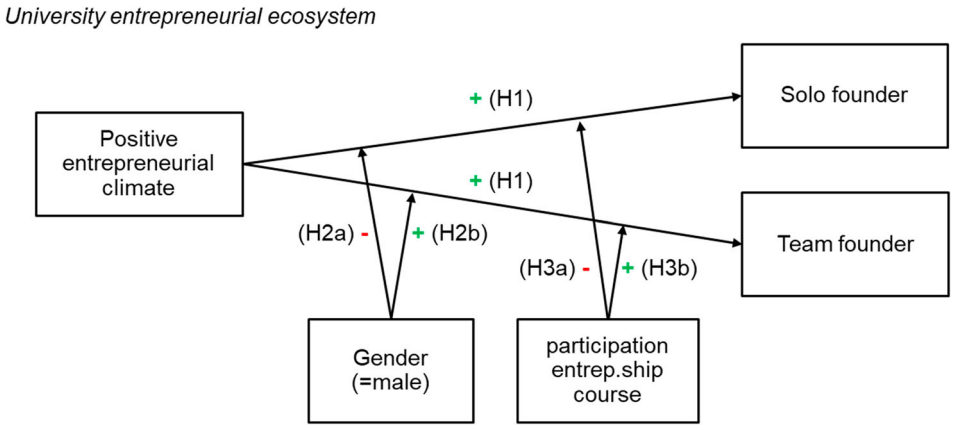



**Figure 1.** Hypotheses model on the effects of entrepreneurial climate on solo and team startups.

**Table 1.** Descriptives and correlations of variables.

| | | Min. | Max. | Mean | Std. dev. | Correlations (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | Nascent solo | 0.00 | 1.00 | 0.02 | 0.14 | | | | | | | | | | |
| (2) | Nascent team | 0.00 | 1.00 | 0.06 | 0.23 | −.035** | | | | | | | | | |
| (3) | Ent. Climate | 2.61 | 5.75 | 3.78 | 0.53 | .067** | .088** | | | | | | | | |
| (4) | Age (years) | 18.0 | 36.0 | 24.2 | 3.91 | .032** | .012 | −.111** | | | | | | | |
| (5) | Gender (=male) | 0.00 | 1.00 | 0.43 | 0.50 | .020** | .097** | .065** | .071** | | | | | | |
| (6) | Parental self-empl. | 0.00 | 1.00 | 0.29 | 0.45 | .024** | .045** | .075** | −.070** | .012 | | | | | |
| (7) | Master level | 0.00 | 1.00 | 0.23 | 0.42 | −.005 | .006 | −.006 | .280** | .020** | .011 | | | | |
| (8) | Entrepr. program | 0.00 | 1.00 | 0.05 | 0.22 | .097** | .125** | .191** | −.021** | −.012 | .011 | .022** | | | |
| (9) | Elective ent. course | 0.00 | 1.00 | 0.19 | 0.39 | .023** | .129** | .124** | .013 | .022** | .018* | .027** | .074** | | |
| (10) | Comp. ent. course | 0.00 | 1.00 | 0.19 | 0.39 | .051** | .089** | .188** | −.041** | −.014 | .007 | .026** | .140** | .071** | |
| (11) | Ent. reputation | 0.00 | 1.00 | 0.06 | 0.23 | .056** | .071** | .262** | −.041** | .034** | .057** | −.010 | .150** | .029** | .066** |

Notes: Remarks: Correlation is significant at the: ** 0.01 level (2-tailed); * 0.05 level (2-tailed). N = 16,832 cases. All the variables are taken from the GUESSS 2016 survey except from the variable 'Ent. climate' which has been taken from the GUESSS 2013/14 survey.

### 4.2. Dependent variables

In our models, we use a dependent variable with three different outcome possibilities: no entrepreneurial activity, nascent *solo* entrepreneurship, and nascent *team* entrepreneurship. We focus on nascent entrepreneurship rather than operating businesses (i.e. self-employed students) because we want to investigate the phase where team formation actually takes place. Self-employed students might have started their businesses some time ago, already (Bergmann, Hundt, and Sternberg 2016). Similar to Carter, Gartner, and Reynolds (1996), all respondents who state that they are 'currently trying to start a new business', who expect to (partly) own this business, and who have already conducted at least one gestation activity, count as nascent entrepreneurs. We then distinguish between nascent solo and nascent team entrepreneurs, depending on whether the respondents try to start a new business on their own or with one or more co-founder(s). In our multinomial models, we analyse the antecedents of starting a solo business ('nascent solo entrepreneur'; 1.9% of the total sample) and of starting a team business ('nascent team entrepreneur'; 5.7% of the total sample) compared to *not* being entrepreneurially active which serves as the reference category (see Table 2).

### 4.3. Independent and moderating variables

We calculate the aggregate *entrepreneurial climate* based on data from the GUESSS 2013/14 survey. Based on previous research (Geissler 2013; Lüthje and Franke 2004), we measure entrepreneurial climate perceptions using a three-item measure. Students were asked to indicate their level of agreement with the following three statements on a 7-point scale: 'The atmosphere at my university inspires me to develop ideas for new businesses', 'There is a favourable climate for becoming an entrepreneur at my university', and 'At my university, students are encouraged to engage in entrepreneurial activities'. On the level of individual respondents, Cronbach's Alpha of this measure is 0.86. It is justified to aggregate individual climate observations to an average value for groups if there is a certain level of agreement among members of this group (Patterson et al. 2005). As suggested by LeBreton and Senter (2008), we calculate the inter-rater agreement IRA ($r_{wg}$). Because students are more likely to interact with fellow students studying the same or a similar subject, subject groups at universities (which are similar but not identical to university faculties) and not whole universities are the adequate organizational unit for aggregating climate perceptions. We calculate the entrepreneurial climate for students of the same subject group at each university and use this measure as main independent variable in our analysis. The average IRA value for the 178 subject groups in the analysis is 0.63 which can be interpreted as a moderate level of agreement (LeBreton and Senter 2008).[3] A minimum of 10 and on average 148 individual climate perceptions of students from the same subject group at one university went into the calculation of *one* aggregate entrepreneurial climate value.

*Gender* (1 = male; 0 = female) acts as the first moderating variable in our models. We measure our second moderator, *participation in an entrepreneurship course*, using three different variables, to get a more fine-grained understanding of the effect of such courses: participation in an *elective* entrepreneurship course (1 = attendance; 0 = no attendance), participation in a *compulsory* entrepreneurship course (1 = attendance; 0 = no attendance), and studying in a *specific program on entrepreneurship* (1 = yes; 0 = no), as reported by students. While almost a fifth of all students has participated in an elective course (19%) or compulsory course (19%), respectively, only few students have chosen a specific entrepreneurship program (5%).

The choice and measurement of the control variables (see Table 1) is described in the supplementary material.

### 4.4. Methods

We calculate the likelihood of being a nascent solo entrepreneur or a nascent team entrepreneur in comparison to *not* being entrepreneurially active (Table 2). This research design is consistent with

**Table 2.** Multinominal multi-level regressions on being a nascent solo and nascent team entrepreneur compared to not being an entrepreneur.

| | Solo | | Team | | Solo | | Team | | Solo | | Team | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reference group: Non-entrepreneurs | *(1) Individual level only* | | | | *(2) Including Climate* | | | | *(3) Including Interactions* | | | |
| | *Coeff.* | *(s.e.)* | *Coeff.* | *(s.e.)* | *Coeff.* | *(s.e.)* | *Coeff.* | *(s.e.)* | *Coeff.* | *(s.e.)* | *Coeff.* | *(s.e.)* |
| Regression intercept | −4.304*** | (0.11) | −3.170*** | (0.07) | −4.324*** | (0.11) | −3.179*** | (0.07) | −4.312*** | (0.11) | −3.167*** | (0.07) |
| U: Entrepreneurial Climate | | | | | 0.304** | (0.10) | 0.155** | (0.07) | 0.291** | (0.10) | 0.173** | (0.08) |
| $X^1$: Gender (1 = male) | 0.252*** | (0.06) | 0.447*** | (0.04) | 0.252*** | (0.06) | 0.447*** | (0.04) | 0.281*** | (0.07) | 0.445*** | (0.04) |
| $X^1$ * U: Gender * Climate | | | | | | | | | −0.111* | (0.06) | −0.006 | (0.04) |
| $X^2$: Age (years) | 0.325*** | (0.05) | 0.114** | (0.04) | 0.329*** | (0.05) | 0.115** | (0.04) | 0.328*** | (0.05) | 0.115** | (0.04) |
| $X^3$: Parental Self-Employment (1 = yes) | 0.225*** | (0.05) | 0.191*** | (0.04) | 0.222*** | (0.05) | 0.190*** | (0.04) | 0.216*** | (0.05) | 0.189*** | (0.04) |
| $X^4$: Academic Status (1 = master) | −0.072 | (0.06) | −0.002 | (0.04) | −0.075 | (0.06) | −0.003 | (0.04) | −0.066 | (0.07) | 0.002 | (0.04) |
| $X^5$: Entrepreneurship program | 0.221*** | (0.04) | 0.214*** | (0.03) | 0.218*** | (0.04) | 0.213*** | (0.03) | 0.194*** | (0.05) | 0.239*** | (0.03) |
| $X^5$ * U: Ent.ship program * Climate | | | | | | | | | 0.031 | (0.02) | −0.034 | (0.03) |
| $X^6$: Elective Entrepreneurship-Course | 0.067 | (0.05) | 0.349*** | (0.03) | 0.064 | (0.05) | 0.348*** | (0.03) | 0.096$^+$ | (0.05) | 0.348*** | (0.03) |
| $X^6$ * U: Elective Ent.ship-Course * Climate | | | | | | | | | −0.080$^+$ | (0.03) | −0.019 | (0.03) |
| $X^7$: Compulsory Entrepreneurship-Course | 0.025 | (0.06) | 0.110** | (0.04) | 0.024 | (0.06) | 0.110** | (0.04) | 0.140** | (0.05) | 0.137*** | (0.04) |
| $X^7$ * U: Compulsory Ent.ship-Course * Climate | | | | | | | | | −0.243*** | (0.03) | −0.069* | (0.03) |
| $X^8$: Entrepreneurial Reputation | 0.107* | (0.04) | 0.097*** | (0.03) | 0.096* | (0.04) | 0.093*** | (0.03) | 0.094* | (0.05) | 0.097*** | (0.03) |
| $X^{9.1}$: Social Sciences (Reference group: medicine) | 0.022 | (0.15) | 0.132 | (0.13) | 0.045 | (0.15) | 0.142 | (0.13) | 0.076 | (0.14) | 0.151 | (0.13) |
| $X^{9.2}$: Arts and Humanities | 0.060 | (0.06) | 0.179*** | (0.05) | 0.022 | (0.06) | 0.160*** | (0.05) | 0.015 | (0.06) | 0.156** | (0.05) |
| $X^{9.3}$: Natural sciences, mathematics | 0.082 | (0.16) | 0.063 | (0.12) | 0.062 | (0.16) | 0.051 | (0.11) | 0.064 | (0.16) | 0.050 | (0.11) |
| $X^{9.4}$: Business, law, economics | 0.347$^+$ | (0.20) | 0.497* | (0.17) | 0.223 | (0.20) | 0.432* | (0.18) | 0.219 | (0.20) | 0.427* | (0.17) |
| $X^{9.5}$: Engineering, computer sciences | 0.097 | (0.20) | 0.399* | (0.17) | 0.046 | (0.20) | 0.371* | (0.18) | 0.023 | (0.20) | 0.365* | (0.17) |
| $X^{9.6}$: Science of Art | 0.151 | (0.12) | 0.267* | (0.11) | 0.177 | (0.12) | 0.278* | (0.12) | 0.203$^+$ | (0.12) | 0.286* | (0.11) |
| University level variance component: var ($u_j^0$) | 0.80*** | | 0.28*** | | 0.77*** | | 0.27*** | | 0.73*** | | 0.28*** | |
| Deviance (−2lnL) – Null Model | 9,991 | | | | 9,991 | | | | 9,991 | | | |
| Deviance (−2lnL) – Model shown | 9,403 | | | | 9,400 | | | | 9,375 | | | |

Notes: The table displays standardized logit coefficients and robust standard errors. All predictor variables are grand mean centered. Influence is statistically significant on the 0.001 = ***, 0.01 = **, 0.05 = *, or 0.10 = $^+$ level.

Sources: Own calculations based on GUESSS data from 16,832 individuals and 58 universities (178 subject-group values).

the notion that the decision for a solo or a team business goes hand in hand with the business idea pursued which has prompted people to start a business (Kamm and Nurick 1993; Lazar et al. 2020).

Given that we are particularly interested in the effect of contextual characteristics and their interplay with individual characteristics, an appropriate technique to quantify such cross-level interactions is provided by multi-level modeling (Snijders and Bosker 2004). Specifically, we calculate multinomial multi-level regressions with nascent entrepreneurial activity (solo or team) as the dependent variable and independent and control variables on the individual and organizational levels. The suitability of the multi-level approach is demonstrated in the supplementary material. We compute the multinominal multilevel regressions with random intercepts and cross-level interactions (Hox 2010; Raudenbush and Bryk 2002). We apply a stepwise estimation procedure (see Table 2). First, we amplify the intercept-only model by adding control variables from the individual level. Second, we include the hypotheses-relevant variables of the organizational level, before – in a third step – testing the theoretically derived cross-level interaction effects.

## 5. Results

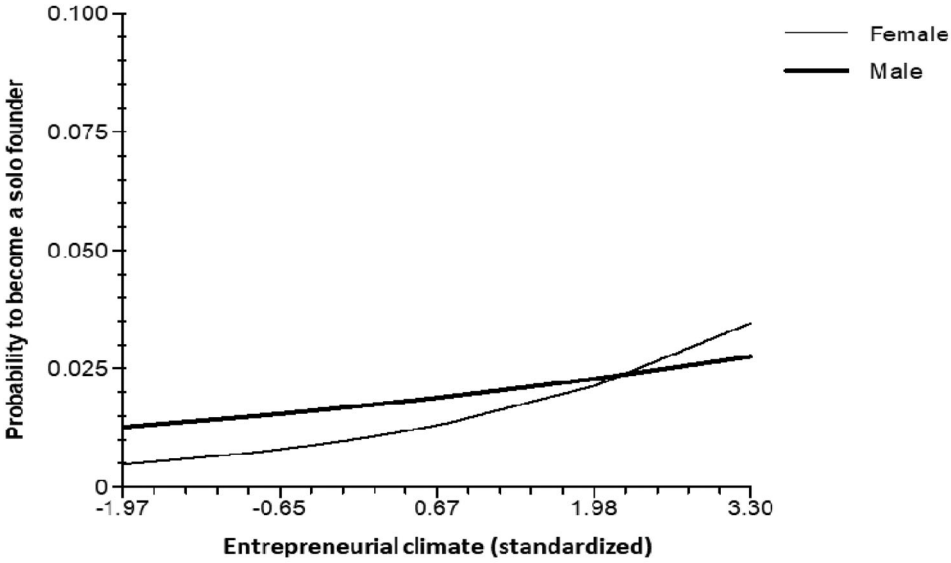
Our models analyse the likelihood of starting a solo business and of starting a team business in comparison to not being entrepreneurially active, respectively (Table 2).

We find support for our baseline hypothesis H1. The likelihoods to become a nascent solo and a nascent team entrepreneur are higher when students study at a university with a positive entrepreneurial climate.

In line with H2a, there is a negative interaction between gender and the entrepreneurial climate on the likelihood of forming a solo startup. The interaction plot visualizes the relationship (see Figure 2, at the top). While men have a higher propensity than women to start a solo business when the entrepreneurial climate is negative, the difference becomes smaller with an improving climate. When the entrepreneurial climate is very positive, women are even slightly more likely than men to engage in a solo startup. There is no statistically significant interaction effect between climate and gender on team startups and thus no support for H2b. Still, there is a large gender difference. For solo startups, women are catching up with men with an improving entrepreneurial climate (resulting from the negative interaction effect) while this is not the case for team startups (resulting from the absence of a such an interaction). The likelihood of men to be involved in a team startup is always more than twice as high as that of women, as also illustrated in Figure 2 (at the bottom). In absolute terms, the difference in team entrepreneurship between men and women even becomes considerably larger with an increasing entrepreneurial climate. Together with the above-mentioned result concerning solo-entrepreneurship, the findings suggest that the ratio of team to solo start-ups rises significantly more among men than among women when the climate improves.

By and large, we find support for H3a. For the most common types of entrepreneurship courses, elective and compulsory ones, there is a negative interaction effect between course participation and the entrepreneurial climate on the formation of a solo business. In the case of elective course participation, this effect is only weakly significant. The interaction plots in Figures 3 and 4 visualize the relationships (at the top of the figures, respectively). While the entrepreneurial climate has a positive effect on solo entrepreneurship when people have *not* participated in a course, there is hardly any or even a negative effect when they have participated in a course. There is no significant interaction effect for students who are studying in a specific entrepreneurship program. Therefore, we do not include any interaction plots for this variable.

There is no support for H3b. For elective entrepreneurship courses and specific entrepreneurship programs, there is no significant interaction effect with entrepreneurial climate on starting a team business. Both types of courses positively influence solo and even more so team entrepreneurship, but there is no significant additional influence in conjunction with the entrepreneurial climate. For compulsory entrepreneurship courses, the interaction effect on the formation of team businesses is



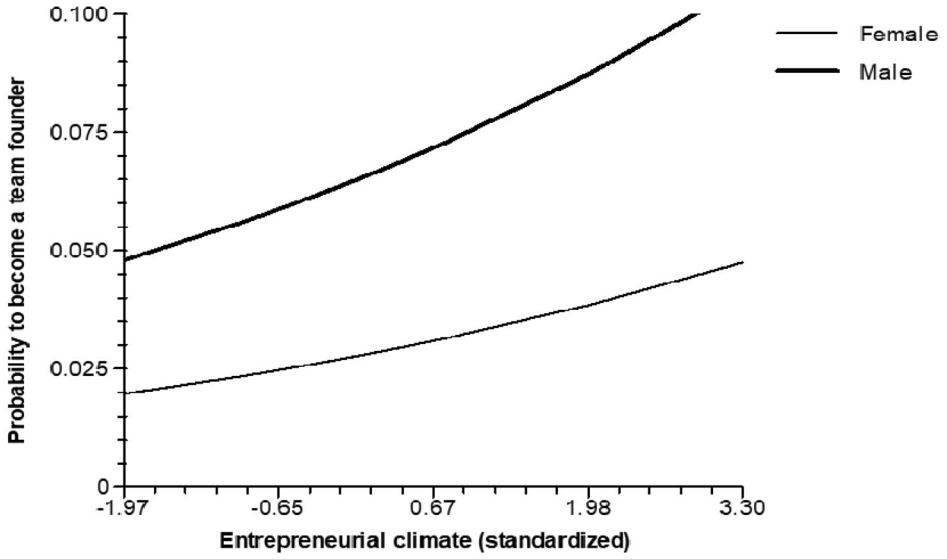




**Figure 2.** Interaction effects of entrepreneurial climate and gender.

significant but negative, contrary to what we expected. The interaction plot in Figure 4 (at the bottom) indicates that, overall, there is almost no association between the entrepreneurial climate and the formation of a team business when students have participated in a compulsory entrepreneurship course while there is a positive relationship – albeit for large parts on a lower level – when they have not participated in such a course.

Overall, we find support for H1, H2a, and H3a; we have to reject H2b and H3b.

## 6. Discussion

Universities have the capacity to stimulate and influence students' entrepreneurial activities (Bergmann, Hundt, and Sternberg 2016; Clarysse, Mustar, and Dedeyne 2022), including entrepreneurial

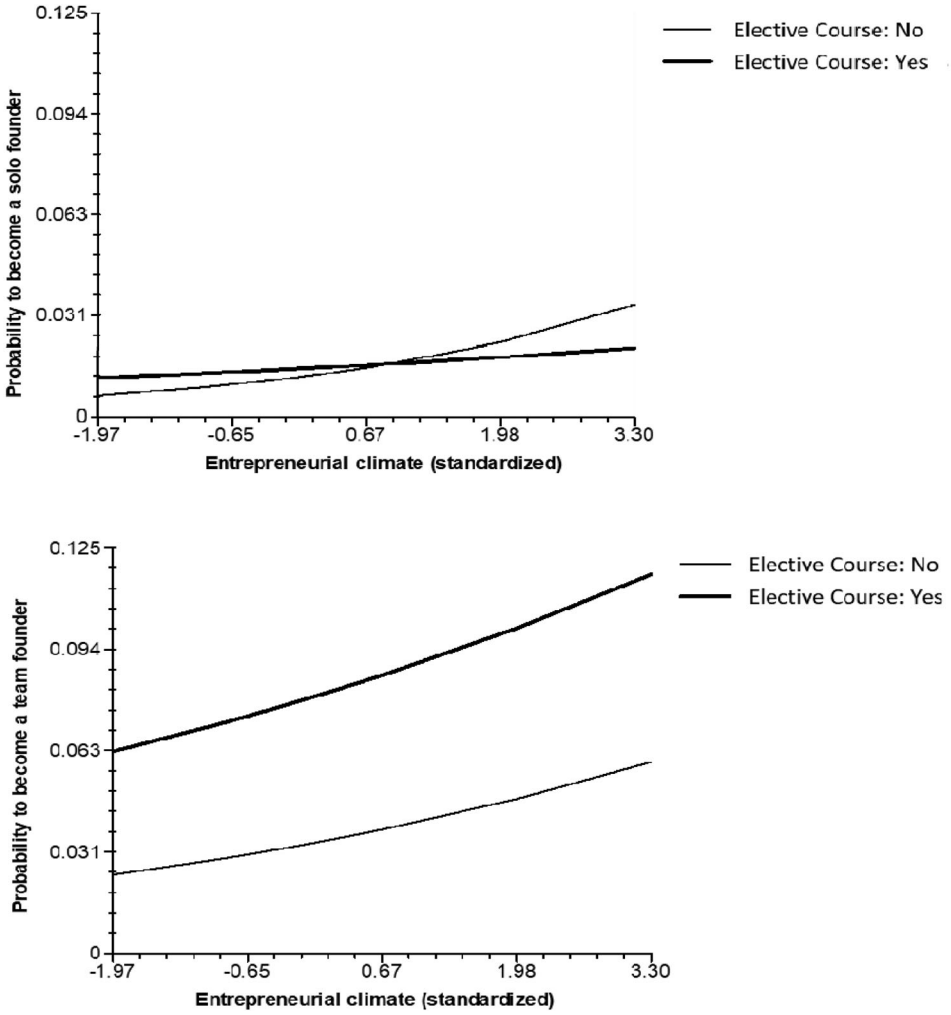



**Figure 3.** Interaction effects of entrepreneurial climate and elective entrepreneurship course.

teams, but our knowledge about relevant organizational factors shaping early team formation processes in combination with individual characteristics, such as gender, has been very limited. Our study provides new insights into how the university context affects the emergence of independent solo startups and presumably more ambitious team startups among students.

### *6.1. Entrepreneurial climate and the solo/team decision*

Our results suggest that a positive entrepreneurial climate may indeed stimulate new entrepreneurial activity in the form of solo and team startups. While previous research has shown that being embedded in an academic department which is supportive of entrepreneurship positively affects startup activities of academics in general (Bercovitz and Feldman 2008; Hunter, Perry, and Currall 2011; Kenney and Richard Goe 2004), our results more specifically suggest that a supportive context fosters solo and team endeavors of students. It is important to point out that we receive this result even with measuring dependent and independent variables in different years, thereby reducing the risk of endogeneity biases.[4] In addition, our results suggest that a positive climate does not only influence the number of solo and team founders but also *who*

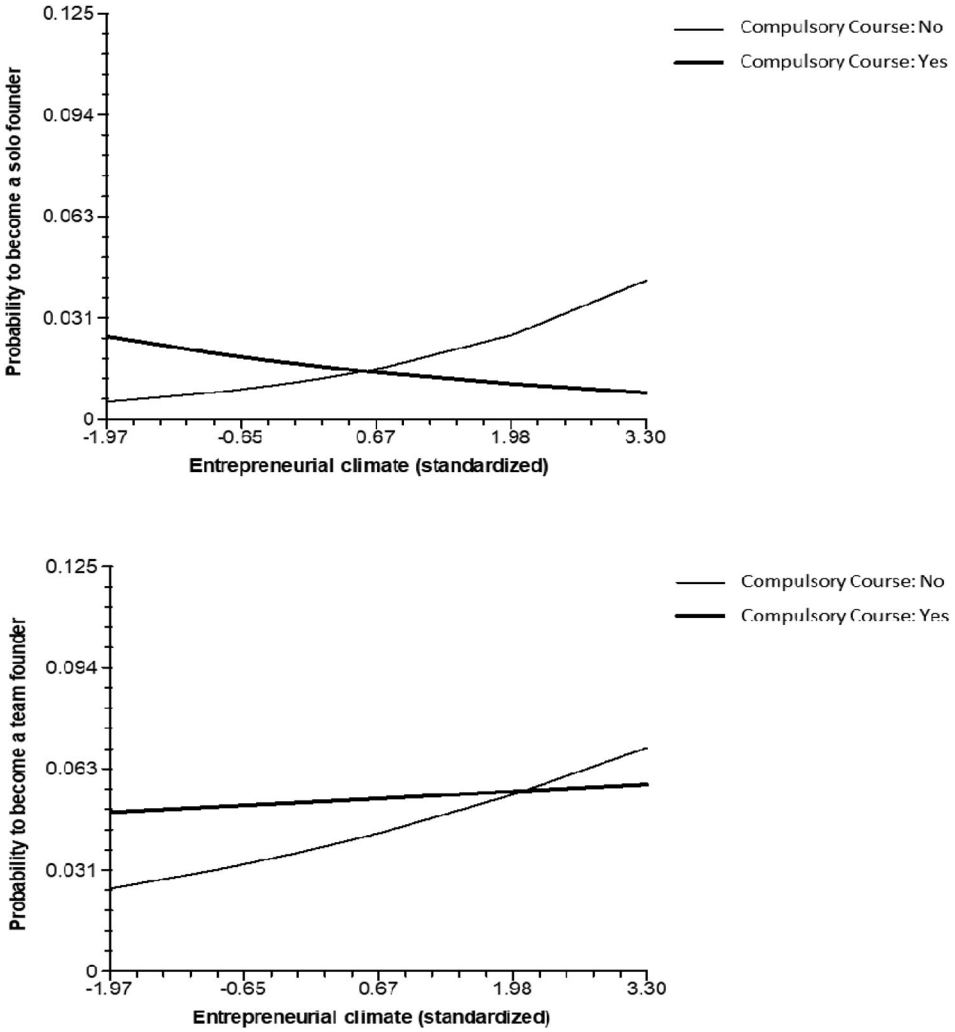



**Figure 4.** Interaction effects of entrepreneurial climate and compulsory entrepreneurship course.

engages in entrepreneurial activity. Specifically, when the organizational context is perceived as supportive of entrepreneurship, more but also younger students are encouraged to engage in entrepreneurial activities (see supplementary material). A positive entrepreneurial climate seems to encourage students to try to start a new business early on rather than to wait for graduation or a later point in time, as is typically the case for university startups (Åstebro, Bazzazian, and Braguinsky 2012).

### *6.2. The gender-specific effect of entrepreneurial climate*

We have also hypothesized that one needs to take *different* gender-specific, intrinsically motivated pathways to solo vs. team entrepreneurship into account when aiming to understand the effect of a positive entrepreneurial climate on students. Our results concerning H2a indeed suggest that the entrepreneurial climate affects women and men differently. While we could not find evidence for a positive interaction between being male and a positive climate on starting a team business (H2b), it should be noted that there is no relevant negative interaction, as in the case of a solo

business. This leads to a consistently higher likelihood of men to start a team business compared to women. Our findings help to explain the results of previous studies on the gender distribution in startup teams. While women account for a substantial proportion of all entrepreneurial activities in many societies around the world (GEM (Global Entrepreneurship Monitor) 2022), they more often start smaller businesses and solo projects compared to men. In OECD countries, 16% of all women nascent entrepreneurs work in teams of three or more, relative to 22% of men (OECD/European Union 2017). Our findings suggest that a supportive entrepreneurial context inspires women more strongly than men to aim for a solo business. Using the analogy of the 'throne vs. the kingdom' (Wasserman 2017), we argue that a positive entrepreneurial climate more strongly encourages women to achieve intrinsic motivation and financial success by starting a business that they can manage themselves and over which they retain control (i.e. 'own the throne'), while men more strongly seem to be encouraged and intrinsically motivated to aim at a large business requiring co-founders (i.e. 'the kingdom'), even if they must relinquish some control. While we cannot explain the specific origin of these different preferences, our analysis suggests that such preferences are acted out when the context is perceived as conducive for entrepreneurial activity, leading to different outcomes for male and female entrepreneurs.

Overall, our findings contribute to a better understanding of gender differences in solo and team startups, specifically in the university context. Although a supportive context has presumably been intended by policy makers and university decision makers as a means to close the pervasive gender gap in ambitious entrepreneurial activities and settings, it might – somewhat paradoxically – have the opposite effect by contributing to the persistence or even increase in gender differences in team startups, which can be assumed to be more ambitious than solo endeavors. Similar paradox effects have been found concerning the gender gap in STEM education outcomes in particularly egalitarian countries (Stoet and Geary 2018).

### *6.3. The moderating effects of course participation*

We tested our hypotheses on entrepreneurship education for different types of courses, revealing in some cases significant interactions and in others none. While we did not formulate specific hypotheses concerning such different courses, our results suggest that indeed different mechanisms are at play. We argue that in some cases the inspiration aspect of entrepreneurship education prevails (Souitaris, Zerbinati, and Al-Laham 2007) while in others the sorting effect seems to be more important (von Graevenitz, Harhoff, and Weber 2010), leading to different interactions with the entrepreneurial climate.

As outlined in the hypotheses development, the sorting effect has been found to play a prominent role in the case of compulsory entrepreneurship courses, which might explain why – overall – the entrepreneurial climate has no positive effect for respective course participants, as indicated in the interaction plots (see Figure 4). Such a course might have motivated some students to become entrepreneurially active but presumably convinced many others that starting a business is not desirable for them (von Graevenitz, Harhoff, and Weber 2010). As a large share of participants has come to realize that starting a business does not meet their preferences and abilities, a positive climate cannot act as a motivator for an entrepreneurial career. For students who have not participated in such a course, the entrepreneurial climate can still act as a motivator as no such sorting has taken place, leading overall to a positive relationship with solo and team entrepreneurship (see Figure 4).

On the other hand, students who voluntarily participate in an entrepreneurship course are motivated to improve their entrepreneurial skills and can also be assumed to have some basic understanding of possible gains but also the demands and challenges of starting a new business. For them, the participation in an elective entrepreneurship course is likely to inspire them further and raise their ambitions while only very few will come to realize that starting a business is not desirable for them (Oosterbeek, van Praag, and Ijsselstein 2010; Souitaris, Zerbinati, and Al-Laham 2007). This is

likely to increase their likelihood to start a team business, as indicated by the significant positive effect on team entrepreneurship (see Figure 3). In addition, the entrepreneurial climate acts as supportive context for implementing entrepreneurial activities. In the case of solo entrepreneurship, the positive direct effects of course participation and climate are partly offset by a negative interaction effect, as indicated in the interaction plots (see Figure 3). In contrast, there is no such significant negative interaction effect in the case of team entrepreneurship. This result suggests that the positive effect of entrepreneurship education can only play out when the university is perceived as a credible context for implementing truly entrepreneurial businesses. When students take an elective entrepreneurship course at a university with a positive entrepreneurial climate, they are likely to be motivated to start a team business.

Previous research suggests that the broad implementation of compulsory entrepreneurship courses is a way to improve the entrepreneurial climate at universities (Bergmann et al. 2018). Yet, the likelihood of students to start a business, especially a team business, is particularly high when they decide themselves to attend entrepreneurship education while at the same time the university is perceived as supportive for entrepreneurial activities.

While one might assume that the participation in an entrepreneurship course increases the likelihood of finding a fellow student as suitable founding partner, as argued by the social psychological view of team formation (Ruef 2010), we could not find evidence for such an effect (see supplementary material).

Overall, our results stress the importance of taking a contextual view and acknowledging different types of courses when studying the effects of entrepreneurship education (Pittaway and Cope 2007). Our results are in line with other studies on entrepreneurship education which suggest context-specific effects. For example, Hahn et al. (2020) argue that parents' performance in entrepreneurship increases the extent to which students are motivated to learn entrepreneurial skills. Concerning other career trajectories, entrepreneurship course participants have been found to view larger firms as more attractive employers because of their greater availability of resources compared to small ones. Again, this effect seems to be stronger for students who grew up in an enterprising family (Hahn, Brumana, and Minola 2022).

We discuss the policy implications of our findings in the supplementary material.

## 7. Limitations

Our paper and methods are not without limitations. First, despite measuring the entrepreneurial climate two years ahead of the dependent variables and controlling for whether people study at their university because of its good entrepreneurial reputation, we cannot completely rule out the possibility that our results are partly affected by other sources of endogeneity. Such could occur when people who self-select into certain contexts (i.e. universities with a positive entrepreneurial climate) are more likely to aim for a team business than others. Also, our moderator entrepreneurship course participation might be related to entrepreneurial climate, as a positive entrepreneurship climate is likely to form at universities where students have to visit compulsory entrepreneurship courses (Bergmann et al. 2018). Conversely, a positive entrepreneurial climate might encourage students to register for an entrepreneurship course. Second, our interaction hypotheses assume that context has a different effect on people with different preferences. In our study, we have not been able to measure the preference for growth and/or independence directly but only personal characteristics such as gender and course participation. We encourage future research do directly measure personal preferences and their interaction with context characteristics. Also, there are likely to be further person-related factors that interact with context characteristics in stimulating solo and team startups. Third, while our data basis has the advantage of offering data for a large number of students from different contexts, we can identify subject groups only and not specific academic disciplines the students are studying (like biology or economics). Fourth, there might be students who simultaneously try to start a solo and a team business, which is not captured in the GUESSS data collection. While such

cases should in theory be deleted from a multinominal regression, we believe that the number of such portfolio nascent entrepreneurs is likely to be small in reality. Finally, we are not able to consider the individual social networks of entrepreneurs and how they are affected by the organizational context, which might also influence the decision to start a team business.

## 8. Conclusions

Our study was motivated by the need to better understand the emergence of solo and team entrepreneurship as embedded in and shaped by the university context. Our study highlights person-context interactions within a university that stimulate solo and team entrepreneurship. Ruef, Aldrich, and Carter (2003) have stressed the importance of (gender-)homophily and social relations in team formation processes. Yet, our study suggests that the decision to start a team business or a solo business is driven by strategic resource considerations and intrinsic motivation pathways which interact with the perceived supportiveness of the organizational context. Current approaches to support entrepreneurial thinking and acting at universities might have appealed differently to people with specific motivations and aspirations, unintentionally leading to gender-specific team formation processes and resulting in more female solo startups and male-dominated startup teams.

## Notes

1. Scholarly publications based on GUESSS data are listed here: www.guesssurvey.org/publications/
2. The main reason why we only consider European universities is to have a greater homogeneity in our sample concerning structure of the university system, cultural characteristics, and level of economic development. All nine countries in our sample are members of the EU or EFTA and are high-income economies, according to the definition of the World Bank.
3. We assume a uniform distribution of individual evaluations for calculating the IRA values.
4. In other words, we can rule out the explanation that our results can only be attributed to people who think and act entrepreneurially and at the same time provide a positive assessment of the entrepreneurial climate.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Declarations

All participants in our data collection have given their informed consent to participate in this study and to the storage of their data in anonymous form. The link to the online survey was sent via the email distribution list of the 58 participating universities. In some cases, the approval of the university ethics committee was necessary to send the invitation to participate.

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