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Effort provision in entrepreneurial teams: effects of team size, free-riding and peer pressure

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Abstract This paper analyzes whether effort provision in entrepreneurial teams depends on the size of the team, assuming that size determines the strength of free-riding and peer pressure effects in entrepreneurial teams. We provide a theoretical model and empirical analyses to explain the joint effect of free-riding and peer pressure on effort in start-up teams. We begin with an economic model by Kandel and Lazear in J Polit Econ 100(4):801–817, (1992) and enrich it using insights from entrepreneurship research. Based on our model, we first hypothesize that with increasing team size in entrepreneurial teams, the efforts of the individual team founders should follow an inverted U-shaped pattern. Second, we argue that the peer pressure effect is stronger if team members have stronger social ties, and thus we expect the effort-maximizing team size to be larger in teams with stronger social ties. Using a data set from 214 German start-up teams, we find that our hypotheses are supported by the data.

Keywords Peer pressure · Free-riding · Entrepreneurial teams · Team size

JEL Classification M13 · M59 · L26

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1 Introduction

The entrepreneurship literature shows that although a large fraction of entrepreneurial activity is undertaken by solo entrepreneurs, a substantial fraction of entrepreneurship is shaped by founding teams (see, e.g., Reynolds and Curtin 2009). Therefore, a key question is why and under what conditions entrepreneurial teams are likely to be (un)successful given that they, on the one hand, have particular advantages such as increased skills and resources, but on the other hand also have particular disadvantages such as increased coordination and incentive problems; the latter problem may lead to inefficiently low efforts and is the focus in this paper. Assuming that team size determines not only free-riding but also peer pressure in entrepreneurial teams, we show that effort provision in entrepreneurial teams follows an inverted U-shape with increasing team size and that close social ties moderate the effect.

Regarding the advantages of skills and resources for entrepreneurial ventures, Lazear (2005) shows that successful entrepreneurs must be "jacks of all trades" who are equipped with a balanced variety of skills. Although most entrepreneurs may decide that they have all of the skills and resources necessary to become successful solo entrepreneurs (Lazear 2005), other entrepreneurs may decide to assemble a founding team because they need the additional skills and resources of founding partners—and they weigh the benefits of the additional founders higher than the likely conflicts with additional team members (e.g., Brüderl et al. 1996; Ensley and Amason 1999; Jehn et al. 1999; Ensley and Hmieleski 2005; Chowdhury 2005). The benefits from forming a team are a greater set of skills and competencies and a wider network of social and business contacts, which should better prepare the founders to manage the challenges imposed upon them (e.g., Aldrich 1990; Cooper and Daily 1997; Kor and Mahoney 2000; Brinckmann and Hoegl 2011; Fabel et al. 2013). The additional costs are that the team needs more coordination and that they may run into severe incentive problems, which do not occur for solo entrepreneurs. Therefore, unsurprisingly, start-up teams do not always achieve (in any performance measure) more than single founder start-ups despite their resource-based advantages (e.g., Cooper et al. 1994; Almus and Nerlinger 1999). Thus, only a relatively small proportion of new ventures is actually started by more than one individual and larger start-up teams are more the exception than the rule (e.g., Chandler and Hanks 1998; Mellewigt and Späth 2002; Ruef et al. 2003; Chandler et al. 2005).

In our paper, we focus on the above-mentioned incentive problems in startup teams, namely free-riding leading to inefficiently low efforts on the one hand and peer pressure as a possible solution to offset the problem on the other hand.[1] Whereas previous literature primarily suggests that these disadvantages result from too much team diversity causing (affective) conflicts among start-up team members, which may remain unresolved (e.g., Ensley and Amason 1999; Ensley et al. 2002; Lockett et al. 2006; Talaulicar et al. 2005; Littunen 2000; Vyakarnam and

[1] Thus, working in teams (of founders) creates particular problems and may result in a less-than-optimal use of additional resources if these problems cannot be resolved. Resources brought in by additional team members may not be fully or efficiently utilized and may therefore hinder the success of team startups.

Handelberg 2005; Parker 2009),[2] we provide an additional explanation: we argue that startup teams are faced with the typical incentive problems of teams that only share their returns. Members of a team of founders share their profits, but their costs (in our case, the effort costs) are covered by each member individually. Consequently, such teams run into the well-known free-riding problem (e.g., Demski 1972; Alchian and Demsetz 1972; Holmström 1982), and as a result, team founders keep their effort inefficiently low—particularly when team size increases. Thus, according to this economic theory, large teams cannot be expected to better perform than small teams. Reduced efforts lead to a less-than-optimal use of the additional resources and to reduced performance and start-up success.

The novelty in our paper is that we examine how peer pressure may help to offset this free-riding effect in startup teams. We study how the joint effect of peer pressure and free-riding determines effort in start-up teams of different sizes, and we expect an inverted U-shape for entrepreneurial effort. We also examine how incentives change with increasing start-up team size and how that effect is moderated by the characteristics of its team members. Our theoretical analysis is built on an economic model introduced by Kandel and Lazear (1992) in which free-riding and peer pressure in teams already counterbalance one another; however, team size does not determine the joint effect in their model.

In our extension of their model, we introduce team size as an important variable determining the strengths of each of the two opposing effects, thereby determining the total effort among teams. By applying this extended model to the particular situation of startup teams, we are able to derive two hypotheses regarding how the size of entrepreneurial teams affects effort provision in such teams. We argue that entrepreneurial teams (consciously or not) use a unique monitoring technology that is based on 'spatial proximity' and 'high-frequency decision making' and that both of these characteristics increase peer pressure and, thereby, the effort of their fellow team founders.[3] Based on this special entrepreneurial monitoring technology, we derive two testable hypotheses. First, with increasing initial team size, effort within start-up teams should follow an inverted U-shaped (concave) pattern, meaning that there is an effort maximizing initial team size N^*. Second, we expect N^* to be larger if the founders have *stronger social ties*, as is the case with social interactions between family team members (due to stronger peer pressure) (e.g., Francis and Sandberg 2000; Ruef et al. 2003).

Our paper extends beyond Kandel and Lazear (1992) by explicitly introducing team size as one important variable determining the strength of the peer pressure effect and by applying their model to the special situation of entrepreneurial teams (as opposed to established teams). While Kandel and Lazear model the level of peer pressure as an exogenous factor that is not dependent on team size N, we argue that

[2] In contrast, research also emphasizes that diverse teams are more effective because they better overcome cognitive conflicts (e.g., they allow team members to see multiple perspectives and avoid hazardous decisions).

[3] In an established firm with already developed HR management, this monitoring technology would be a human resource tool, e.g., a feedback system including performance measures to control and incentivize employees' effort level. In a start-up, such instruments are missing. However, we argue that founders monitor each other while working together, consciously or unconsciously.

peer pressure also depends on *N*. Moreover, and to the best of our knowledge, this present paper is the first to focus simultaneously on the effects of team size on free-riding and peer pressure in entrepreneurial teams.

We test our model using a data set of 214 German team start-ups from the greater Cologne area. As expected, we find that effort (measured by weekly working hours) has an inverted U-shape in the context of increasing team size, meaning that there is an effort-maximizing team size N^*. With respect to our moderator, we find that N^* is higher if there are stronger social ties among team founders (i.e., family ties) because such ties strengthen the internal (i.e., the pressure that a person puts on himself or herself) and external (i.e., the direct pressures that others put on a person) peer pressure effect.[4]

Thus, the primary contribution of the paper is twofold: we first provide an extension of a theoretical model by Kandel and Lazear (1992) to derive hypotheses on the relationship between effort provision and team size in entrepreneurial teams, and we also test these hypotheses with econometric analyses using field data. We acknowledge that measuring effort is complicated and that using the average weekly working hours of only one team member (i.e., the responding team member) could present potential problems. Thus, our empirical results should be regarded as first tentative evidence stimulating more empirical future research.

The remainder of the paper is structured as follows. In the next section, we outline the theoretical framework for our empirical analysis. Then, we test our propositions using multivariate analysis. Finally, we conclude with a discussion of our primary results, some limitations to our analysis and questions for future research.

2 Theory and hypotheses

Although there is a large body of literature in entrepreneurship that focuses on team-level issues, to date, the impact of initial team size on effort in start-up teams has not been analyzed in depth. In recent years, a strand of research has emerged that addresses the actual formation of entrepreneurial teams and subsequent changes. Forbes et al. (2006), for example, show that resource seeking is a primary motive behind adding team members. In addition, Ucbasaran et al. (2003) provide evidence that the size of the founding team is negatively associated with subsequent team member entry, while family firms are negatively related to team member exit. Such results already suggest that in new venture teams, optimal team sizes appear to exist, which seem to be higher in a family firm context.

Another body of research focuses on team processes and team effectiveness. Chowdhury (2005), for example, pays particular attention to diversity in team composition and the effectiveness of entrepreneurial teams (see also Jehn et al. 1999; Ruef et al. 2003; Horwitz 2005; Vanaelst et al. 2006; Nederveen Pieterse et al. 2012; Leung et al. 2013; Fabel et al. 2013). He finds that demographic diversity

[4] The wording "internal and external peer pressure" (Kandel and Lazear 1992) means more or less the same as the terminus "team identification" in the sociological literature.

does not appear to be important for entrepreneurial team effectiveness. Chandler et al. (2005) analyze whether departures from a start-up team are positively related to performance, i.e., they implicitly study the effect of a shrinking team size on performance. Building on additional insights from the lifecycle literature, these authors find a positive relationship between team departures and performance that is moderated by the stage of development, meaning that the effect of dropping members from a start-up team becomes increasingly positive as the venture develops. Similar results were achieved for adding members to the team. Adding members reduces performance for emerging ventures. Thus, in their study, there obviously appears to be a non-linear relationship between team size and performance. However, the paper does not analyze the effect of a different size at the starting time on the individual effort of the team members or where the effect may originate. In particular, they do not analyze whether free-riding and/or peer pressure effects exist and dominate their results. To summarize the literature, research to date does not address the relationship between team size and the effort of team members and the respective results in terms of entrepreneurial effectiveness. Thus, in our paper, we try to fill this gap by analyzing free-riding and peer pressure in initial new venture teams and their consequences on effort.

Standard economic theory suggests that team members generally have an incentive to exert less-than-efficient levels of effort, whereas *single* owners always choose the most efficient effort level because they aim to maximize the value of their firms (Jensen and Meckling 1976). In a *team* of owners (partnerships), however, partners are expected to suffer from standard free-riding problems just as any other team of workers does (for seminal studies, see Demski 1972; Alchian and Holmström 1982; Bailey 1970; Newhouse 1973).

Kandel and Lazear (1992) show that in partnerships (i.e., ownership teams), free-riding may be counterbalanced by *peer pressure*. A large body of literature picks up their idea. Recent economic papers have provided empirical evidence regarding peer pressure. For example, Knez and Simester (2001) examine the introduction of a company-wide team incentive scheme at Continental Airlines and observe an increase in productivity. Regarding the experimental evidence of peer effects, Falk and Ichino's (2006) paper has become very popular because they are the first authors to provide empirical evidence for the existence of "pure" peer pressure. In a real effort experiment with fixed compensations for the participants, they find a significantly positive effect if people work side by side compared to working alone. For the most part, however, the existing literature focuses on teams of workers within an employer-employee relationship and therewith analyzes the use of incentive contracts to overcome the free-riding problem via peer pressure (see, e.g., Huck et al. 2010; Radoslawa 2009; Grosse et al. 2011). Che and Yoo (2001) theoretically prove that incentives for team performance are more effective in an infinitely repeated game because the team members can sanction the past behavior of their co-workers. A more recent stream of the literature on peer effects considers social preferences; these behavioral approaches explain which type of social preferences triggers peer pressure. Mohnen et al. (2008) assume inequity aversion and provide theoretical and experimental evidence regarding how peer pressure affects effort. A key result of their paper is that transparency is a necessary

condition. Hence, workers must be able to observe their counterparts; otherwise, peer pressure does not work. Their transparency argument is consistent with our characteristics of venture teams, namely spatial proximity and interaction due to high frequency decision making. Mas and Moretti (2009) also show that peer pressure is more effective for worker teams if the team members work face-to-face with their counterpart. Bandiera et al. (2010) provide evidence using Facebook data that social incentives (social ties) on average have a positive impact on output. However, to the best of our knowledge, a publication examining peer pressure effects and the factors triggering peer pressure in a new venture team is still missing.

To determine the team size at which free-riding and peer pressure best counterbalance one another in new venture teams, we utilize the formal model by Kandel and Lazear and modify it using the specificities of entrepreneurial teams, namely *spatial proximity* and *high-frequency decision-making* (e.g., Sapienza and Gupta 1994; Chen and Börner 2005). These characteristics are key features of start-ups, as several papers show (e.g., Thornton 1999; Aldrich 1990; Lechler 2001). It also appears that founder teams, unlike established partnerships, are characterized by a particular communication structure. Because organizational structures and formal processes are not yet established, steady and close social interaction between the founders is a key characteristic of start-ups. Additionally, spatial proximity leads to intensive social interaction. Due to this spatial closeness and the need to continually make rapid and often fundamental decisions, founders constantly interact (informally, formally or randomly) and stay in close personal contact. One consequence of this set-up is that monitoring does not entail a formal process; team members have many implicit opportunities to monitor one another independent of team size. We consider these special features of start-up teams to be a particular monitoring feature within our model. Consequently, the resulting peer pressure effect increases with additional partners (at a decreasing rate). That is, not only does free-riding depend on team size N (as is well known), but peer pressure does as well.

Hence, *two effects* exist that move in opposite directions with increasing start-up team size. Free-riding causes effort levels to decrease, but peer pressure causes effort levels to increase; as a result, the total effort level should follow an inverted U-shape, as we show with our model. Consequently, there should be an effort-maximizing team size N^* for any particular type of start-up, and N^* itself should depend on the specific characteristics of each start-up. The basic features of our formal model will be explained in more detail and intuitively in the following section, but the full formal model can be downloaded from http://www.uf.wi.tum.de/forschung/forschungsprojekte/.

2.1 Free-riding and peer pressure in start-up teams: formal model and hypotheses

Similar to the model used by Kandel and Lazear (1992), our formal model builds on a set of straightforward *general economic assumptions*. A start-up team has N partners i $(i = 1, \ldots, N)$, each of whom chooses his or her (hereafter his) individual effort level e_i and bears individual costs $C(e_i)$ with increasing marginal

costs $C'(e_i)$. Individual efforts taken together[5] determine the output of the team $f(e)$ with diminishing rates of return $f'(e)$. Total output is split evenly (or with ex ante fixed shares) among all partners. Each partner maximizes his individual utility u_i: that is, his individual share of the output $f(e)/N$ minus the individual costs of effort $C(i)$. Because the individual bears the full costs of effort $C(i)$ but only receives $1/N$ of the output $f(e)$, start-up teams suffer from *free-riding,* with individual effort at a lower-than-efficient level and with the free-riding effect increasing with team size N.[6]

As Kandel and Lazear (1992, p. 805f) have shown, *peer pressure* (in their case, mostly *external* peer pressure) may effectively counterbalance free-riding in partnerships if two conditions are met. First, the effort of one team member i must affect the well-being of the other team members so that they have an incentive to exert peer pressure P_i on him. Given the typical rule of profit-sharing in start-up teams, this condition is generally fulfilled; if one of the team members fails to perform his share of the work, then the returns to all other team members will be diminished. Therefore, it can be assumed that these members have an interest in exerting peer pressure. Second, in addition to willingness to exert peer pressure, there must be a channel through which the effort choices of fellow team members can be influenced. Kandel and Lazear introduce *mutual monitoring activities* a_i as a way to actively influence the strength of peer pressure. Monitoring actions create individual costs; thus, the cost function now includes effort costs and monitoring costs $C(e_i,a_i)$. Monitoring increases the effort levels of other team members via peer pressure $P(e_i,(N-1)a_j)$. What ultimately causes team members to increase their effort is the interaction between being monitored by others and exerting a particular effort level to alter the probability of being caught shirking.

In our model, we also use a *monitoring cost function* $C(e_i,a_i)$ and a *peer pressure function* $P(e_i,(N-1)a_j)$ but introduce assumptions that enable us to adapt the model to the special qualities of start-up teams. We assume a *cost function* $C(e_i,a_i)$ that reflects the typical *spatial arrangements* of start-up teams. As described above, start-up teams usually work in close *spatial proximity* and they must continually make rapid and often fundamental decisions; hence, they constantly interact and remain in close personal contact.[7] Accordingly, founders have many opportunities to monitor one another because of these intensive interactions (Clarysse and Moray 2004). When such a dynamic exists, mutual monitoring evolves as a byproduct of daily business with almost no additional costs. More specifically, individual *costs* $C(e_i\ a_i)$ are not related to the number of fellow team members because watching an additional team member adds no noteworthy additional costs if the team members are frequently together anyway. We also assume a *peer pressure function* that reflects the typical spatial arrangements of start-up teams. We assume that the peer

[5] There are no complementarities assumed in our model. This approach is consistent with Adams (2002), who uses a similar production technology for medical and legal practices. In our case, this assumption appears to be reasonable because output for us is not sales or profits but rather effort (as measured by individual working time, which simply adds up to a total amount of working time).

[6] Under our assumptions, these results have already been proven by Barua et al. (1995, p. 500), among others.

[7] For the importance of close spatial proximity for the strength of peer pressure, see Zimmermann (2003).

pressure that a person feels stems from the probability that others will notice him withholding effort e_i. As our intuition tells us, peer pressure increases with N but does so at a decreasing rate: a large number of peers watching a team member i makes it more likely that member i's shirking will be detected, creates a greater level of pressure, which member i feels, and encourages member i to exert greater efforts to avoid censure. Altogether, the cost function $C(e_i,a_i)$ of mutual monitoring a_i and the strength of the exerted peer pressure create a peer pressure effect $P(e_i,(N-1)a_j)$ that increases with increasing start-up team size N (at a decreasing rate).

The ultimate question involves the *joint effect of free-riding and peer pressure,* which in our model now both depend on N. By mathematically solving the effort-maximization problem for individual team members i, we show that effort follows an inverted U-shaped pattern. In relatively small start-ups, the positive effect of peer pressure on effort dominates the negative free-rider effect on effort, whereas in large teams, the reverse is true. Consequently, effort first increases with the number of initial founders on the team (up to a certain size) and then decreases again. Therefore, smaller teams suffer less from free-riding than do large teams because peer pressure is strong enough to counterbalance free-riding However, as teams grow, peer pressure becomes less able to counterbalance free-riding, and above a certain team size, free-riding takes over and causes effort to decrease again. A possible reason behind this mechanism could be an increase in coordination costs. There is thus an "optimal" (effort-maximizing) team size N^*, which leads us to develop our first empirically testable hypothesis:

> *1. Effort follows an inverted U-shaped pattern with increasing team size, and there will thus be an effort-maximizing team size N* for start-up teams* **(Hypothesis 1)**.

Regarding the relative strength of peer pressure, we again begin with Kandel and Lazear, who make a distinction between internal and external peer pressure and apply this distinction to the dynamic of entrepreneurial teams to derive more specific hypotheses regarding the determinants of the "optimal" team size N^*. While external peer pressure refers to the direct pressures that others put on a person, internal peer pressure emerges whenever a team member's individual effort e_i deviates from an established group norm $\bar{e}$ that has been internalized by that member. This norm could be a cultural one or could simply be the average effort level $\bar{e}$ of the team. Thus, internal peer pressure is driven by an individual desire to maintain the group norm because deviations from the norm are costly at an individual level. Thus, no external tool is needed; internal pressure is pressure that a person puts on himself or herself. For example, this type of peer pressure might be driven by questions of fairness or inequity aversion (e.g., Fehr and Schmidt 1999; Mohnen et al. 2008), and according to sociological studies (e.g., Liden et al. 2004; Karau and Williams 1997), internal pressure works particularly well in teams with strong social ties, including teams composed of family members or old friends, old boys' networks or other cultural in-groups. Put differently, social interactions between family members in new ventures are particularly shaped through high-trust channels of communication; that is, in this context, social interactions are

characterized by an ease of communication (same language, common culture) and a high degree of trust and emotional intensity (see, e.g., Dubini and Aldrich 1991; Casson and Della Giusta 2007).

For example, if a team member in a new venture family team would be shirking, then his individual costs would be higher—because the consequences are not restricted to the work environment—than they would be if the team did not include family members or friends. Thus, as indicated above, external peer pressure works when a fellow team member *j* observes the effort of team member *i* and "makes" him "feel bad". That is, if other team members *j* monitor member *i,* peer pressure leads to increased individual effort e_i. In this context, we believe that social pressure not to shirk will be effective if mutual monitoring occurs between family members in new venture teams.

Furthermore, the effectiveness of mutual monitoring, as we describe it for start-up teams, is also improved if it is easier for team members to evaluate the work of their fellow team members. Therefore, we expect the peer pressure effect to be higher and thus expect the effort-maximizing team size N^* to be larger for start-up teams whose members have more similar social backgrounds. Moreover, shirking may also be less likely in dense teams because deviant behavior is not only easily observable but social sanctions (e.g., social exclusion) are also less costly and more effective in dense networks (Coleman 1990).

Finally, we find evidence of the importance of strong social ties in entrepreneurship and family business research. That is, we follow a large body of entrepreneurship research suggesting that family ties in particular are strong ties (see, e.g., Witt 2004) and that support from such strong ties appears to be especially important for new venture survival and growth (see, e.g., Brüderl and Preisendörfer 1998). Ensley and Pearson (2005), for example, show that the unique dynamics created by the social aspects of family-owned firms result in greater cohesion, potency and strategic consensus compared to top management teams of new firms (see also Nordqvist 2005). Francis and Sandberg (2000) show that tie strength (i.e., friendship) has a positive impact on the foundation of a venture team and its success (see also Patel and Terjesen 2011). A key result of Ruef et al. (2003) is that homophily and network constraints based on strong ties have an impact on group composition (see also Parker 2009). Regarding performance, Bandiera et al. (2010) find a positive effect from social incentives (social ties) as well. In sum, we thus conclude that, all else being equal, start-up teams with strong social ties should exert more effort than other types of teams. This conclusion leads us to our second hypothesis:

2. Because peer pressure is stronger if team members have stronger social ties, the effort-maximizing team size N should be larger for teams with closer social ties: e.g., start-up teams composed of family members (***Hypothesis 2***).*

3 Data, measurement issues and methodology

3.1 Data

To provide initial empirical support for our hypotheses, we use a cross-sectional data set for start-up companies in the greater Cologne area in Germany. The data were gathered as part of a large entrepreneurship project conducted by one of the authors (for more details see Backes-Gellner and Werner 2007). A representative sample was drawn from independent new ventures registered with the Cologne Chamber of Commerce in the last quarter of 1998 and the first quarter of 1999. All firms considered were founded between 1992 and 1998. The distribution of firms was representative across sector and size classes. In 1999, approximately 17,800 new ventures in the greater Cologne area received a questionnaire by mail covering a broad spectrum of questions regarding their founders' personal background, the economic background of the start-up, their financial situation and their production technology. A total of 910 questionnaires were returned, yielding a response rate of approximately 5.1 %. While the response rate may appear to be quite low, we find that these 910 start-ups match the original sample quite well with respect to the sectors and firm sizes represented. Moreover, we find no significant differences between early and late respondents with regard to sector and size classes. The present study uses a sub-sample of 214 new ventures that were founded by a team. Originally, a sub-sample was obtained of 320 start-ups launched by a team, but only 214 of these 320 initial team start-ups answered all of the questions that were relevant to our empirical analysis. Note, however, that the characteristics of the sub-sample of 320 team start-ups and the sub-sample of 214 team start-ups are nearly identical. Non-response bias should thus not be a significant problem. Start-ups with initially just one founder were excluded from our empirical analysis because in such cases, neither a free-rider effect nor a peer pressure effect exists. Moreover, we focus on the initial phase of the new venture's life cycle (i.e., when the new firm was created) because these start-up teams often have little or no formal organizational structure at their creation, making peer pressure and mutual monitoring even more important for them. Please note that most of the variables used in our study were measured at the individual level, that is, for the team member who answered the questionnaire, while some characteristics such as industry, year of foundation or the number of initial team members relate to the new team venture as a whole. Therefore, our proxy for effort is calculated at the individual level (as suggested by our theoretical model) and not at the team level. Hence, we assume that the person responding to the questionnaire is representative of all start-up team members because a single team member from each team was randomly selected to receive the survey. We argue that if the respondents are a non-biased sample of team founders, the relationship between team size and effort that we estimate in this particular sample of "responding" team founders should be the same as the relationship between team size and effort in the overall sample of team founders. Following this line of reasoning, the results should then be generalizable to all start-up team members, although we collected most of the information from one team member from each start-up team. However, we are aware that not having any information on

the effort of the other team members is a potential limitation of our study. We will discuss this point in more detail in the limitations section.

3.2 Measures

3.2.1 Dependent variable

The dependent variable measures work effort with the variable "WeeklyHours-Worked" of individual team members. In considering the internal validity of our dependent variable, we follow Verheul et al. (2009). In their study, time-allocation decisions in new ventures are investigated using a model that distinguishes between the effect of preferences (i.e., alternative time-consuming activities) and that of productivity on working hours. They find proof that the productivity of the founder's work time is strongly related to his human and financial capital, while the preference for more or less work time is strongly related to start-up motivation and the availability of other income. In addition, they find that the same human and financial capital variables that are positively linked to initial work time are also positively linked to actual profit 1 year after the creation of the start-up (see also Bosma et al. 2004). Thus, the number of "WeeklyHoursWorked" appears to indicate both the quantity and the quality aspects of effort quite well. In our estimations, we use a similar set of independent variables as controls to rule out the effects of productivity and work time preferences on the number of working hours. In turn, our major explanatory variable, team size, should reflect important facets of the joint effect of free-riding and peer pressure on the individual team members' effort levels. Moreover, because the founders of a start-up typically have maximum discretion as to how much individual working time they invest as well as when and where they spend it, they have substantial discretion regarding how much input/effort they exert. However, we assume that the individuals' overall working time is not fully observable by fellow team members. Furthermore, part of this time may be spent outside the company talking to customers, clients or suppliers (i.e., in situations in which other team partners are absent). If working hours were fully observable and verifiable by the other team members, then the first-best contractual solution would be achieved by paying a variable salary, as shown by Kandel and Lazear (1992).

3.2.2 Explanatory variables

Initial team size N was measured (following Chowdhury (2005) and others) based on the total number of active partners with an equity interest in the new venture at the actual start of the new venture's business operations. According to hypothesis 1, we should observe an inverse U-shaped (concave) relationship between "Team-Size" and "WeeklyHoursWorked". Furthermore, we expect the optimal team size N^* to be larger if a start-up includes team members who have stronger social ties. Our data set contains a variable that directly measures strong social ties. The respondents were asked if their start-up team consists of family members. If the answer is "yes", then our dummy variable, strong social ties, is equal to one. If the

answer is "no", then our two-level variable is equal to zero. According to hypothesis 2, we should also observe a concave relationship between "TeamSize" and "WeeklyHoursWorked" when moderated by strong social ties. The effort-maximizing team size should be larger if team members have stronger social ties.

3.2.3 Control variables

Closely following the methodology of Verheul et al. (2009), we include a range of control variables that account specifically for the effects of preferences (i.e., alternative time-consuming activities) and productivity on the number of working hours. Furthermore, it is important to rigorously control human and financial capital because they may be subject to signaling effects based on qualities of the responding team founder. High-quality entrepreneurs, for example, may work fewer hours if they are able to attract other team partners at the start of the new venture. Consequently, in our estimations, we include seven human capital variables (experience in business, ownership, experience in the industry in which the new business is active, experience as an employee, having parents who are self-employed, founder's age, years of education, higher education and non-completion of higher education) and two financial capital variables (whether the start-up initially experienced financial problems because of a past business bankruptcy and whether the start-up initially struggled to acquire sufficient debt capital because of problems providing enough collateral security). Subsequently, we control for other time-consuming activities (a second job/income, other motivations and marriage). Verheul et al. (2009) argue that the non-pecuniary benefits of self-employment [such as being one's own boss or the desire to develop one's own business idea (intrinsic motivation)] can be seen as a factor that determines the time spent on self-employment (Hamilton 2000; Werner and Moog 2007). Therefore, it can be assumed that intrinsically motivated entrepreneurs work longer hours than others. In contrast, individuals who are forced into self-employment (because of unemployment or the threat of becoming unemployed) are expected to be less intrinsically motivated and to spend fewer hours on their self-employment. Moreover, we include more control variables that place the focus on team relationships. First, we include a measure for ownership interest, which is the ratio of the team respondents' own invested equity and the total amount of capital invested in the new venture (by all team members): that is, a type of equity ratio. At the most basic level, we assume that high ratios indicate that the responding team member owns a large percentage of the shares. We also control for hired employees at the beginning of the new venture to rule out the possibility that team members may not have needed to work as many hours because they were able to hire employees. In addition, we include a large number of industry dummies to control for industry-specific differences in the competencies and resources required for a start-up (Mellewigt and Späth 2002). Finally, to mitigate problems associated with survival bias (recall that the respondents were retrospectively asked about the number of hours per week they had worked at the start of the new team venture), we include a set of dummies denoting the year when the team start-up was founded. Recall bias could also be

reduced by including year dummies because using year dummies refers the answers to more recent or more dated effort.

Table 1 presents the definitions, means and standard deviations of all variables included in our study. Table 2 presents zero-order correlations between "WeeklyHoursWorked" and all independent variables. Several independent variables are significantly correlated with "WeeklyHoursWorked" on a bivariate basis, most prominently "SecondJob" (reflecting alternative time-consuming activities).

4 Results

Using hierarchical regression analysis to test the first hypothesis, we estimate four econometric models. Because the variable "WeeklyHoursWorked" is metric, we use OLS regressions. Table 3 displays the results using robust variance estimators, with "WeeklyHoursWorked" as the dependent variable.

In Model 1, we include only the above-described sets of control variables and of human and financial capital variables. In Model 2, we include our team size variable by assuming a linear relationship between "TeamSize" and "WeeklyHoursWorked". Model 3 allows for an inverted U-shaped relationship by adding "TeamSizeSquared" to test for the non-linear effect of the number of team members. In Model 4, we include the above-described two-level categorical variable measuring social ties interacted with "TeamSize" and "TeamSizeSquared" to test if the quadratic relationship is moderated by strong social ties.

We find that hypothesis 1 (effort follows an inverted U-shaped curve with increasing team size) is strongly borne out in the data: in model 2, which implies a *linear* impact from team size on effort, the team size variable has *no* significant effect. However, in model 3, which implies a U-shaped relationship, we find a significant positive coefficient of "TeamSize" and a significant negative coefficient of "TeamSizeSquared": i.e., an inverted U-shape (concave) relationship as expected. The predictive values of the curvilinear nature are displayed in the left panel of Fig. 1. The results show that effort measured in terms of "WeeklyHoursWorked" first *increases* with the number of founders up to a maximum size of three team members and then *decreases* again with the number of founders in a start-up-team. Put differently, the peer pressure effect appears to dominate the free rider effect in small start-up teams ($N^* \leq 3$) and the free rider effect appears to dominate the peer pressure effect in larger start-up teams ($N^* > 3$).

The importance of the inverted U-shape effect is also indicated by the goodness of fit, which increases substantially from Model 2 to Model 3. That is, the inverted U-shaped impact of "TeamSize" and "TeamSizeSquared" explains a substantial share of the variation in "WeeklyHoursWorked". In addition, an incremental F-test was conducted that confirmed the significant effect of the squared team size variable. Moreover, the Ramsey test for omitted-variable bias produced no evidence of omitted variables. The Breusch-Pagan/Cook-Weisberg test showed that the null hypothesis of constant variance had to be rejected, so we used White-corrected (robust) standard errors. Finally, the information-matrix test showed no evidence of non-normal skewness.

Table 1 Description of variables

Variable name	Variable description	Mean	SD
Dependent variable			
Weekly hours worked	Number of hours worked weekly with the start-up measured at the starting time of the new team venture [metric, in hours]	54.98	17.13
Major explanatory variables			
TeamSize	Number of team partners at the starting time of the start-up [metric, in numbers]	2.60	0.89
StrongSocialTies	Is (are) your initial team partner(s) family members? [0 = no; 1 = yes]	0.23	
Human capital variables			
ENTexperience	Did you have founding experience before starting this new business? [0 = no; 1 = yes]	0.32	
INDexperience	Did you have prior job experience in the industry of the start-up before starting the new business? [metric, in years]	9.03	7.52
EMPLexperience	Were you employed before starting the new venture? [0 = no; 1 = yes]	0.24	
ParSelfemployed	Has either of your parents been self-employed? [0 = no; 1 = yes]	0.36	
Education	Years of education before start-up was launched [metric, in years]	16.60	2.79
CollDropout	Respondent has college dropout experience prior to start-up [0 = no; 1 = yes]	0.06	
HighEducation	Respondent has higher education prior to start-up (University degree and/or master craftsmen) [0 = no; 1 = yes]	0.61	
FoundersAge	Age of founder at the time the business was started [metric, in years]	36.26	8.14
FounderForeign	Nationality? [0 = German; 1 = Foreign]	0.05	
Financial capital variables			
ProbBankruptcyPast	Problems obtaining initial start-up credits because of bankruptcy in the past [0 = no; 1 = yes]	0.12	
NoDebtRequested	No initial debt capital for the new venture requested [0 = no; 1 = yes]	0.40	
NoDebtReceivedProbColl	Debt capital requested at the starting time of the new venture but none received because of problems with collateral [0 = no; 1 = yes]	0.27	
LessDebtReceivedProbColl	Less initial debt capital received than requested because of problems with collateral [0 = no; 1 = yes]	0.17	
AllDebtReceived	All requested debt capital received at the starting time of the new venture received without any problems [0 = no; 1 = yes]	0.16	
Controls			
SecondJob	Did you have another job besides running the new business at the beginning of the new venture? [0 = no; 1 = yes]	0.16	

Table 1 continued

Variable name	Variable description	Mean	SD
EquityRatio	Ratio of the team respondents' own invested equity and the total amount of capital invested at the beginning of the new team venture [metric, ratio]	0.59	
EmployeesHired	Employees hired at the starting time of the start-up [0 = no; 1 = yes]	0.45	
Married	Are you married? [0 = no; 1 = yes]	0.54	
BusinessIdea	Did your wish to realize a business idea have an important role in your start-up decision? [0 = else; 1 = yes, very important]	0.40	
Unemployment	Did (anticipated) unemployment play a role in your decision to start your own business? [0 = else; 1 = yes, very important]	0.07	
Age and industry			
StartupAge	Age of Team start-up when survey was conducted (metric, years)	2.80	1.80
Constr	Construction [0 = no; 1 = yes]	0.05	
Manufact	Textiles, motor vehicles, machinery and equipment etc. [0 = no; 1 = yes]	0.11	
Food	Food products and beverages, catering etc. [0 = no; 1 = yes]	0.02	
WholeSale	Wholesale, sale agencies [0 = no; 1 = yes]	0.09	
RetailSales	Retail sales and repair of consumer durables [0 = no; 1 = yes]	0.10	
Communication	Communication and information transmission [0 = no; 1 = yes]	0.04	
CredInsurance	Credit business, insurance industry, health and education services [0 = no; 1 = yes]	0.07	
DataProc	Data processing, hard- and software consultation [0 = no; 1 = yes]	0.14	
TradFreelance	Architecture, management consultancy, legal advise etc. [0 = no; 1 = yes]	0.14	
OtherFreelance	Advertisement, film distribution, recreation etc. [0 = no; 1 = yes]	0.14	
OtherServ	Other Services [0 = no; 1 = yes]	0.10	

Data are from the Cologne Founder Study

Table 2 Correlations between weekly hours worked and all independent variables

	1	2	3	4	5	6	7	8	9	10	11
1. WeeklyHoursWorked	1										
2. TeamSize	−0.002	1									
3. StrongSocialTies	0.034	−−0.057	1								
4. ENTexperience	−0.070	0.011	0.034	1							
5. INDexperience	−0.001	−0.089	0.005	0.154*	1						
6. EMPLexperience	−0.126	−0.066	0.002	0.456*	0.039	1					
7. ParSelfemployed	−0.047	−0.053	0.223*	0.039	0.057	0.103	1				
8. Education	0.060	0.132	0.153*	0.100	0.425*	0.070	−0.026	1			
9. CollDropout	0.092	−0.018	0.092	0.037	0.012	0.038	0.016	−0.167*	1		
10. HighEducation	0.088	0.108	0.068	0.008	0.316*	0.071	−0.011	0.825*	−0.320*	1	
11. FoundersAge	0.056	−0.042	0.064	0.143*	0.667*	0.122	−0.066	−0.089	−0.057	0.013	1
12. FounderForeign	−0.081	−0.001	0.037	0.039	0.057	0.029	0.113	0.048	0.129	0.040	0.102
13. ProbBankruptcy	−0.006	0.064	0.025	0.033	0.034	0.031	−0.057	−0.005	0.151*	0.039	−0.055
14. NoDebtRequest	−0.094	−0.003	0.080	0.021	0.069	0.008	0.076	0.001	−0.127	0.001	0.070
15. NoDebtReceived	−0.027	−0.007	0.087	0.073	0.017	0.041	0.045	−0.061	0.106	0.088	−0.038
16. LessDebtReceived	−0.011	0.004	0.052	0.042	0.006	0.095	0.032	0.002	0.043	0.050	−0.022
17. SecondJob	−0.468*	0.022	0.054	0.253*	0.006	0.380*	0.132	0.076	−0.057	0.057	0.063
18. EquityRatio	−0.099	−0.045	0.060	0.082	0.025	0.124	0.099	−0.030	−0.072	0.011	0.078
19. EmployeesHired	0.158*	0.016	0.129	0.004	0.080	0.009	0.070	−0.017	−0.035	0.012	0.061
20. Married	0.025	0.085	0.077	0.164*	0.373*	0.040	−0.023	−0.072	−0.080	0.000	0.487*
21. BusinessIdea	0.070	−0.073	0.061	0.007	0.051	0.047	−0.011	0.070	−0.049	0.046	0.087
22. Unemployment	−0.013	0.020	0.025	0.069	0.134	0.028	−0.051	0.007	−0.070	0.068	0.120

Table 2 continued

	12	13	14	15	16	17	18	19	20	21	22
1. WeeklyHoursWorked											
2. TeamSize											
3. StrongSocialTies											
4. ENTexperience											
5. INDexperience											
6. EMPLexperience											
7. ParSelfemployed											
8. Education											
9. CollDropout											
10. HighEducation											
11. FoundersAge											
12. FounderForeign	1										
13. ProbBankruptcy	−0.012	1									
14. NoDebtRequest	0.001	−0.147*	1								
15. NoDebtReceived	0.111	0.231*	−0.501*	1							
16. LessDebtReceived	−0.040	0.031	−0.365*	−0.278*	1						
17. SecondJob	0.146*	−0.039	0.117	−0.011	−0.025	1					
18. EquityRatio	0.131	−0.012	0.380*	0.195*	−0.371*	0.162*	1				
19. EmployeesHired	0.021	−0.097	−0.068	−0.121	0.067	−0.062	−0.119	1			
20. Married	−0.019	0.013	0.037	−0.021	−0.063	0.040	0.004	0.046	1		
21. BusinessIdea	0.044	0.058	0.094	0.049	−0.088	0.087	0.292*	−0.076	0.046	1	
22. Unemployment	0.199*	−0.043	−0.073	−0.006	0.023	−0.119	−0.021	−0.140*	0.032	0.001	1

* $p < 0.05$

Table 3 Robust OLS estimation results—team size and effort in start-up teams

Dependent variable: WeeklyHoursWorked	Model 1	Model 2	Model 3	Model 4
TeamSize (numbers)		0.079 (1.481)	15.91* (6.558)	10.89** (7.349)
TeamSizeSquared (numbers^2)			−2.355* (0.942)	−1.742$^+$ (1.048)
StrongSocialTies (yes)				−49.37* (23.82)
StrongSocialTies × TeamSize				30.47* (15.31)
StrongSocialTies × TeamSizeSquared				−3.896$^+$ (2.197)
Human capital				
ENTexperience (yes)	1.179 (2.464)	1.171 (2.450)	0.489 (2.425)	−0.067 (2.430)
INDexperience (up to 5 years)[a]	5.394 (3.683)	5.379 (3.696)	5.647 (3.721)	6.367$^+$ (3.733)
INDexperience (5–10 years)[a]	5.800 (3.628)	5.788 (3.630)	6.604$^+$ (3.710)	7.611* (3.808)
INDexperience (more than 10 years)[a]	5.204 (4.367)	5.188 (4.386)	4.995 (4.383)	4.619 (4.232)
EMPLexperience (yes)	1.880 (3.055)	1.899 (3.036)	2.514 (3.014)	2.755 (2.980)
ParSelfemployed (yes)	0.433 (2.452)	0.438 (2.466)	0.439 (2.460)	0.671 (2.535)
Education (years)	0.246 (0.704)	0.241 (0.710)	0.146 (0.716)	0.181 (0.724)
CollDropout (yes)	7.300$^+$ (4.135)	7.333$^+$ (4.146)	6.638 (4.285)	7.436$^+$ (4.383)
HighEducation (yes)	6.557 (3.996)	6.562 (4.011)	6.773$^+$ (4.095)	6.765$^+$ (3.986)
FoundersAge (years)	0.004 (0.214)	0.004 (0.215)	0.050 (0.214)	0.093 (0.211)
FoundersForeign (yes)	−1.898 (5.717)	−1.900 (5.736)	−3.236 (5.451)	−3.554 (5.740)
Financial capital				
ProbBankruptcyPast (yes)	0.740 (3.608)	0.737 (3.607)	1.620 (3.741)	2.797 (3.874)
NoDebtRequested (yes)[b]	−5.276 (3.525)	−5.282 (3.551)	−4.548 (3.515)	−5.709 (3.635)
NoDebtReceivedProbColl (yes)[b]	−5.485 (3.953)	−5.494 (3.996)	−5.185 (3.964)	−6.183 (3.978)
LessDebtReceivedProbColl (yes)[b]	−5.489$^+$ (3.168)	−5.495$^+$ (3.170)	−6.264$^+$ (3.225)	−7.130* (3.238)
Control variables				
SecondJob (yes)	−21.33** (4.106)	−24.35** (4.110)	−23.05** (4.138)	−22.61** (4.081)

Table 3 continued

Dependent variable: WeeklyHoursWorked	Model 1	Model 2	Model 3	Model 4
EquityRatio (ratio)	0.559 (4.223)	0.568 (4.249)	−1.448 (4.439)	−0.714 (4.557)
EmployeesHired (yes)	3.567 (2.162)	3.560 (2.190)	3.111 (2.157)	3.245 (2.207)
Married (yes)	−0.857 (2.502)	−0.874 (2.540)	−1.621 (2.540)	−2.040 (2.520)
BusinessIdea (very important)	4.777* (2.218)	4.796* (2.299)	5.320* (2.292)	5.356* (2.257)
Unemployment (very important)	−5.293 (3.920)	−5.302 (3.938)	−5.056 (4.031)	−3.262 (4.142)
Industry (11 categories)	Yes ($p < 0.01$)	Yes ($p < 0.01$)	Yes ($p < 0.01$)	Yes ($p < 0.01$)
Year of foundation (5 categories)	Yes ($p = 0.95$)	Yes ($p = 0.96$)	Yes ($p = 0.97$)	Yes ($p = 0.88$)
Observations	214	214	214	214
F value	3.89**	3.77**	4.14**	4.42**
R^2	0.388	0.388	0.406	0.414

Robust standard errors in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

[a] Reference no experience in industry

[b] Reference All requested start-up debt capital received (without any problems)

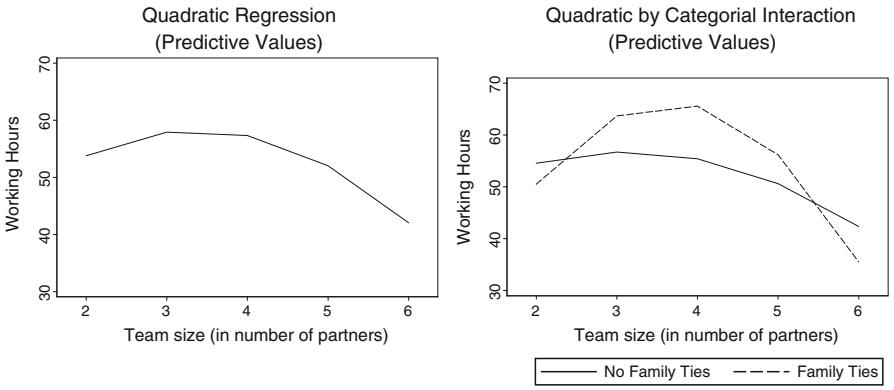

Fig. 1 Intitial team size, strong social ties and effort in start-up teams

Regarding our control variables, the results are consistent with what we find in the literature (e.g., Verheul et al. 2009). Intrinsically motivated team partners, ceteris paribus, work longer hours at their new venture, as do partners with prior job experience in the start-up industry. Furthermore, partners in team start-ups that have received less debt capital because of difficulty providing sufficient collateral security work fewer hours than do those who received all of the requested debt capital at the start of the new venture. The Equity Ratio (i.e., the share of capital invested by the responding team member) appears to have no effect on working hours, whereas having a second job negatively affects the number of work hours.

In model 4, we determine the specific conditions under which the effort-maximizing team size N^* is larger because of stronger peer pressure effects. According to hypothesis 2, we expect start-ups with team members with strong social ties to have larger effort-maximizing team sizes N^*. To test this hypothesis, we fit a model with "TeamSize", "TeamSizeSquared", our categorial social ties variable, as well as the interaction of these variables. The results show that the degree of curvature is significantly different ($F = 3.15$, $p = 0.078$) between new team ventures with and without strong social ties. Put differently, we find a significant effect from the interaction variable "StrongSocialTies * TeamSizeSquared". The right panel of Fig. 1 displays the predictive probabilities. Apparently, starting a business with team members with whom one has strong social ties causes founders to spend more time working on their start-ups. Moreover, we can clearly identify an effort-maximizing team size, which is on average four team members if the team members have stronger social ties. This finding suggests that in a situation with stronger social ties, monitoring is more effective with increasing team size, causing the peer pressure effect to counterbalance the free-riding effect for larger teams.

4.1 Robustness checks

As our data may suffer from systematic recall bias because the respondents were retrospectively asked to indicate how many hours per week they worked directly

after the actual start of their new team start-ups, we did several robustness checks to see whether "WeeklyHoursWorked" depend on the length of time since start-up. Team start-ups that were founded in 1992, for example, were approximately 6 years old at the time the survey was conducted (i.e., in 1998/1999), and teams started in 1995 were only 3 years old. Thus, recall bias could be a problem, as the answers may reflect more or less recent effort and may be more or less biased. We performed several robustness checks to address this problem. First, to mitigate the problem of recall bias in a very general way, we included the founding year as a control variable in all of our estimations. Second, we also interacted the year dummies with key explanatory variables to see if the effect of our explanatory variables changed depending on the cohort [with the range extending from 1992 to 1997; see Wooldridge (2003, p. 428) for details]. We did not find that year dummies had a significant effect based on any of the regressions. Third, we calculated the mean and standard deviation of the variable "WeeklyHoursWorked" by founding year. To the extent that the mean or the variability is systematically different for earlier years, one could argue that this outcome is due to a recollection bias that causes the reported "WeeklyHoursWorked" to be lower/higher or less precise if they stretch further back. However, in our data, we find no systematic variation in the average of "WeeklyHoursWorked" or in the standard deviation of "WeeklyHoursWorked". Finally, we tested the issue of selection bias given that we use a subsample of ventures in which there is a team. To account for the selection problem, we fit the regression models with selection by using Heckman's two-step consistent estimator. The primary results were still robust. However, the Inverse Mills ratios were all statistically insignificant, indicating that selection does not appear to bias our results.

5 Discussion, limitations and practical implications

The key findings of our paper are helpful for understanding why start-up teams are typically neither very small nor very large and how incentive problems may drive the "optimal" team size of founders. Our theoretical and empirical results provide an additional explanation for which factors determine effort levels in founder teams. We show that not only does the negative effect of free-riding increase with team size, but also that the counterforce peer pressure generates a positive effect on effort in start-up teams. The inverted U-shaped relationship between team size and effort also delivers a possible explanation for some ambiguous results in the entrepreneurship literature. Some authors note that entrepreneurial start-up teams that are larger than four people might be, in practice, very difficult to run (e.g., Clarysse and Moray 2004) or that team diversity might cause (affective) conflicts leading to serious obstacles with regard to effort and venture performance (e.g., Ensley and Amason 1999). However, it is also well known that team diversity can have a positive influence on new venture performance by overcoming cognitive conflicts.

Regarding some practical implications, we conclude that larger start-up teams can successfully rely on strong social ties to avoid free-riding and shirking. However, if strong social ties do not exist, larger teams should then ensure that they

have more explicit managerial procedures and decision-making processes. These types of processes and procedures guarantee sufficient mutual monitoring and external peer pressure, which in turn counterbalances free-riding effects. Therefore, if a founder team considers adding an additional member to their team, it might require the implementation of a more explicit incentive system or a formal monitoring procedure. Otherwise, additional resources such as human capital, financial capital or a network might not be used efficiently. Exactly when and how such systems should be put in place and how start-ups can successfully clear this hurdle to team size growth will be interesting topics for future theoretical and empirical research.

Furthermore, some other interesting questions arise that could be subject to future research. It would be important to examine, for example, the interaction with human capital of all team members; i.e., could social ties or other forms of peer pressure compensate for a lack of human capital? Given our data set, we first find indications that this type of compensation works, but more detailed information would provide deeper insights. Another factor influencing peer pressure and free-riding by the team founders could be their level of alternative income or whether psychological ownership has an impact.

First, the data do not explicitly measure the 'efforts' of all entrepreneurial team members, but in fact only measure the effort of a single respondent on any given team. Thus, we were not able to measure and examine differences in effort levels within a founder team. Therefore, we cannot directly study the relative contribution (or free-riding) of team members given different team sizes. The only evidence we can present that the response of a single individual is representative for all team members is that the single representative from each team was randomly selected to receive the survey. We have reason to believe that this random assignment can be used to mitigate this issue, but we could also face a potential and unknown response bias. However, experiments by Falk and Ichino (2006) or Mohnen et al. (2008) have found that effort levels in teams become more homogenous, which supports our assumption that we would not find different results if we had obtained responses from other or more founders from each team. Second, the dependent variable is effort, and the measure is weekly hours worked. It is quite obvious that the number of hours spent at work is not fully equivalent to effort. Moreover, if we assume that this measure of time at work reflects effort, it potentially better addresses the issue of quantity and not the quality of effort. However, we do find in our data that the average weekly working hours are linked to new venture performance (see also Verheul et al. 2009). Thus, we believe that our proxy at least captures some facets of individual effort because it is not sufficient if team founders only bring in additional resources (knowledge, skills, etc.) as suggested by a resource-based view. The founders must also exert effort so that these resources are used effectively. Third, it could be argued that the growth of start-ups and, thus, team size are primarily driven by other factors that we cannot control for, e.g., by financial constraints. Our results cannot contradict this argument. Financial constraints could create an incentive to include an increasing number of founders (to improve internal finances). However, an ever-increasing number of founders is not what we observe; thus, there must also be a strong non-financial effect working against large start-up teams. Fourth, the

economic model refers to peer pressure and free-riding (similar to the model by Kandel and Lazear and consistent with the standard economic approach in the field), whereas in our data, we cannot directly measure these two forces. However, we examine the resulting change in behavior (here, in working hours) due to the two effects. Hence, there exists a gap between the formal model and the empirical measurement. Finally, our data set only contains one variable that directly measures strong social ties in new venture teams, namely family ties (the respondents were asked if their start-up team consists of family members). Therefore, we are not able to test whether, in addition to close ties with relatives, ties with close friends also result in a larger effort-maximizing team size. However, according to our theoretical analysis, the effects should be similar and future empirical research should try to test the effect of other close social ties.

With these limitations in mind, we want to encourage further research to address these points with new data. Moreover, given our results but also the limitations of our analysis, future research should focus on more detailed information about human capital, different types of social ties and the individual effort level of each team member. Moreover, the organization of the firm should be addressed in future research, e.g., how many team meetings take place per week or whether performance is measured per individual team member. These aspects would be interesting subjects for deeper insight. Although more research needs to be performed, our results show that effort in startup teams is an important topic that should receive more attention in the entrepreneurship literature. As in any team, in startup teams, free-riding problems may occur and founders should be aware of them and not enter naively into a team start-up. We also show that the mechanism of peer pressure may help to offset free-riding problems, and we show certain circumstances in which the peer pressure effect is stronger than the free-riding effect. Thus, founders should strive to establish these types of circumstances to ensure that peer pressure helps them to offset their free-riding problems.

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