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ORIGINAL PAPER

Strategic decisions: behavioral differences between CEOs and others

Håkan J. Holm[1] · **Victor Nee**[2] · **Sonja Opper**[1]

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Abstract

We study whether CEOs of private firms differ from other people with regard to their strategic decisions and beliefs about others' strategy choices. Such differences are interesting since CEOs make decisions that are economically more relevant, because they affect not only their own utility or the well-being of household members, but the utility of many stakeholders inside and outside of the organization. They also play a central role in shaping values and norms in society. We expect differences between both groups, because CEOs are more experienced with strategic decision making than comparable people in other professional roles. Yet, due to the difficulties in recruiting this high-profile group for academic research, few studies have explored how CEOs make incentivized decisions in strategic games under strict controls and how their choices in such games differ from those made by others. Our study combines a stratified random sample of 200 CEOs of medium-sized firms with a carefully selected control group of 200 comparable people. All subjects participated in three incentivized games—Prisoner's Dilemma, Chicken, Battle-of-the-Sexes. Beliefs were elicited for each game. We report substantial and robust differences in both behavior and beliefs between the CEOs and the control group. The most striking results are that CEOs do not best respond to beliefs; they cooperate more, play less hawkish and thereby earn much more than the control group.

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1 Introduction

One aim of game theory is to understand the strategic decisions of important actors in the economy (e.g., Von Neumann and Morgenstern 1944; Tirole 1988). Yet, only a few experimental studies have employed subject pools representing important decision-makers. In this paper, we focus on business leaders and compare their strategy choices and beliefs with those of a control group of other professionals. The study of CEOs' strategic decisions is a natural choice given their prominent role in economic decision making as firm leaders whose actions have significant implications for other stakeholders (employees, suppliers, clients, and the local economy at large).[1] They are also likely to play an important role in transmitting values, norms and beliefs to other economic actors (e.g., employees, politicians and business partners).Their greater experience in strategic performance would suggest that they could differ in their strategic decision making from other people. For sure, people who are not CEOs also make strategic decisions, but the type and impact of these decisions tend to be more limited, influencing the well-being of individuals living in the same household rather than a large number of external stakeholders.

Whether and how CEOs differ behaviorally from others is an empirical question.[2] A priori, one can think of many mechanisms that might make a CEO's strategic behavior different from that of other people. Overall, one would expect that competitive forces weed out irrational CEOs so that surviving CEOs choose strategies which are best responses to each other; that is, they constitute Nash equilibria. Such a mechanism is plausible if the Nash equilibria are evolutionary stable strategies (Maynard Smith 1982). There are also strategic situations (e.g., prisoner's dilemmas) where individually rational choices according to the non-cooperative Nash paradigm lead to a detrimental outcome for the involved parties, and where instead prosocial or efficiency-oriented choices are favored (Bowles and Gintis 2011). Examples of situations where the benefit of cooperation and prosocial behavior are evident for CEOs include joint ventures and investments in infrastructure. Hence, another mechanism is social norms favoring efficient strategy choices that maximize the sum of the involved parties' payoffs. Such behavior can be sustained by welfare-maximizing

[1] Although this paper investigates differences between CEOs and others, we do not claim that CEOs comprise a homogenous group, for of course CEOs differ from each other in various respects, including management style, and that this may affect how they run their firms (e.g., Bertrand and Schoar 2003). We also alert readers who associate the term "CEO" with an externally recruited top manager to the fact that most of our CEOs, in contrast, both own and have founded their firms.

[2] It is not difficult to find two opposing perspectives: one warm and bright—portraying business leaders as socially responsible actors who contribute to social welfare —and, one cold and dark, portraying entrepreneurs as selfish profiteers (e.g., Van de Ven et al. 2007; Benabou and Tirole 2010).

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norms in close-knit groups (Ellickson 1991) and/or altruistic preferences through assortative matching (Bergstrom 2002; Alger and Weibull 2013).

Various empirical studies have investigated the strategic decision making of professionals (e.g., Cooper et al. 1999; Palacios-Huerta and Volij 2008, Fréchette 2015); but because high-level professionals are hard to recruit, few studies (e.g., Fehr and List 2004) investigate incentivized choices in well-defined strategic games with CEOs. The present study is the first to investigate CEOs' choices in not just one but several incentivized strategic situations that capture fundamental problems of cooperation and coordination in business. In addition, this study is also the first to combine group comparisons with belief elicitations allowing us to study the impact, accuracy of beliefs and best responses to beliefs. This will allow us to test if experienced CEOs best respond to their own beliefs, which is a fundamental implicit assumption in many modern models of industrial organization. Our sampling strategy lends high credibility to the results presented here. In contrast to earlier studies that use convenience samples (for the obvious reason that business leaders are difficult to recruit to perform experimental tasks), we use a stratified random sample of CEOs managing firms with ten or more full-time employees. The control group of other professionals was sampled to match core demographics of the CEOs. Finally, our samples are relatively large compared to earlier studies.

For our study, we have data for 200 CEOs from private firms in two cities in the Yangzi delta region of China and 200 control group individuals from the same cities. To capture the multiple dimensions of strategic behavior, we used three different games to observe aspects of cooperativeness (Prisoner's Dilemma), coordination (Battle-of-the-Sexes) and anti-coordination (Chicken). We also included incentivized elicitations of beliefs about others' choices, asking the subjects to guess the behavior of others in their respective group.

Our first main result is that in all games the behavior of the CEOs differed substantially from the behavior of the control group. The CEOs cooperated more in the Prisoner's Dilemma game and played less hawkishly in the Battle-of-the-Sexes and Chicken games. This result is significant in all games not only when we make raw comparisons of proportions of the strategy choices between the groups but also when we include control variables in regressions. When calculating the expected payoffs, the differences are substantial between the groups, with CEOs earning from 11 to 44 percent more than the control group in these games. Remarkably, however, CEOs did not out-compete the control-group members by being more rational (in the narrow textbook sense) or more selfish, but by being more cooperative and less aggressive. Furthermore, CEOs believed in significantly higher cooperation levels than the control group in the Prisoner's Dilemma game. Overall and again contradicting the rational "textbook CEO", beliefs were frequently inconsistent with behavior. Under the assumption of selfish preferences, compared to the control group, CEOs did not best respond more frequently to their beliefs. However, the CEOs' beliefs about other CEOs' behavior were on average more accurate than the corresponding beliefs the control group held about other control-group members' behavior.

The aim of this paper is to study the strategic behavior and beliefs of CEOs compared to others. We perceive the identification of underlying causal mechanisms as a natural second step and beyond the scope of the present paper. Nevertheless, our

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research design comparing the behavior of two distinct groups invites methodological questions about the subjects' background characteristics, their selection into the study and other factors that could hypothetically bias our results. We have therefore scrutinized our findings with a large battery of robustness tests exploring the influence of recruitment method, income differences, the definition of CEO and other factors. Results of these tests consistently confirm our baseline results.

2 Related literature

This paper connects to two different strands of research. First, there is a growing body of literature that explores how market transactions shape individual behavior and preferences (see Bowles 1998 for a review). Some research in this area suggests that property rights and market integration play an important role in the development of efficient and prosocial behavior (Henrich et al. 2001),[3] which would lead us to think that CEOs—being more intensely involved with the market than others—should display distinctly efficient and prosocial behavioral strategies. On the other hand, it has also been observed that specific market mechanisms may trigger disregard for third parties, which is normally seen as anti-social (e.g., Falk and Szech 2013; Bartling et al. 2015). Partly, these seemingly contradictory results are due to different definitions of prosociality, but they may also be associated with the different research methods used.[4] Economic transactions take place in very different market environments that can have diverse mediating impacts on individual behavior. In the 'idealized' competitive market where anonymous buyers and sellers transact, there is no obvious room for prosocial behavior, and this may encourage ethically questionable conduct (Shleifer 2004). In real-world market environments, however, transactions are typically personalized and anonymity absent. Repeat transactions and cultivation of long-time business relations clearly represent the standard rather than the exception for corporate transactions. Hence, this paper contributes to research on the potential impact of non-anonymous market activities by studying if and how experienced business leaders differ from people otherwise sharing the same cultural and local setting, but not the same extent of market exposure.

Secondly, our study relates to the literature about behavioral preferences of business leaders and entrepreneurs. This research area includes theories about why these

[3] The finding by Ockenfels and Weimann (1999) that student subjects who grew up in socialist Eastern Germany contributed less in a public good game and showed less solidarity than similar subjects who grew up in market-oriented West Germany is in the same spirit.

[4] For instance, higher accepting rates in the ultimatum game in Henrich et al. (2001) are interpreted as cooperative and prosocial, whereas a higher accepting rate (at a given price) in the double auction in Falk and Szech (2013) increases the efficiency in terms of the monetary reward for the two bidders, but since the third party (the mouse) is worse off when a bid is accepted, it is interpreted as a sign of moral erosion. The method used by Henrich et al. (2001) is based on comparing behavior in experimental games of widely different groups in the field relying on the hypothesis that different habits and cultures "spill over" into the groups' behavior in the games, whereas Falk and Szech (2013) and Bartling et al. (2015) induce different "institutional" settings in strictly controlled laboratory experiments of given and relatively homogenous subject pools.

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groups should differ from other people (e.g., Kihlstrom and Laffont 1979; Van de Ven et al. 2007) and studies investigating whether such differences can be empirically established (e.g., Van Praag and Cramer 2001; Holm et al. 2013; Hvide and Panos 2015; Åstebro et al. 2014; Koudstaal et al. 2016). The latter literature is extensive but typically focuses on personality characteristics such as risk and uncertainty preferences, overconfidence, the locus of control and desire for achievement.

Only a few studies have explored CEOs' strategic behavior in controlled settings using incentivized games, where behavior is interactive and where the outcome is predicted by the theoretical concepts of equilibrium. If we use a 'generous' definition including not only CEOs but also high-ranking managers and professionals, we obtain a small set of eight studies on strategic behavior with similarities to the present one (see Table 1). These studies compare the behavior of business leaders under various definitions (e.g., CEOs, entrepreneurs, managers, self-employed) with control-group members (e.g., students, salary workers) in distinct controlled and incentivized strategic settings. Most closely related to ours is a study by Fehr and List (2004), who conducted a trust game experiment with CEOs in the Costa Rican coffee industry and undergraduate students. They found that the CEOs were more trusting and reciprocated more than the students.

While the results of the studies listed in Table 1 naturally vary due to differences in design and subject groups, one can draw some highly tentative conclusions. For one, the self-employed tend to be more willing to take decisions on their own (Cooper and Saral 2013; Masclet et al. 2009). Furthermore, managers are more willing to cooperate (in team production and in trust relations) than control subjects (Fehr and List 2004; Holm et al. 2013; Montmarquette et al. 2004). However, Cooper and Saral (2013) detect no differences in free-riding.

Our study contributes to this literature in a number of ways. None of the above studies links behavior to general theoretical constructs (like Nash equilibrium) across more than one game. By having three different games in our design, we put any theoretical hypothesis about differences between CEOs and the control group to a tougher test, since the set of theoretical mechanisms that are consistent with an observed pattern of differences shrinks the more potential differences we can observe. Furthermore, the present study is the first that elicits subjects' beliefs about others' choices, which allows us to identify to what extent behavior is associated with specific beliefs regarding others' behavior. The belief elicitations also make it possible to study the accuracy of beliefs and whether actions are best responses to beliefs.

We also make a methodological contribution by using a stratified random sampling technique for recruiting CEOs and the comparison group. By including CEOs from five different manufacturing industries, we reduce the risk of industry-specific results, yet limit the risk of noise linked to different background conditions. Further, by excluding CEOs operating very small firms, we ascertain that our subjects are used to exercising strategic decisions that have a certain economic relevance. Many of the above studies use specific comparison groups (most often students) who differ significantly from the CEOs along multiple dimensions (e.g., age, professional experience, income). We have reduced these differences substantially by matching the CEOs more closely with the control group in terms of age, gender, education and

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Table 1 Studies on strategic decisions with business leaders

Paper	Focus group	Comparison group	Game	Frame	Belief elicit.	Samp-ling	Main finding
Cooper et al. (1999)	Managers and foremen in textile industry (N = 150, China)	U. students (N = 160, China)	Ratchet effect game	A + F	No	NR	Field context increases managers' but not students' strategic play
Cooper (2006)	Executive MBA students (N = 19, USA)	U. students (N = 20, USA)	Weakest link game	SA	No	NR	Exec. MBA students better at overcoming coordination failures
Cooper and Saral (2013)	SE (N = 44, USA)	Students, alumni (N = 140, USA)	Team production	A	No	NR	SE less willing to join team, no difference in free-riding
Elston et al. (2006)	SE visitors at a convention (N = 82, USA)	Non-SE visitors at a convention (N = 90, USA)	Market entry game	A	No	NR	Part-time SE less willing to compete
Fehr and List (2004)	CEOs from coffee industry (N = 76)	Students (N = 126)	Trust game	A	No	NR	CEOs more trusting and trustworthy
Holm et al. (2013)	CEOs from five different industries (N = 700, China)	Subjects sampled to match CEOs (N = 200, China)	Trust elicitation + Willingness to compete	A	No	SR	CEOs more trusting and more willing to compete
Masclet et al. (2009)	SE (N = 14, France)	Salary workers and students (N = 130, France)	Risk-taking decision on their own or in group	A	No	NR	SE pay more for taking decisions on their own
Montmarquette et al. (2004)	Managers from pharmaceutical company (N = 36, France, Germany)	Students (N = 72, Canada, France)	Team effort task	A	No	NR	Managers more cooperative than students

A abstract frame, *F* field frame, *SA* semi abstract frame, *NR* non-random sample, *SR* stratified random, *U* undergraduate, *SE* self-employed)

residential living area. The present samples of CEOs and control group subjects are also relatively large compared to most previous studies.[5]

3 Theory and hypotheses

We analyze decisions in three simple 2×2 games—Prisoner's Dilemma, Battle-of-the Sexes, and Chicken (see Tables 2, 3 and 4)—that capture situations requiring cooperation, coordination and anti-coordination.

These three games involve strategic elements that differ along important dimensions and are likely to be more important in the context of running a firm than in other settings. Because these situations occur at a higher frequency for CEOs and are also likely to have greater economic consequences for them than for other professionals, we expect on average different behavioral strategies between CEOs and the control group (henceforth denoted as "CG"). At this early stage, the identification of the exact causal mechanism explaining different strategies goes beyond the scope of this paper. Potential mechanisms include self-selection of distinct types into professional roles, a weeding out of distinct behavioral strategies through competitive pressure, or social learning through repeat experience in similar or related situations. In the following subsections, we discuss in more detail why each of the games was chosen and why the CEOs' behavior may differ from responses by other professional groups.

3.1 Prisoner's Dilemma

Situations analogous to the Prisoner's Dilemma (henceforth denoted as PD) are common between the CEO and employees, where free-riding opportunities frequently co-exist with possible benefits of cooperation. Similar strategic situations emerge between firms horizontally, e.g., in terms of price-setting (collusion), recruitment and joint investments. A priori, one can think of different mechanisms that would make a CEO's strategic behavior different from that of other people in PD—recognizing, however, that these alternative mechanisms imply both more and less defection in such a game.

From a traditional economic perspective, one can argue that competitive forces ought to weed out irrational CEOs so that surviving CEOs choose strategies that constitute Nash equilibria.[6] As noted in the introduction such a mechanism is plausible when the Nash equilibria are evolutionary stable strategies (Maynard Smith

[5] The only larger sample of CEOs on incentivized strategic decision-making besides the present study is in Holm et al. (2013), which is based on data from a study conducted in 2009 containing two strategic situations (in terms of trust and willingness to compete). However, the objective there was to investigate differences between CEOs and a control group in behavior relating to uncertainty preferences.

[6] It is well-known (e.g., Fehr and Schmidt 1999; Engelmann and Strobel 2004) that the Nash equilibrium prediction is contingent on the underlying (possibly social) preferences assumed. To simplify the presentation and theoretical conceptualization, we assume standard selfish materialistic preferences (i.e., players only care about their own payoff) when referring to Nash equilibrium and socially optimal outcomes.

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1982). However, social norms favoring efficient strategy choices that maximize the sum of the involved parties' payoffs might constitute an alternative mechanism. Such behavior can be sustained by the development of welfare-maximizing norms in well-defined social groups characterized by mutual monitoring and social reward and punishment (Ellickson 1991; Bowles and Gintis 2011) and/or altruistic preferences through assortative matching (Bergstrom 2002; Alger and Weibull 2013). If this is the case one can expect that CEOs will be more cooperative in their strategic decision making than others and that the population as a whole consists of different strategic 'types' (e.g., Kurzban and Houser 2005). Assuming that these two mechanisms are more prominent for CEOs than for others, we can expect differences in behavior between CEOs and others on average. In PD these alternative mechanisms have both straightforward (diametrically opposite) predictions since there is a unique Nash equilibrium (both players Defect) and a unique social optimum (both players Cooperate).

3.2 Battle-of-the-sexes

The Battle-of-the-Sexes game (henceforth denoted as BSS) captures situations where subjects can choose to act more or less aggressively, while coordination would lead to preferable outcomes. From a general management perspective coordination problems are fundamental. Inside the organization, leadership tasks for the CEO include the management of beliefs (Foss 2001) and the alignment of incentives with the adoption of new information (Bolton et al. 2013) in order to solve arising coordination problems. In inter-organizational dilemmas, coordination situations with the flavor of BSS are likely to emerge with upstream and downstream firms, specifically if decisions involve the implementation of new technology, (re-)location, and changes of market linkages.

In BSS coordinating on one of the two pure Nash-equilibria, where both players choose the same strategy (A, A) or (B, B), is obviously preferable for both players. At the same time, (player) Row prefers coordination on Strategy A and (player) Column prefers coordination on Strategy B. Hence, the players need to strike a balance between coordination and "domination" motives. In the following, we will also refer to Strategy A (B) for Row (and Column, respectively) as the "hawkish" strategy, since by choosing this strategy the player has excluded all outcomes where he is dominated by his opponent in terms of payments. With the same logic, we will also refer to Strategy B (A) for Row (and Column, respectively) as the "dovish" strategy, since this strategy will always give the opponent at least as much payoff as the player himself.

The motives of coordination and domination would most likely be reflected in a negotiation between the Row and Column player if they could communicate. However, in our game communication is not possible and there are no obvious coordination devices. Given the difficulty of coordination on the pure strategy Nash equilibria, it is reasonable to expect that players with selfish preferences play the unique mixed strategy where Row and Column play A with probability 0.6 and 0.4, respectively.

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Table 2 The prisoner's dilemma

	Defect	Cooperate
Defect	100, 100	400, 50
Cooperate	50, 400	250, 250

The payoffs to the subjects in Chinese Yuan, CNY

Table 3 The Battle-of-the-sexes

	Strategy A	Strategy B
Strategy A	600, 400	0, 0
Strategy B	0, 0	400, 600

The payoffs to the subjects in Chinese Yuan, CNY

Table 4 Chicken

	Hawk	Dove
Hawk	0, 0	600, 150
Dove	150, 600	300, 300

The payoffs to the subjects in Chinese Yuan, CNY

There are reasons to believe that CEOs differ in the way they play BSS compared to others. For one thing, leading business people may have a strong preference for relative domination. Alfred Marshall (1890/1920, p. 23) claimed that "a manufacturer or a trader is often stimulated much more by the hope of victory over his rivals than by the desire to add something to his fortune." If this holds for our CEOs, we would expect more hawkish play among them in BSS than among those in CG. Other possible mechanisms relate to the experience, skill and, motive to coordinate mentioned above. If CEOs as leaders of private firms are more exposed and experienced than others in detecting and handling coordination situations compared to others they may well differ from others in how they form beliefs and act in BSS.

Our research focus is not on focal points. We will simply assume that the players do not intend to coordinate through focal points.[7] As a consequence, all our subjects

[7] The analysis of BSS is more complicated since it is an asymmetric game. In a standard matching protocol (e.g. in a computer lab) half the subjects would have been randomly assigned the Row and Column player role. In such a setting it would be possible to calculate if they were able to coordinate by the use of coordination cues (i.e., focal points) like strategy labels (see Schelling, 1960). Although, it has been shown that focal points based on strategy labels are successfully used in symmetric (pure) coordination games, when introducing asymmetries as in the BSS, the coordination through focal points more or less vanishes (see Crawford et al. 2008 and Parravano and Poulsen 2015). Furthermore, the use of focal points is often context or culture-specific. We can not rule out that some try to use "A" as a focal point since it is the first letter in the alphabet. However, given results from the cited literature and noting that our Chinese subjects do not have an alphabet similar to the English, we believe that this focal point is not likely to be salient.

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were given the Row player role. (The limited number of opponents matched for real payoffs, denoted as X-players, had the Column player role, see Sect. 4).

3.3 Chicken

The Chicken game illustrates elements of situations characterized by anti-coordination where it is vital (contrary to the coordination games) that the players do not choose the same strategy. CEOs are likely to encounter 'Chicken-like' situations in private markets where some valuable capacity, resource or demand are scarce and where there is competition for it. One relevant example would be a market-entry decision where it is only profitable for one firm to serve the market.

In this game, there are two pure equilibria where one of the players plays Hawk and the other Dove. If the players could communicate, one would expect that the players would try to convince each other (e.g., with threats) that they would play Hawk. However, in our game, they cannot communicate, which means that it is reasonable to expect that the players (with selfish preferences) play the unique mixed strategy where Row and Column play Hawk with probability 0.67.

As in the previous games there are reasons to believe that CEOs may differ in the way they play Chicken compared to others and that the direction of this difference is not obvious a priori. It has been argued that private business leaders and entrepreneurs are more optimistic than others or may even be overconfident. The theoretical literature draws on this to explain excessive market entry (see e.g., Bernardo and Welch, 2001; Hayward et al. 2006; Wu and Knott, 2006). These arguments would suggest that CEOs are more hawkish in Chicken games than other comparable people. At the same time, if CEOs will be more used to and trained to handle such situations, it may be that they have learned the cost of hawkishness the hard way and therefore will be more inclined to guarantee a non-zero payoff by playing Dove than others with less experience. In addition, Dove would also be an attractive strategy for less selfish subjects with a strong preference for fairness, since it can lead to the non-zero equal payoff (300, 300).

3.4 Hypotheses

In the preceding sections, we have discussed some potential mechanisms that would lead to behavioral differences between CEOs and CGs. However, as there were no unambiguous directional predictions we use the null hypothesis that there are no differences in behavior or beliefs. Hence our hypotheses are as follows:

1. On average, the CEOs and the CGs choose strategies similarly in the different games.
2. On average, the CEOs' beliefs about others' behavior are similar to those of the CGs.
3. On average, the CEOs' best responses to their beliefs are similar to those of the CGs.

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4 Research strategy and design

In this section, we briefly present the research strategy and design of our study in terms of tasks, treatments, sampling strategy and implementation.[8]

4.1 Tasks and treatments

Initially, the subjects received general information about the tasks (see Instructions in the Appendix provided in the online Supplementary Material) and payments. They were also informed that in some tasks they would play against another anonymous person, who was denoted as X. To mitigate potential order effects, the CEOs and the CGs were divided into six different treatment groups based on the order and frames of the games, so that each game with a given frame had the 1st, 2nd and 3rd position exactly once (see Appendix 1C). Hence, each subject participated in six different tasks (three games and the belief elicitations). One of the games was randomly selected at the end of the experimental session as the money-earning task. By paying for only one task (a strategy choice in a game or a guess in a belief elicitation), we follow Blanco et al. (2010) to avoid the 'hedging problem' of the belief elicitations.

The framing of a game can affect behavior (Tversky and Kahneman 1981; for a review Levin et al. 1998). Increasing awareness of these framing effects has motivated many researchers to increase the "field content" that subjects are exposed to (Harrison and List 2004).[9] We investigate this link by presenting each game with both an abstract frame and a field frame, which introduces the game as a common type of business decision that could also be easily grasped by non-CEOs without managerial experience. Both frames were randomly assigned, with half of the subjects in each group receiving an abstract frame and half a field frame.[10] If our results are robust with respect to the frame, we can claim that the results generalize beyond the situational construct and decision domain.

The decisions in the three games were to choose between strategies 'A' and 'B'. In the abstract frame, the game explanation focused on the payoff information. In the field frame, three scenarios preceded the payoff information (see Instructions in the Appendix for details). The belief elicitation tasks were to guess the percentage of other players who chose either strategy in the game respondents had just played. The closer the subject's guess was to the observed frequency, the higher the earnings.[11]

[8] Comments on the design and more details are provided in the Appendix.

[9] In fact, Cooper et al. (1999) find that managers (in the textile industry in China) become more strategic when exposed to field frames than students. However, the result from Cubitt et al. (2011) appears to go in the opposite direction, indicating that experienced subjects tend to be less susceptible to framing.

[10] The descriptions of the frames are available in the Instructions.

[11] To limit the cognitive load and due to time constraints, we used a simple scoring rule rather than a proper continuous scoring rule like the quadratic one. Subjects earned 500 CNY if they were ± 2 percentage points from the correct answer; and gradually less the further away the answer was from the correct one. While such a simplistic scoring rule may tilt beliefs slightly away from true beliefs, they should do so in the same way for all subjects. The choice of scoring rule should therefore be unproblematic in studies like ours where the main focus is not point predictions but between-subjects comparisons. Simplistic

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By eliciting beliefs about the percentage of other players choosing a certain strategy we get more precise information about beliefs than if we had elicited beliefs about the opponent's binary choice.

To be able to pay out cash rewards on the spot immediately after the experimental tasks, we obtained choices from a small additional group of 11 CEOs and another small group of 9 CGs who took the role as X persons in the experiment before we approached the 200 CEOs and 200 CGs in the main study.[12]

4.2 Sampling and descriptive statistics

For this study, we recruited 100 CEOs and 100 CGs from each of the two Chinese coastal cities of Shanghai and Wenzhou for a total of 400 participants.[13] CEOs were sampled from firms stratified according to industry.[14] Industries range from labor-intensive to technology-intensive and include textile, ordinary machinery, vehicle and auto parts, medical and pharmaceutical products, and computer and communication equipment. So as not to end up with a sample of managers running small-scale marginal firms, the sample was stratified by firm size. More specifically, we over-sampled 'large' (more than 300 employees) and 'medium-size' (100–300) firms. Finally, to avoid fresh start-ups and self-employed businesses our sampling frame included only firms that had survived for at least three years. The CGs were randomly selected from household registers to match the CEOs with respect to gender, age, education. To get a reasonable match with respect to income, we added the restriction that CG subjects should live in the residential areas where the CEOs themselves lived. In this way, we avoided having a very select control group (for instance, a specific group of highly paid professionals), and we avoided having a sample of people who differed very much from the CEOs.

Footnote 11 (continued)
scoring rules for beliefs are not uncommon in the experimental literature; see, e.g., Gächter and Renner (2010).

[12] The behavior of the X subject is of no interest to the study, but is necessary to avoid deception of the subjects in the main study. Each X subject was matched to more than one subject. Some information given to this group was adapted to their role (e.g., that they got paid after the main study was finalized). To test the design, we also had 39 additional CEOs who were matched to the 'XCEOs' in a pilot study.

[13] The games employed in this paper were appended to a firm survey conducted in 2012 including 7 cities and a total of 700 entrepreneurs. Games were conducted in 5 cities, with a total of 500 CEOs (100 CEOs in each city). For the purpose of a comparative study we recruited 200 CGs in two of the five cities. To get a clean design for this paper focusing on differences in strategic behavior between CEOs and CGs, the data used here is based on the two cities, in which we have matching CEO and CG data for 200 subjects. The behaviors of the remaining 300 CEOs (together with the 200 CEOs used in this paper) will be used to explore questions of within-subject/within-firm variation and to explore the external validity of revealed game behavior. Experimental data collected in connection with an earlier firm survey (2009) was analysed in studies by Holm et al. (2013), Opper et al. (2017) and Nee et al. (2018).

[14] Specific aspects of conducting this study in China are commented in the Appendix.

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Table 5 summarizes the descriptive statistics for the 400 participants in our study according to gender, age, income, and education.[15] The matching of gender and age in the CG worked well. There is also virtually no difference in education between the two groups.[16] The average household income of the entrepreneurs is—as can be expected—more than twice as high compared to the average of the CG. While this is a large difference, it would be much larger without a residential selection of the control group.[17] To minimize the risk that income is driving the results we will complement our basic group comparison analysis with regressions where we control for income.

4.3 Execution

A key to recruiting very busy people for a study like this is to make it easy to participate and to be persistent. We relied on 20 professional interviewers of Shanghai Yihong Business Consulting (a local company specializing on survey research), each with multiple years of field experience, to conduct the survey, after making individual appointments.[18] For the CEOs, the interviews and experimental tasks were conducted at the firm site, usually in a conference room or at the CEO's private office, by a team of two interviewers. The CEOs were first asked questions about their background (education, demographics) and the firm (start-up capital, firm revenues, etc.). The CGs were also visited by a team of two interviewers at their private residence where they were asked the same set of questions, except for those regarding the firm and business development.[19] Each subject was then presented with the three games and the belief elicitation tasks. Both CEOs and the GGs made their task choices using a paper-and-pencil format. As interviewers were in charge of collecting the questionnaires once completed, interviewers were naturally able to see their choices, but choices were not observable by others, such as employees and staff members or family members in the case of CGs. Hence, the degree of anonymity

[15] These are standard demographic variables often controlled for in empirical studies. There is also evidence that these variables may matter for incentivized strategic behavior. Earlier research suggests that gender affects social and competitive preferences as well as risk preferences (Croson and Gneezy 2009; Dohmen et al. 2011). Education and age have been reported to matter for trust, cooperation and ultimatum game behavior (Glaeser et al. 2000; Güth et al. 2007 and Thöni et al. 2012). A subject's income will affect the salience of experimental earnings and the stakes that a subject confronts. Stakes have been demonstrated to affect strategic behavior in ultimatum games (Andersen et al. 2011).

[16] When the CGs were just randomly selected from the household registers in the same cities as the CEOs, the latter group had significantly more years of education (Holm et al. 2013). In Appendix 5 we provide additional detailed information on the matching between the CEOs and the CGs.

[17] In Holm et al. (2013), where the control group was just randomly selected from the household registers in the same cities as the entrepreneurs, the median income of the entrepreneur was eight times higher than that of one of the CGs.

[18] If a CEO had to cancel a meeting, the assistants would try to reschedule it at some other time. This is one reason that it took these 20 assistants over four months to collect the data.

[19] The difference of location of the interviews and experimental tasks (at work versus at home) might affect results. However, we can exclude this possibility since we find that the subgroup of "CGCEOs" who did the interview and tasks at home differ from the other CGs in the same way as the CEOs who were visited at their firms (see the robustness check in Sect. 5.3).

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is the same for the two subject groups and corresponded to a single blind experiment.[20] Afterward, one task was randomly selected as the money-earning task. The earnings were calculated and the subject received the payment immediately. The average subject in our experiment earned 247 CNY (or USD 39) on the behavioral tasks that took only 18 min on average, which corresponds to hourly earnings of USD 130.[21] The main experiment took place during a period of about four and a half months, starting with the first subject on August 25, 2012, and ending with the last subject on January 9, 2013.

5 Results

In this section, we report observations of the subjects' behavior on the experimental tasks. We start with the strategy choices in the games, after which we analyze the subjects' beliefs.

5.1 Behavior in the games

Results presented in Table 6 show significant differences between the average behavior of the CEOs and the CGs in terms of strategic choices in each game. The differences are also substantial in percentage points, ranging between 13 percentage points and 25 percentage points in one game. Clearly, the CEOs are significantly more cooperative in PD and play significantly less hawkishly in BSS and Chicken.[22] This suggests that null hypothesis 1, stating that on average the CEOs and the CGs will choose strategies similarly in the different games, can be rejected. However, to reach a final conclusion we need to confirm that the observed differences between the groups are not due to confounding effects. We return to this concern in the following sections.

It should be evident from Table 6 that the Nash equilibrium (NE) predictions are not always consistent with the groups' behaviors. The CEOs are close to the mixed NE in BSS and the CGs are close to the mixed NE in Chicken, but in PD both groups are far from the NE.[23] Hence, the groups alternate in being close to the NE,

[20] This is important since the degree of anonymity may be an important factor for social desirable behavior (see e.g., Bernheim 1994; Andreoni and Bernheim 2009).

[21] This translates to an average hourly experimental earning of around 220 USD if we correct for purchasing power according to the Big Mac index (which was 1.68 in January 2014). It should be stressed that the income of CEOs in successful firms in China is relatively low from an international perspective, which makes it possible to provide salient incentives in the games and belief elicitations at a reasonable cost. Though even moderately successful CEOs are a high-income group in China, their median annual family income in our sample was only around USD 75,000 (according to the exchange rate 6.38 CNY/USD in August 2012).

[22] Note that the game was presented to the subjects in the BSS so that they were Row players (in Table 3), which means that Strategy A is interpreted as the hawkish strategy. The X-players had the reversed payoffs and the Column player role.

[23] The fact that NE does not point predict one shot behavior in PD is in line with many other studies using different subject groups (e.g., Kagel and Roth 1995).

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Table 5 Descriptive characteristics of the subjects

Variable	CEOs	Control Group
Gender (proportion males)	.85 (.36)	.82 (.39)
Age (year, mean)	45.77 (7.79)	41.30 (6.80)
Yearly household income (million CNY, mean)	.55 (.47)	.24 (.25)
Years in school (mean)	13.64 (3.22)	13.84 (2.78)
Number of observations	200	200

Standard deviations in parentheses

and the CGs are closer to the NE in four out of six versions of the games. Therefore we cannot convincingly state that CEOs and the CGs differ in how they behave in playing NE. In fact, nothing in the data suggests that the CEOs are "more" consistent with the standard textbook predictions of economics (based on selfishness and Nash equilibrium) than are the CGs.

5.1.1 Probabilities for outcomes and expected payoffs

We will now elaborate on the relative probabilities of the outcomes for the CEOs and CGs end up in given their behavior (in Table 6). This will also help us to understand the substantial differences in expected payoffs between the groups. By using the proportions of chosen strategies among CEOs and CGs, while assuming that players are randomly matched (and cannot use any coordination devices etc. as explained in Sects. 3.2 and 3.3), it is possible to calculate the probability for the various outcomes in the games for the respective group. To simplify the presentation, we merge the abstract and field frame proportions given in Table 6 (which means, e.g., that the proportions playing Defect among CEOs and CGs are 0.42 and 0.56, respectively). The probability for ending up in an outcome where both players play Defect in PD is then given by $prob(DD) = q_D^2$, where q_D is the proportion in the group that play Defect. The probability that both cooperate is given by $prob(CC) = \left(1 - q_D\right)^2$ and the probability that they play different strategies is given by $prob(DC, CD) = 2q_D\left(1 - q_D\right)$. If the probability for each outcome is multiplied by the sum of the two players' payoffs (given in the parentheses in Table 7) and these terms are added together we get the expected earnings for a pair of players in the game. Clearly, the same logic can be applied when calculating the probabilities and expected earnings in BSS and Chicken.

One general pattern in Table 7 is that the probabilities for CEOs to end up in high payoff outcomes are in most cases substantially higher than for the CGs. For instance, in PD, the probability that CEOs end up in the outcome where both players cooperate is 72% higher than the corresponding probability for CGs. Conversely, the probabilities that CGs will have low payoff outcomes are higher compared to the CEOs. For instance, in the Chicken game, the probability for the zero payoff outcome where both players play Hawk is 85 percent higher for CGs. Naturally, these distributions of outcomes are reflected in the expected payoffs of the different

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Table 6 Average percentage play of strategies in the games

Game and frame	CEOs: Average playing Defect or Hawk	CGs: Average playing Defect or Hawk	Nash Equilibrium PredictionNE
PDA**	44.6 (101)	59.4 (101)	100
PDF*	39.3 (99)	52.5 (99)	100
BSSA**	62.4 (101)	75.2 (101)	60
BSSF***	61.2 (99)	79.8 (99)	60
CA***	48.5 (101)	73.3 (101)	67
CF*	56.6 (99)	69.7 (99)	67

The suffix letter in the game acronyms indicates frame: *A* abstract, *F* field. Number of observations in parentheses. Significance levels in Chi square tests, *p value <0.1; **p value <0.05; ***p value <0.01

groups. Compared to the CGs, the CEOs expected payoffs are 11%, 35%, and 44% higher in PD, BSS and Chicken, respectively.

5.1.2 Regression analysis

In Table 8 we present marginal effects from logistic regressions where we control for likely confounders, such as gender, education, age and income (reported in: Glaeser et al. 2000; Güth et al. 2007; Croson and Gneezy 2009; Andersen et al. 2011; Dohmen et al. 2011; Thöni et al. 2012; see also Table 5).[24] We also control for location (Shanghai) to take into account possible cultural differences between both municipalities.

All results presented in Table 6 appear robust. The CEOs are more cooperative in PD and less hawkish in BSS and the Chicken game compared to the CGs, even when we control for conceivable confounding effects. The main variable of interest is the dummy variable CEOs, which is significant for PD and BSS at the 5% level and at 1% for Chicken. The direction is the one expected from the previous analysis. All effects are substantial. Keeping all other variables at their averages, the probability for defection in PD decreases by 0.12 when a CEO makes the strategic choice compared to the probability for defection by the CGs. The probabilities for Hawk in BSS and Chicken are even further reduced, namely by 0.13 and 0.18.

Except for the CEO variable, none of the other variables is consistently significant. Family income has a significant negative effect on hawkish behavior in BSS, which may reflect a higher degree of generosity or lack of care for the experimental money in this game. However, there is no significant income effect in the other games, suggesting that we should be cautious not to draw too strong conclusions

[24] Note that the effects of these variables could either be direct or indirect. For instance, education might correlate with cognitive ability and gender with risk aversion which indirectly can affect the behavior in the strategic games. Note that even if we have matched our sample groups insofar as possible with respect to these variables, there is still individual variation that might correlate with the dependent variable.

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from this observation.[25] The frame is insignificant in all games, which suggests that the underlying game is more important in explaining individual behavior than the framing of the decision.

5.2 Beliefs

The observed behavioral differences may simply reflect different preferences. Another possibility is that players' beliefs about others' choices differ and that subjects aim to optimize their own choices in response to these beliefs with or without regard to social preferences. We use data from the belief elicitation task to shed some light on the question of what is more likely to guide players' behavior.

In Table 9 we present the average percentage the subjects believed that the other players choose Defect or Hawk in the respective games.[26] Compared to the CGs, the CEOs believe that other subjects defect on average less and are less hawkish. Hence, the CEOs' beliefs about others' behavior differ from the CGs in the same way as they play the games. The difference in beliefs is significant in four out of the six tasks. The difference is especially strong in PD.

With regard to the closeness to NE there is no consistent pattern. The beliefs of the CEOs and the CGs are on average almost equally close to NE in BSS and Chicken when abstractly framed. When there is a significant difference, the CGs' beliefs about others' choices are closer to NE than those of the CEOs.

5.2.1 Difference in beliefs: a regression analysis

We now inspect whether these inter-group differences in beliefs about others' behavior are robust to the inclusion of the demographic variables introduced earlier. Since the dependent variable is proportional, we run a fractional response regression as suggested by Papke and Wooldridge (1996).

Table 10 presents the regression results in terms of average partial effects, which have a similar interpretation as linear regression coefficients without compromising the non-linear relationship (Gallani et al. 2016). The negative sign for the CEO variable indicates that the CEOs generally tend to believe that co-players defect less and play less hawkishly than the CG believe, even when we control for demographic

[25] It can also be noted that if family income is interacted with the CEO variable the interaction term is insignificant for all games.

[26] In the abstract frame subjects were asked to guess how many percent of subjects chose "Option A" in the game they just had played. In the field frame subjects guessed about the corresponding field alternatives (e.g., "City"). Option A and the paralell field alternatives corresponded to "Cooperate" and "Hawk" in PD, BSS, and Chicken, respectively. It is then assumed that the subjects' believed that the residual percentage chose Defect and Dove, respectively. We use "belief of average percentage belief in Defect/Hawk" to simplify the presentation, but the reader should know that framing effects may play a role in how such questions are formulated. The reader should also know that because of the asymmetry in BSS (discussed in Sect. 3.2) it is assumed that if a subject believes that q percent played strategy A (i.e., Hawk) as Row players, it implies that the subject believes that the same percent play strategy B (Hawk) as Column players. We do not claim that such an assumption is entirely without complications but we think it is the most natural interpretation given how the instructions were formulated.

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Table 7 Probabilities for outcomes and expected payoffs

Game/group	Probability that both play Defect or Hawk (pair payoff, SEK)	Probability that both play cooperate or dove	Probability that players choose different strategies*	Expected payoff for a pair (SEK)
PD/CEO	0.176 (200)	0.336 (500)	0.487 (450)	423
PD/CG	0.314 (200)	0.194 (500)	0.493 (450)	381
BSS/CEO	0.384 (0)	0.144 (0)	0.471 (1000)	471
BSS/CG	0.601 (0)	0.051 (0)	0.349 (1000)	349
C/CEO	0.276 (0)	0.226 (600)	0.499 (750)	509
C/CG	0.511 (0)	0.081 (600)	0.408 (750)	354

2nd, 3rd and 4th column contain probabilities for different possible outcomes and the numbers in parentheses are the sum of both players' payoffs in the outcome. 5th column contains expected earnings for the two-player pair. *Different strategies in BSS presumes that strategies are referred to as hawkish or dovish (see Sect. 3.2)

Table 8 Behavior: marginal effects

	(1) Defect	(2) Hawk_BSS	(3) Hawk_Chicken
CEO	−0.123**	−0.127**	−0.177***
	(0.056)	(0.051)	(0.054)
Male	0.044	−0.078	−0.053
	(0.067)	(0.057)	(0.065)
Age	−0.001	0.005	−0.000
	(0.004)	(0.003)	(0.003)
School	−0.013	0.008	0.019*
	(0.011)	(0.010)	(0.011)
Income	−0.006	−0.015***	−0.003
	(0.008)	(0.006)	(0.007)
Shanghai	−0.010	−0.113*	−0.030
	(0.065)	(0.060)	(0.064)
Frame Abst	0.064	−0.016	−0.024
	(0.051)	(0.047)	(0.050)
Wald chi^2	13.189	25.414	19.758
Prob > chi^2	0.068	0.001	0.006
Pseudo R^2	0.025	0.049	0.039
N	400	400	400

Results from logistic regressions. Robust standard errors in parentheses, *$p<0.1$, **$p<0.05$, ***$p<0.01$

factors. The variable is strongly significant in PD, but not significant in the other games. The frame appears to have affected beliefs in Chicken substantially, with the field frame inducing the players to form more hawkish beliefs. There are no other strong predictors of beliefs. The conclusion is that the difference in beliefs between CEOs and the CG is a robust finding in PD, and for this game, we can firmly reject null hypothesis 2. For the other games, the CEOs' beliefs appear somewhat less

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Table 9 Descriptive data on beliefs

Game and frame	CEOs: belief of average playing Defect or Hawk	CGs: belief of average playing Defect or Hawk	Average deviation from NE CEOs/CGs
PDA***	46.3 (101)	54.2 (101)	53.7/45.8***
PDF***	47.0 (99)	55.7 (99)	53.0/44.3***
BSSA	57.2 (101)	60.0 (101)	14.1/15.8
BSSF**	56.8 (99)	62.8 (99)	12.6/12.9
CA	49.7 (101)	50.7 (101)	19.5/19.0
CF**	54.0 (99)	59.3 (99)	17.8/13.1***

A abstract, *F* field. Number of observations in parentheses. Significance levels in the leftmost column concern differences in means in beliefs of Defect and Hawk between CEOs and CGs (t-tests). The 2nd and 3rd column contain the average percentages the subjects believed that the other players choose Defect or Hawk. Significance levels in the rightmost column indicate differences in mean deviation in beliefs from NE (*t* tests). **p* value < 0.1; ***p* value < 0.05; ****p* value < 0.01

hawkish compared to the CGs', but the statistical relationships are too weak to reject null hypothesis 2 in these games. It is difficult to know exactly why this difference exists, but one possibility is that in PD the trade-off between self-interest and efficiency is more evident than in BSS and Chicken, where issues of coordination are also involved. The additional complexity in the latter situations may blur the relationship between beliefs and behavior. We will return to this idea in the next section.

5.2.2 Beliefs and behavior

The impact of beliefs on behavior in games is not straightforward but depends on underlying motivations and preferences. Hence, the individual response to a certain belief depends on preferences and the underlying model of behavior assumed. However, when controlling for beliefs in a logit regression, the results indicate that beliefs do in fact matter for the behavior in PD and BSS (see Appendix 2A).

5.2.3 Best responses to beliefs

One measure of strategic sophistication is a player's ability to best respond to his own beliefs about other players' strategy choices. Our design with belief elicitation allows for non-trivial analyses of best responses in BSS and the Chicken game since in these games both strategies are possible best responses contingent on the subject's belief. If selfish preferences are assumed, then Hawk is the best response in BSS if the subject believes that less than 60 percent of their co-players play Hawk (given the assumptions outlined in Sect. 3.2.). The corresponding number for Chicken is 67 percent. In BSS only 45 percent of the CEOs and 41 percent of the CGs best responded. The percentages for Chicken are 51 and 62, respectively. In Chicken, the difference in proportions is significant, which suggest that CEOs best respond less frequently than the CGs in Chicken. However, when controlling for other variables

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there is no significant difference in best responses in any of the two games (see Appendix 2B). To sum up, the statistical evidence for differences in selfish best responses to belief is weak. For a given set of beliefs, there is some evidence that neither CEOs nor CGs is especially inclined to selfish best responses. This means that hypothesis 3 cannot be rejected.

5.2.4 Accuracy of beliefs

In a final step, we compare the accuracy of the CEOs' beliefs with the accuracy of those of the CGs. Accurate beliefs about others' behavior are essential in order to generate realistic business plans and profitable strategies for firms. Our findings indicate that the CEOs have more accurate beliefs about their co-player's behavior than the CGs (see Appendix 2C). Here it is important to stress that the beliefs for CEOs concerned other CEOs, while beliefs for the CG concerned fellow citizens, we are comparing the accuracy of beliefs in reference to different groups. Hence, the question posed is whether CEOs have developed behavior and systems of beliefs that make them more accurate in their predictions of other CEOs' strategic behavior than the CGs are in their predictions about the strategic behavior of the general population. Further investigation into this matter (see Appendix 2C) suggests that the CEOs' superiority in accuracy depends on the target group for the beliefs. Thus, CEOs are better in predicting the average behavior of their own group, but they are not better at predicting the average behavior of society at large. One might think that since the CEOs are a more homogenous group the superior accuracy might be linked to a substantially higher variance of beliefs in the GG group, but this is not the case.

5.3 Concerns and robustness tests

We conduct a number of additional tests to scrutinize the robustness of our main findings along various dimensions (tests and results are available online as Supplementary Material). First, we have explored the potential influence of the defined focus groups. As can be expected in a random sample, the CG did also include a number of individuals ($n=43$) who indicated that they are currently employed as CEOs. To test whether our results are robust if we exclude these 43 CEOs from the CGs and include them in the sample of CEOs, we run regressions similar to those reported in Table 8 above. Our results show that the magnitude of the CEO coefficients increases for all games, and in BSS the significance level increases from the 5% level to 1% (see Appendix 3, Table A7). We report similar tests on differences in beliefs and find that the results are robust (see Appendix 3, Tables A8 and A9).

Further, a skeptic may be concerned about a potential 'location effect', as CEOs 'played' the strategic games and made their choices in their workplaces, whereas CGs did so in their homes. There were also subtle differences in the way the opponent was described, with the CEOs being informed that X "is a CEO of a Chinese firm and is a Chinese citizen", while the CGs were informed that X "is a Chinese citizen" (see the instructions). Theoretically, referring to a more exclusive group may create stronger in-group emotions, which in principle can drive differences in

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Table 10 Beliefs: average partial effects

	(1) Belief_PD	(2) Belief_BSS	(3) Belief_C
CEO	−0.231***	−0.082	−0.049
	(0.051)	(0.050)	(0.045)
Male	−0.032	−0.029	0.019
	(0.065)	(0.067)	(0.056)
Age	0.002	0.001	0.001
	(0.003)	(0.003)	(0.003)
School	−0.003	−0.001	0.013
	(0.010)	(0.011)	(0.009)
Income	0.039	−0.101	−0.113*
	(0.084)	(0.078)	(0.062)
Shanghai	−0.089	−0.024	0.016
	(0.056)	(0.056)	(0.049)
Frame_Abst	−0.029	−0.028	−0.159***
	(0.045)	(0.045)	(0.041)
Wald chi^2	25.930	9.178	28.087
Prob > chi^2	0.001	0.240	0.000
Pseudo R^2	0.006	0.002	0.005
N	400	400	400

Results from fractional response regressions. Belief_PD, Belief_BSS, Belief_C represent the subjects' belief of the proportion playing Defect (PD) and Hawk (BSS and Chicken), respectively. Coefficients represent average partial effects. Robust standard errors in parentheses, $^{*}p<0.1$, $^{**}p<0.05$, $^{***}p<0.01$

results. To explore whether these effects are likely to influence our results we have compared the behavior of control group CEOs with non-CEO control group members (both interviewed in their home and both stating beliefs regarding other fellow citizens), but did not detect substantive differences in comparison with our baseline results (see Appendix 4, Table A10–A12).

Then, we have explored whether differences in average cooperativeness and quality of education between both groups may have influenced our results (see Appendix 5). Yet we can show that both factors are unlikely to have a significant influence on our baseline findings. Further, we have ruled out that extreme values (Appendix 6) or interviewer effects (Appendix 7) explain our findings. Further, we have also applied narrower definitions of the CEOs, as many of the subjects are also owners or even founders of their companies. A focus on these sub-groups, however, does not generate substantively different results (Appendix 8). Finally we have explored the possible effect of differences in the CEOs' competitive environment on the strategic choices made in the game but could not identify such association (Appendix 9).

In sum, we feel confident that our results accurately reflect differences between CEO behavior and the behavior of others, less familiar and experienced with strategically relevant decisions.

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6 Explanations and implications

One of the strongest results of this study is that CEOs tend to be more oriented towards cooperation and non-aggressive behavior than other people, which leads to substantial differences in expected earnings. As shown in Table 7, the expected payoffs of the CEOs were substantially higher than for the CGs. If these observed behavioral differences reflect how CEOs and CGs interact in real strategic settings, then this implies the existence of a "CEO culture" of norms and beliefs generating substantial returns, not only to the CEOs' own firms but also to society as a whole.[27]

Given that the orientation towards efficiency among CEOs outside experimental tasks is real it is natural to ask why this is so. Our data is not designed to offer conclusive answers, but we can speculate as to some possible underlying factors in addition to the mechanisms discussed in Sect. 3. First, the observed behavioral difference may be linked to market activity per se. Virtually all transactions on private markets involve voluntary agreements of at least two parties, which means that such transactions are inherently prosocial and may generate—or may attract and reinforce—a mindset oriented towards identifying efficiency enhancing win–win solutions.[28] The observed behavioral differences may also be related to the CEO's leadership role within an organization. Social image and identification with the organization may be crucial for a business leader to mobilize support and loyalty from employees and business partners. Such experience may frame a CEO's mindset and generate less aggressive and more prosocial choices in our experimental tasks (Akerlof and Kranton 2005; Benabou and Tirole 2006). Finally, CEOs may generally pay more attention to the responses of their 'followers' to their own actions. If this is the case, CEOs may have developed a certain style to lead 'by example' or 'by sacrifice' (Hermalin 1998), which can involve costly cooperative or non-hawkish actions.[29]

What are the implications of our findings? How do our results inform the literature on the interplay between institutions and moral values and norms (Bowles 1998)? Key ingredients for a successful institutional structure are what Douglass North denotes as "informal constraints", which among other things, consist of "conventions and codes of behavior", including norms (North 1990/2007, p. 4). To explain the development of norms is a highly complex problem involving the interplay between formal rules and informal constraints. However, as North points out: "Even if we do not possess a good explanation for social norms, we can model wealth-maximizing norms in a game theoretic context. That is, we can test, empirically, what sorts of informal constraints are most likely to produce cooperative

[27] We do not claim that choosing certain strategies in experimental games necessarily reflects how CEOs run their firms. It is possible that the game choices reflect personal attitudes, which are unrelated to the choices made for their firms. In any case the potential connection between game choices and firm characteristics and outcomes is an interesting empirical question that ought to be addressed in future research.

[28] It should be stressed that our use of the term "prosocial" and win–win solutions only concerns the involved parties. We cannot say anything about potential prosocial behavior if a passive third party is affected by a negative externality, as in Falk and Szech (2013) and Bartling et al. (2015).

[29] This mechanism has gotten support in experiments where one player is assigned the leader role and the other the follower role (Potters et al. 2007).

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behavior…." (Ibid., p. 43). We partly follow this approach by using games to study cooperative and non-aggressive behavior. We then analyze how the norms indirectly revealed by the strategy choices in these games differ between subjects embedded in different environments or "cultures": Those heavily involved in strategic private market decisions (the CEOs) and those who are less likely to make socially relevant strategic decisions (the CG). While we did not strive to identify a definite causal explanation, the findings open the way for hypotheses as to how familiarity with strategic decision-making in private markets can affect soft institutions in a society. One can hypothesize that a frequent encounter with strategic market decisions fosters the emergence of norms favoring efficiency. Furthermore, if the within-group interaction is more pronounced than the interaction between distinct social groups, it would be reasonable to assume that cultures relying heavily on strategic market exchange will grow faster than others and may "export" wealth-creating norms to the rest of the society.[30]

The orientation towards efficiency among our private company CEOs could imply that they also, by generating efficient informal constraints and within-group norms of cooperation, they can also shape institutions in the rest of the economy over time. Our finding may serve as a step in increasing our understanding of how economic institutional development can be "channelled" through private markets in transition economies such as China.[31]

7 Conclusion

As the health of most economies depends on the aggregate behavior of their business leaders and CEOs, it is a crucial task for economic theory to understand and predict the behavior of these individuals. Equally important, it is of interest to learn in what way CEOs may influence the norms in the societies they live in. This question can be related to the broader debate as to how private markets and a frequent reliance on market exchange affect norms and values.

We investigate the strategic decision-making of private-firm CEOs in well-defined games. In particular, we study whether CEOs differ from that of other comparable subjects, in what we believe to be the most ambitious study of CEO's behavior in strategic games thus far. For this research, we recruited a stratified random sample of 200 CEOs and a carefully selected sample of 200 control group members to participate in three incentivized strategic games, the Prisoner's Dilemma, the Battle-of-the-Sexes, and the Chicken game. We find substantial differences in behavior

[30] This efficiency orientation among private CEOs is likely to be transmitted to actors in the surrounding society, both because its relative success may stimulate others to imitate their strategies and also because as the private sector grows in importance, its leaders have the ability and power to persuade others to accept their own norms and values (e.g., politicians, bureaucrats employees).

[31] Nee and Opper (2012) argue that much of the recent institutional change in China is a bottom up process, driven by private entrepreneurs. This conclusion is supported by a multitude of historical facts, registry data and observations from interviews. A more formal agent-based model of this bottom-up process is offered in DellaPosta et al. (2017).

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between the CEOs and the control group, but not in the way many would expect. The CEOs were not in general closer to the Nash equilibrium prediction (assuming selfish preferences). On the contrary, the average control group behavior was closer to the Nash equilibrium in the majority of the games and did not best respond less frequently to their beliefs. The most striking and consistent pattern was that the CEOs had higher expected earnings than the comparison group in all the games. The CEOs cooperated more and played less hawkishly compared to the control group, no matter how the game was framed (abstractly or with a narrative). Compared to the control group the CEOs' also had significantly higher average beliefs that others would cooperate in the Prisoner's Dilemma.

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Affiliations

Håkan J. Holm[1] · Victor Nee[2] · Sonja Opper[1]

✉ Håkan J. Holm
Hakan.Holm@nek.lu.se

Victor Nee
Victor.Nee@cornell.edu

Sonja Opper
Sonja.Opper@nek.lu.se

[1] Department of Economics, School of Economics and Management, Lund University, P.O. Box 7082, 22007 Lund, Sweden

[2] Department of Sociology, Cornell University, Ithaca, USA

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