Facultad de Ciencias Económicas y Empresariales
Universidad de Navarra

Working Paper nº 09/07

Team Formation and Self-serving Biases

Brice Corgnet
Facultad de Ciencias Económicas y Empresariales
Universidad de Navarra

Team Formation and Self-serving Biases
Brice Corgnet
Working Paper No.09/07
August 2007

ABSTRACT

There exists extensive evidence that people learn positively about themselves. We build on this finding to develop a model of team formation in the workplace. We show that learning positively about oneself systematically undermines the formation of teams. Agents becoming overconfident tend to ask for an excessive share of the group outcome. Positive learning generates divergence in workers' beliefs and hampers efficient team formation. This result is shown to be robust to high degrees of workers' sophistication. We finally apply our model to co-authorship and organizational issues.

Brice Corgnet
Universidad de Navarra
Depto. Economía
Campus Universitario
31080 Pamplona
bcorgnet@unav.es

Team Formation and Self-serving Biases

Abstract

There exists extensive evidence that people learn positively about themselves. We build on this finding to develop a model of team formation in the workplace. We show that learning positively about oneself systematically undermines the formation of teams. Agents becoming overconfident tend to ask for an excessive share of the group outcome. Positive learning generates divergence in workers' beliefs and hampers efficient team formation. This result is shown to be robust to high degrees of workers' sophistication. We finally apply our model to coauthorship and organizational issues.

1 Introduction

1.1 The teams inefficiency result

In recent years, more intensive use of teamwork in organizations has raised interest in the factors affecting the success of teams. In this paper, we consider the role of psychological factors on team formation and in particular we analyze the impact of self-serving biases in individuals' learning processes. To analyze team formation we consider a two-period model in which workers jointly decide whether to form a team or work alone. We assume

that workers' abilities are unknown, and individuals update their beliefs about abilities after receiving a signal at the end of the first period. Our model establishes a basic framework to analyze the necessary psychological conditions for individuals to form teams. We show that when workers suffer from self-serving attribution, cooperation among individuals is undermined whatever the allocation rule that is considered for the group outcome. The negative impact of self-serving biases on team formation is referred to as the *teams inefficiency result*. We show that this result is robust to high degrees of workers' sophistication. We also analyze the design of teams contracts that foster team formation among self-serving workers. We show that fixed allocation rules can be preferred to contingent contracts based on workers' abilities. This finding is seen as the evidence of psychological limitations on contracting. As psychological biases are present, workers interpret information differently and this renders difficult the use of complex contracts that are contingent on workers' performances. We then apply the model to organizations with a particular focus on research institutions. We provide a psychological explanation for the fact that research institutions over-reward joint works.

1.2 Related literature

The focus on individuals' biased self-attribution is motivated by widespread evidence in Psychology literature showing that people take credit for successes but deny responsibility for failures (Bradley 1978, Miller and Ross 1975, Zuckerman 1979). Individuals tend to process information distortedly so as to build a positive self-image (Fiske and Taylor 1991, Nisbett and Ross 1980). In addition, there is extensive evidence that people recall their successes better than their failures (Korner 1950, Silverman 1964, Mischel, Ebbesen and Zeiss 1976). This leads individuals to hold excessively positive beliefs

about themselves (Greenwald 1980, Svenson 1981 and Cooper, Woo and Dunkelberg 1988). Also, people are inclined to process efficiently positive personality information whereas they imperfectly process negative personality information (Kuiper and Derry 1982, Kuiper and McDonald 1982, Kuiper et al. 1985). Psychology literature has mostly interpreted biases in inference and attribution as motivational biases. These authors argue that people feel better-off when they learn positively about themselves. We account for these motivational biases by assuming that workers are likely to process bad signals about their abilities as if they were good signals. We assume that individuals update the actual processed information using Bayesian inference. Our updating process belongs to a wider class of learning processes defined by Rabin (2002) as quasi-Bayesian.[1]

In our framework, positive self-image arises because of individuals' mental processes that modify beliefs about abilities. Positive self-image can also be generated without assuming individuals' need to distort their perceptions of successes and failures. For example, Van den Steen (2004) develop a model in which individuals have different priors about the probability of success on a given task. In that context, individuals will select actions for which they overestimate the likelihood of success. As a result, individuals will overvalue the probability with which their failures are due to bad luck rather than to insufficient talent. Another possibility is to generate positive self-image by considering that individuals have subjective perceptions of the levels of ability (Santos-Pinto and Sobel 2005). According to Santos-Pinto and Sobel, individuals develop positive self-image since they invest in improving the skills that are most relevant for their personal definition of abilities. In this paper we do not provide a theory of positive illusions, rather, we analyze how positive illusions affect cooperation in the workplace. In that

[1] "A person is modeled as having a specific form of misreading of the world meant to correspond to a heuristic error, but then is assumed to operate as a Bayesian given this misreading." (Rabin 2002).

respect, the specific process used to generate positive illusions is not of decisive relevance in our work.

Other authors have considered the effect of individuals' positive illusions in organizations. Special attention has been devoted to the analysis of managers' overconfidence and its impact on the decision to enter an industry (Camerer and Lovallo 1999), invest (Bernardo and Welch 2001, Malmendier and Tate 2005) or share information with subordinates (Blanes i Vidal and Möller 2007). In this paper we analyze the impact of coworkers' positive illusions in the formation of teams.

Various researchers have studied the role of behavioral factors in the context of teams. They have focused on finding possible solutions to free riding arising in teams when efforts of its members are not observable.[2] Rotemberg (1994) demonstrates how altruism can improve workers' cooperation and welfare when complementarities exist among team members. Kandel and Lazear (1992) show how peer pressure can increase cooperation among workers by stressing how workers can reduce the negative effects of peer pressure by exerting higher levels of efforts. Gervais and Goldstein (2006) find that workers' biased self-perception facilitates cooperation among individuals. In their model, overconfident individuals overestimate their marginal product of effort leading themselves and their coworkers to exert more effort in the team. The authors show that both the self-confident and the rational workers can benefit from overconfidence.

Our framework differs from the ones previously mentioned since it eliminates free riding issues by assuming observability of coworkers' actions. We consider the most favorable case for workers' cooperation by focusing on teams with a sufficiently close level of collaboration such that individuals are able to observe each others' performances

[2]Free riding issues in teams have been studied in numerous papers such as Holmstrom (1982), Itoh (1991) or Che and Yoo (2001).

and actions. In contrast to Gervais and Goldstein (2006), we find that workers' biased self-perception has a negative impact on cooperation in the workplace. Our approach differs from Gervais and Goldstein since we analyze cooperation as the decision of team formation whereas they analyze the level of effort undertaken by individuals assuming that a team has already been formed.

The rest of this paper is organized as follows. We present and solve our model in the case of rational coworkers in Section 2 and analyze the model with self-serving biases in the third section. In Section 4, we study the robustness of the *teams inefficiency result* to the case of sophisticated workers willing to overcome their biases. We present possible extensions of our framework in Section 5. Subsequently, we discuss applications in Section 6. Section 7 concludes. All proofs are available in the appendix.

2 The benchmark model of team formation

In this section, we analyze the benchmark framework in which workers behave as Bayesian inferers.

2.1 The team formation framework

We consider the case of two workers deciding whether to complete an individual or a team project. Examples of such decisions are found in the academia when researchers decide whether to write a single-authored or a coauthored paper. Workers may also be confronted with decisions to form teams in their organizations as in the case of the Koret Corporation described by Hamilton, Nickerson and Owan (2003). We propose to model team formation in a two-period game described as follows.

At $t = 0$, the two workers decide simultaneously whether to undertake the individual or the group project. The team project is undertaken only if both workers agree to do

so. At the end of the first period workers observe the outcome of the project chosen at $t = 0$. At $t = 1$ workers decide for the second time whether to form a team or work alone and the outcome associated to the project initiated at $t = 1$ is observed at $t = 2$. We denote $l_{i,t} \in L \equiv \{T; NT\}$, worker i's actions at $t = 0$ and at $t = 1$, for $i \in \{1; 2\}$, where $T\,[NT]$ stands for forming a team [working alone]. Team members do not know their level of ability and the level of ability of their coworker. Workers update their beliefs about abilities at the end of the first period after observing the outcome of the project chosen in the first period. individuals are risk neutral so that they select their projects by maximizing expected payoffs.

Assumption 1 (Individual production function)

Worker i's production function is a Bernoulli process $X_{i,t}$, where $X_{1,t}$ and $X_{2,t}$ are independent.

If individual i decides to work alone he undertakes a project that is a success [failure] with probability q_i $[1 - q_i]$, where q_i is worker i's ability. If it is a success [failure] this project delivers a payoff $x_{i,t} = G$ $[B < G]$. We denote $S \equiv \{B; G\}$.

Assumption 2 (Team production function)

If workers choose to form a team, they receive the following payoff: $\gamma\,(x_{1,t} + x_{2,t})$.

Assumption 3 (Learning about abilities)

Workers' abilities follow a Beta prior distribution: $q_i \sim Beta(\alpha, \beta)$.[3]

For notational simplicity we refer to $X_{i,1}$ $[x_{i,1}]$ as X_i $[x_i]$. The total outcome of the group project is shared according to the allocation rule $\eta \in (0, 1)$ so that workers 1 and

[3]The beta prior assumption is convenient since the beta distribution is a conjugate prior for the binomial problem considered here (Box and Tiao 1973). In addition, beta distributions can approximate any reasonably smooth unimodal distribution on $[0, 1]$ (Lee 1997).

2 get respectively payoffs $\eta\gamma\left(x_{1,t}+x_{2,t}\right)$ and $\left(1-\eta\right)\gamma\left(x_{1,t}+x_{2,t}\right)$.[4] The parameter γ represents synergies obtained for working in a team and workers know γ at $t=0$. The absence of synergies corresponds to $\gamma=1$. In that case the total outcome of the team project is the sum of the individual projects outcomes.

2.2 Analysis of team formation

We consider an allocation rule under which the share of the group outcome obtained by an individual is equal to his relative ability as it is defined below.

Definition 1 *The relative ability of worker i is as follows:*

$\frac{\hat{q}_{i,t}}{\hat{q}_{i,t}+\hat{q}_{j,t}}, i\neq j\ \forall\left(i,j\right)\in\left\{1;2\right\},\forall t\in\left\{0;1\right\}.$

We denote $\hat{q}_{i,t}$ the level of ability of worker i as updated by a Bayesian inferrer given information up to time t. For notational simplicity we refer to $\hat{q}_{i,1}$ as $\hat{q}_i$.

Under this allocation rule, worker i's expected payoffs for a team project is $\gamma\hat{q}_{i,t}$. The next proposition shows that, in that case, workers form a team at $t=0$ whenever $\gamma\geq 1$.

Definition 2 *The efficient teams outcome corresponds to the payoffs obtained by team members when workers form a team at $t=0$ and at $t=1$ whenever $\gamma\geq 1$.*

We denote $efficient\ teams\ equilibrium$ an equilibrium that implements the efficient teams outcome.

Proposition 1 *Under the relative ability allocation rule and in the absence of self-serving biases there exists a subgame-$perfect$ $Nash$ equilibrium that implements the efficient teams outcome.*

[4] The allocation rule of the group outcome is *budget-balanced*.

Proposition 1 shows that by selecting an allocation rule that depends on updated workers' ability, individuals can attain the maximum level of cooperation.[5] As a result, the *efficient teams outcome* is attainable in the absence of self-serving biases.

3 The model with self-serving biases: first evidence of the teams inefficiency result

3.1 Assumptions on self-serving biases

In this section we consider that the two workers suffer from biases in their learning process. Self-serving attribution is modelled as Bayesian learning with imperfect processing of negative signals. The self-serving learning process is common knowledge.

Assumption 4 (Self-serving Learning)

We denote σ_{ij} worker i's perception of worker j's performance at $t = 1$.

We assume that, with probability p, a worker i perceives his bad performance at $t = 1$ ($x_i = B$) as if it was a good performance ($\sigma_{ii} = G$).[6]

A worker updates his coworker's ability using Bayesian inference and correct information processing, that is $\sigma_{ij} = x_j$ for $i \neq j$.

Our assumption implies a different treatment of bad and good signals. This asymmetry in the learning process is what we call self-serving learning. Workers distort bad signals about their abilities so that above average effects emerge and lead workers to perceive themselves as more talented than their coworkers. The latter effects generate

[5] Proposition 1 still holds if coworkers' prior abilities are different as long as both workers agree on the priors.

[6] Workers' biases are assumed to be independent.

a dispersion in workers' beliefs about their own ability and the ability of their coworker. This is the case because individuals behave as Bayesian inferers when they update others' abilities but suffer from self-serving biases when updating their own ability. There is evidence in the literature in Psychology that individuals see themselves more positively than others see them. For example, Lewinsohn et al. (1980) compared the ratings made by observers and by college students themselves about personality characteristics like friendliness, warmth and assertiveness of students involved in a group interaction task. They found that self-ratings were significantly more positive than observers' ratings.

Another important element of our quasi-Bayesian learning process model is the degree with which workers are aware of their own biases. We consider that the two coworkers have the same degree of awareness of biases. The level of awareness of biases is common knowledge. We denote $\bar{E}_i$ the expectation of workers suffering from self-serving biases p. We take p_G $[p_B]$ to be the expected probability given information at $t = 0$ that $X_i = G$ $[X_i = B]$.

Assumption 5 (Awareness of Biases)

Assumption 5a: (Asymmetric awareness of biases). Workers are unaware of their learning biases but are aware of their coworker's biases.

Under Assumption $5a$, the updating rule at $t = 1$ is as follows.

$$\bar{E}_i \left[q_i \mid \sigma_{ii} = s \right] \equiv E \left[q_i \mid x_i = s \right], \forall s \in S \equiv \{B; G\}.$$

Assumption 5b: (Full awareness of biases). Workers are aware of their coworker's biases as well as their own biases.

Under Assumption 5b, the updating rule at $t = 1$ is as follows.

$$\begin{cases} \bar{E}_i\left[q_i \middle| \sigma_{ii} = B\right] \equiv q_B \equiv E\left[q_i \middle| x_i = B\right] \\ \bar{E}_i\left[q_i \middle| \sigma_{ii} = G\right] \equiv \hat{q}_G \equiv \frac{pp_B}{pp_B + p_G} E\left[q_i \middle| x_i = B\right] + \frac{p_G}{pp_B + p_G} E\left[q_i \middle| x_i = G\right] \end{cases}$$

Assumption 5a implies that workers are able to recognize that others learn positively about themselves but are not able to identify their own biases (Pronin, Lin and Ross 2002). This assumption is consistent with findings in Psychology that stress the limited awareness of individuals about their mental processes (Epstein 1983, Gilbert et al. 1998). Under Assumption 5b workers are aware of their own biases; this assumption is used in Bénabou and Tirole (2002).[7] We establish the robustness of our results to different degrees of sophistication of individuals by using respectively Assumption 5a (Section 3.2) and Assumption 5b (Section 4).

3.2 Analysis of team formation in the presence of self-serving biases

We present the intuition of our *teams inefficiency result* by showing that it may be impossible to design an allocation rule such that both workers are willing to form a team whenever $\gamma \geq 1$. As a result, we show that the *efficient teams outcome* is not attainable in the presence of self-serving biases.

Consider that both workers performed badly in the first period and both suffer from self-serving biases at $t = 1$, so that $(x_1, x_2) = (B, B)$ and $(\sigma_{11}, \sigma_{22}) = (G, G)$. This occurs a priori with probability $\frac{\beta^2}{(\alpha+\beta)^2} p^2$. Denoting $\hat{q}_{ij}$ the ability of individual i estimated by individual j at $t = 1$, we obtain by assumptions that $\hat{q}_{11} = \hat{q}_{22} = \frac{\alpha+1}{\alpha+\beta+1}$ and $\hat{q}_{21} = \hat{q}_{12} = \frac{\alpha}{\alpha+\beta+1}$.[8] A team will be formed at $t = 1$ if both workers are better-off

[7] Bénabou and Tirole refer to this assumption as metacognition.

[8] We take $G = 1$ and $B = 0$ without loss of generality.

working as a team. This occurs if the following conditions are satisfied:

$$\begin{cases} \gamma\eta\left(\hat{q}_{11}+\hat{q}_{21}\right) \geq \hat{q}_{11} \\ \gamma\left(1-\eta\right)\left(\hat{q}_{12}+\hat{q}_{21}\right) \geq \hat{q}_{22} \end{cases}$$

$\Leftrightarrow \gamma \geq \frac{\frac{\alpha+1}{2\alpha+1}}{Min\{\eta;1-\eta\}} > 1$ since $\underset{\eta}{Min}\frac{\frac{\alpha+1}{2\alpha+1}}{Min\{\eta;1-\eta\}} = \frac{2\alpha+2}{2\alpha+1} > 1$.

The *efficient teams outcome* is not attainable since for synergy levels $\gamma \in \left[1, \frac{2\alpha+2}{2\alpha+1}\right)$ a team is not formed at $t = 1$. We establish a more general result in Proposition 2.

In this section, workers are naive inferers that do not use Bayes rule to update workers' beliefs (Assumption 5a). Under this assumption, workers do not learn about others' decisions in equilibrium since they mistakenly believe that their perceptions of individuals' abilities at $t = 1$ are correct. We define below subgame-perfect Nash equilibria ($SPNE$) that are consistent with Assumption 5a.

Definition 3 *A $SPNE_a$ is a pure-strategy equilibrium defined as $\left(l^*_{1,0}, l^*_{2,0}, l^*_{2,1}, l^*_{2,1}\right)$ that satisfies* (1) *and* (2)*:*

(1) $\left(l^*_{1,0}, l^*_{2,0}\right)$ *is a Nash equilibrium of the team formation game at $t = 0$ and $\left(l^*_{1,1}, l^*_{2,1}\right)$ is a Nash equilibrium of the team formation game at $t = 1$ for any $(l_{1,0}, l_{2,0}) \in L^2$ and for any $(x_1, x_2) \in S^2$.*

(2) *In agreement with Assumption 5a, if the decision of team formation at $t = 1$ of worker i is inconsistent with the beliefs of worker j at $t = 1$, worker i will attribute this inconsistency to worker j's self-serving biases, where $i \neq j$.*

Proposition 2 *Under Assumptions 1, 2, 3, 4 and 5a, there exists no $SPNE_a$ that implements the efficient teams outcome.*

Self-serving biases create a divergence in beliefs among coworkers. Consequently, even if allocation rules are flexible and synergies are present ($\gamma \geq 1$), an allocation rule permitting team formation may not exist.

Our result about the impossibility to find an allocation rule that ensures a sufficiently high level of cooperation is in line with the experimental results of Babcock et al. (1995) and Babcock and Loewenstein (1997) stating that self-serving biases tend to prevent defendants and plaintiffs from reaching an agreement about a settlement. The next corollary establishes that self-serving biases have a negative effect on aggregate expected welfare.[9]

Corollary 1 *In a $SPNE_a$ the aggregate expected welfare in the case of self-serving learning is at most as high as in the case of Bayesian workers using a relative ability allocation rule.*

Conflicting beliefs prevent workers from agreeing on the relative ability sharing rule that would make both individuals better-off by attaining a higher level of cooperation. The intuition is that cooperation is undermined either by a rigidity in allocation rules as for example the equal splitting rule (Farrell and Scotchmer 1988) or by a "rigidity in beliefs". Rigidity in beliefs arises when self-serving biases are present since then workers stick to excessively positive beliefs about themselves being convinced that their beliefs are correct.

We consider in our analysis a situation in which workers have the possibility to leave the team at $t = 1$. However, there exist cases in which individuals may attempt to commit at $t = 0$ to continue with the project started in the first period. We have to stress that commitment at $t = 0$ may be broken at $t = 1$ by one of the two workers. In our framework commitment is not credible as it happens in many real life situations in which an exante agreement can be broken without further costs. We consider such

[9] The aggregate welfare is the sum of the outcomes obtained by the two workers.

examples in the case of the academic profession in Section 6.[10]

4 The teams inefficiency result with sophisticated individuals

4.1 The revelation game

The inefficiency result captured in Proposition 2 is based on the assumption that workers are unable to recover information about their own ability (Assumption 5a). In this section individuals are aware of their incentives to process information with biases (Assumption 5b). Workers will try to overcome their biases by recovering the correct signals about their abilities. We propose to consider allocation rules that depend on coworkers' performances in the first period. The difficulty is that workers' suffering from self-serving biases may disagree about the signals received at $t = 1$. To tackle this issue we consider that allocation rules are contingent on the signals revealed by the individuals rather than on the signals effectively observed. We modify the initial framework by introducing a revelation game at $t = 1$ after workers have observed their performances on the first period project (Figure 1).[11] Workers may be interested in communicating about their perceived abilities since they know that their coworker is an objective observer of their performances. On aggregate workers have complete information about performances since worker 1 [2] knows worker 2 [1] performance at $t = 1$. The structure of the revelation game played at $t = 1$ is as follows.

At $t = 1$ worker i chooses a message $\mathbf{m}_i \equiv (m_{i1}, m_{i2})$, where $\mathbf{m}_i$ is a vector of messages that belongs to the set S of possible signals observed at $t = 0^{'}$. The set S

[10] Two coauthors may not be able to credibly commit to continue working together since they know that one of the researchers can break the agreement at a low cost.

[11] In the context of sophisticated workers, we assume that performances are not verifiable by the court. If performances were verifiable by the court, workers could reach the *efficient teams outcome* by asking the court to reveal workers' performances. Evidently, such a process can be costly to workers.

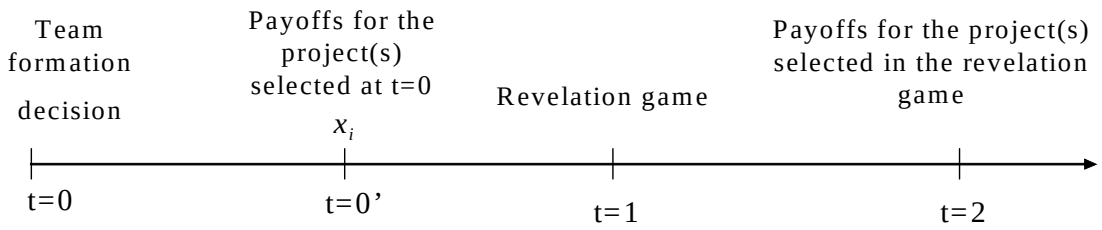

Figure 1: Timeline for the model with sophisticated agents and a revelation game.

is actually the set of possible types of coworkers. This is the case since perceptions of performances constitute workers' private information.[12]

At $t = 1^{'}$ where $1^{'} \in (1, 2)$, workers decide whether to form a team or work alone.

The messages released by the two individuals will determine the share of the group outcome given to the first coworker (η) as a function of the revealed signals, that is $\eta \equiv \eta\left(m_{11}, m_{12}, m_{21}, m_{22}\right)$.[13-14] We denote $V_i\left(\mathbf{m}_i, \mathbf{m}_j, l_i, l_j\right)$ the expected payoffs obtained by worker $i \neq j$ when undertaking the second period project, where l_i stands for worker i's team formation decision at $t = 1^{'}$.

The concept of equilibrium that we use in the case of sophisticated workers is defined below.

Definition 4 *A PBE_b is a pure-strategy Perfect Bayesian Equilibrium of the revelation game $\left(l_1^*, l_2^*, \mathbf{m}_1^*, \mathbf{m}_2^*\right) \in L^2 \times S^4$ that solves* (3) *and* (4) *given condition* (5)*:*

(3) $\max\limits_{\mathbf{m}_i \in S^2} V_i\left(l_1^*, l_2^*, \mathbf{m}_i, \mathbf{m}_j^*\right), \forall i \neq j.$

(4) $\max\limits_{l_i \in L} V_i\left(l_i, l_j^*, \mathbf{m}_1^*, \mathbf{m}_2^*\right), \forall i \neq j$

Where $V_i \equiv 1_{NT}\bar{E}_i\left[q_i \mid \sigma_{ii}, \mathbf{m}_j\right] + 1_T\bar{E}_i\left[\eta_i\left(\mathbf{m}_1, \mathbf{m}_2\right)\left(q_i + q_j\right) \mid x_{j,1}, \sigma_{ii}, \mathbf{m}_j\right].$

[12] The set of possible messages being the set of types, we can use the Revelation Principle and conclude that our results continue to hold for any message space. The Revelation Principle can be applied to our model since it can be represented as a normal form game of a static Bayesian game.

[13] We denote $\eta_i\left(m_{11}, m_{12}, m_{21}, m_{22}\right)$ the share of the group outcome obtained by worker i.

[14] We do not consider the allocation rule of the group outcome delivered $t = 0^{'}$ since using an equal splitting rule $\left(i.e.\ \eta = \frac{1}{2}\right)$ will ensure team formation at $t = 0$.

We denote 1_T $[1_{NT}]$ *the indicator function that takes value one for* $l_1 = l_2 = T$ $[(l_1, l_2) \neq (T, T)]$.

(5) *In equilibrium, individuals' beliefs about workers' abilities at* $t = 1$ *are updated using Bayes rule as it is described in Assumption* 5*b and out of equilibria beliefs are taken to be the prior beliefs.*

A PBE_b is defined for a given function $\eta : (\mathbf{m}_1, \mathbf{m}_2) \mapsto \eta(\mathbf{m}_1, \mathbf{m}_2)$, where $(\mathbf{m}_1, \mathbf{m}_2) \in S^4$ and $\eta(\mathbf{m}_1, \mathbf{m}_2) \in (0, 1)$.

4.2 The teams inefficiency result

Given that workers assess each others' abilities as Bayesian inferers, we may wonder if allowing workers to communicate will lead individuals to eliminate their learning biases and cooperate efficiently. Proposition 3 shows that such conjecture does not hold.

Proposition 3 *Under Assumptions 1, 2, 3, 4 and 5b, there exists no* PBE_b *that implements the efficient teams outcome.*

Proposition 3 is the counterpart of Proposition 2 when individuals are learning about their biases and have the possibility to communicate about their perceived performances through a revelation game. Proposition 3 shows that the *teams inefficiency result* first stated in Proposition 2 is robust to the case of sophisticated workers that attempt to overcome their biases. Workers are unable to reach the *efficient teams outcome* because they have an incentive to reveal themselves as being high-ability workers in order to obtain a higher share of the group outcome. These incentives to lie imply that truthful telling is costly to achieve. Indeed, workers tell the truth in equilibrium only if the allocation rule of the group outcome is not contingent on messages. However, fixed allocation rules do not provide the adequate incentives for workers to form teams since

then high-performance workers will perceive their team rewards as being insufficient. In the case of fixed allocation rules the *efficient teams outcome* is not attainable even in the presence of complete information.[15]

4.3 Team contracts and workers' cooperation

We analyze the impact of self-serving biases on the characteristics of optimal team contracts. In particular, we are interested in analyzing the conditions under which simple team contracts are preferred to contracts that are contingent on workers' performances. In a classical principal-agent model, non-contingent contracts may be optimal if the agent is engaged in multiple tasks (Holmstrom and Milgrom 1991). In that framework, the agent undertakes different projects that are substitutes and for which the outcome is not always observable. In order to ensure that the agent will exert effort in all the activities the principal may decide to use fixed wages. In this section, we propose a behavioral explanation to the fact that contracts used in organizations are usually simpler than predicted by the theory (Holmstrom 1982). There is many real life examples in which workers are not rewarded with respect to their relative contributions as it is the case in partnerships (Levin and Tadelis 2005).[16]

Definition 5 *A contract is the share of the group outcome* (η) *distributed to worker* 1 *at* $t = 2$.

A non-contingent contract is an allocation rule that does not depend on messages released by workers at $t = 1$, *that is* $\eta(\mathbf{m}_1, \mathbf{m}_2) = \bar{\eta}$, *for* $(\mathbf{m}_1, \mathbf{m}_2) \in S^4$.

A contingent contract is an allocation rule that depends on messages released by workers at $t = 1$.

[15] The proof of this result is trivial and is available upon request.
[16] Another example is the case of coauthors in Economics research.

4.3.1 Non-contingent contracts

In the next proposition we establish the conditions for team formation at $t = 1^{'}$ in the case of non-contingent contracts. We consider the uninformative and truthful-telling PBE_b of the revelation game. Uninformative PBE_b are pooling equilibria in which every type of worker plays the same strategy. Under the pooling equilibrium, no information about workers' biases is revealed so that individuals are unable to reduce their learning errors. Truthful-telling equilibria are such that all the information is disclosed in equilibrium.[17] This occurs if workers truthfully reveal their perceived performances ($\mathbf{m}_i = \boldsymbol{\sigma}_i \equiv (\sigma_{ii}, \sigma_{ij})$, for $i \neq j$). In that case, workers are able to recover the true information about their performances and this implies that individuals fully identify their learning biases.

Proposition 4 *Given a non-contingent contract* $(\bar{\eta})$*:*

i) Uninformative PBE_b *imply the following conditions for team formation:*

For $\gamma < \hat{M}$*, workers form a team only if* $\sigma_{12} = \sigma_{21}$*. For* $\gamma \geq \hat{M}$*, workers always form a team. We denote* $\hat{M} \equiv Max\left\{\frac{\hat{q}_G}{\bar{\eta}(q_B+\hat{q}_G)}; \frac{\hat{q}_G}{(1-\bar{\eta})(q_B+\hat{q}_G)}\right\}$ *and* $\hat{q}_G = wq_G + (1-w)\, q_B$ *with* $w = \frac{p_G}{p_G+pp_B}$*.*

ii) Truthful-telling PBE_b *imply the following conditions for team formation:*

For $\gamma < M$*, workers form a team only if workers' performances are identical (i.e.* $x_1 = x_2$*). For* $\gamma \geq M$*, workers always form a team.*

We denote $M \equiv Max\left\{\frac{q_G}{\bar{\eta}(q_B+q_G)}; \frac{q_G}{(1-\bar{\eta})(q_B+q_G)}\right\}$*, where* $M > \hat{M}$*.*

From Proposition 4, we know that the non-contingent contract that maximizes workers' expected payoffs is $\bar{\eta} = \frac{1}{2}$. In the rest of Section 3.2 we use $\bar{\eta} = \frac{1}{2}$ as the non-contingent contract. For $\gamma < \frac{2\hat{q}_G}{q_B+\hat{q}_G}$, a necessary condition for team formation at $t = 1^{'}$

[17] The beliefs in equilibrium are $P[(X_1, X_2) = (m_{21}, m_{12})] = 1$.

is that workers' performances in the first period project are identical. In the case of truthful-telling PBE_b this condition is sufficient but for uninformative PBE_b the absence of self-serving biases is also required to ensure team formation. If workers perform differently in the first period team formation is not possible when the team contract is non-contingent. This is the case since the high-performance worker will require a contract that depends on workers' relative abilities in order to accept the formation of a team. For $\gamma \in \left[\frac{2\hat{q}_G}{q_B+\hat{q}_G}, \frac{2q_G}{q_B+q_G}\right)$, truthful revelation leads to a equilibria in which workers form a team at $t = 1^{'}$ only when workers performed identically at $t = 1$ (*i.e.* $x_1 = x_2$) whereas the uninformative PBE_b imply team formation for any $(\sigma_{12}, \sigma_{21}) \in S^2$. As a result, Proposition 4 implies that full revelation of information can lead to less team formation than no information revelation. This is the case since under the uninformative equilibrium, workers who perceive themselves as being high performers are aware of the possibility that they may have performed poorly in the first period. In that case, a high-performance worker perceives his level of ability to be $\hat{q}_G < q_G$. A high-performer appears to be self-critical and then more inclined to form a team in the second period than if he was fully informed. In particular for $\gamma \in \left[\frac{2\hat{q}_G}{q_B+\hat{q}_G}, \frac{2q_G}{q_B+q_G}\right)$ uninformed high-performers will always form a team at $t = 1^{'}$ even if they receive only half of the group outcome whereas informed high-performers would refuse to work with low-performance workers in that case. As a result, promoting communication among workers is beneficial in terms of cooperation for sufficiently small levels of synergies $\left(i.e.\ \gamma < \frac{2\hat{q}_G}{q_B+\hat{q}_G}\right)$.

4.3.2 A comparison of contingent and non-contingent contracts

Contingent contracts allow workers to be rewarded as a function of their true relative abilities so that team formation can be obtained for $\gamma < \frac{2\hat{q}_G}{q_B+\hat{q}_G}$ even when workers perform differently in the first period. In particular, we consider contingent contracts

that reward worker 1 with a share of the group outcome that is higher [lower] than $\frac{1}{2}$ for $(x_1, x_2) = (G, B)$ $[(B, G)]$.[18] We know from Proposition 3 that there exists no contingent contract that implements the *efficient teams outcome* so that there always exist a probability that a team is not formed at $t = 1$'. More precisely, contingent contracts do not implement team formation when both workers perform poorly in the first period and at least one of the workers is biased, that is for $(\boldsymbol{\sigma}_1, \boldsymbol{\sigma}_2) \in \Sigma$, where $\Sigma \equiv \{\{(B, B), (B, G)\}; \{(G, B), (B, G)\}; \{(G, B), (B, B)\}\}$. This is the case since telling the truth is not an equilibrium strategy in that case. Let the perceptions of performances at $t = 1$ be: $(\boldsymbol{\sigma}_1, \boldsymbol{\sigma}_2) = \{(B, G); (B, G)\}$ so that worker 1 gets a share $\eta_{(B,G,B,G)} < \frac{1}{2}$ of the group outcome in a truthful-telling PBE_b. In that case, worker 1 has an incentive to lie as long as worker 2 accepts to form a team given contract $\eta_{(B,B,B,G)} \geq \frac{1}{2}$ or $\eta_{(G,B,B,G)} \geq \frac{1}{2}$. Indeed, by reporting that worker 2 performed poorly in the first period worker 1 obtains a higher share of the group outcome. As a result a truthful-telling PBE_b is possible only if worker 2 does not accept to form a team when $(x_1, x_2) = (B, B)$ and worker 2 is biased, that is for $(\boldsymbol{\sigma}_1, \boldsymbol{\sigma}_2) = \{\{(B, B), (B, G)\}; \{(G, B), (B, G)\}\}$.

Proposition 5 *Under Assumptions 1, 2, 3, 4, 5b, and for* $\gamma < \frac{2\hat{q}_G}{q_B + \hat{q}_G}$*:*

In a truthful-telling PBE_b *the non-contingent contract* $\left(\bar{\eta} = \frac{1}{2}\right)$ *implies strictly higher workers' expected payoffs than contingent contracts if* (i) *or* (ii) *holds.*

$i)$ $\gamma < \frac{q_B + 3q_G}{2(q_B + q_G)}$ *and* $p(2 - p) \leq \frac{2p_G}{p_B}$

$ii)$ $\gamma \geq \frac{q_B + 3q_G}{2(q_B + q_G)}$ *and* $p \leq \sqrt{\frac{2p_G}{p_B}}$

Workers prefer a contingent contract when p is sufficiently low. This is true in the limit since from Proposition 1 we know that for $p = 0$ there exists a *subgame-perfect*

[18] Any contingent contract that does not satisfy this condition is dominated by another contingent contract.

Nash equilibrium that implements the *efficient teams outcome* when the contingent contract is the relative ability allocation rule. A decrease in workers' biases does not affect the probability with which workers form a team under the non-contingent contract whereas it increases the frequency with which workers form a team under contingent contracts.[19] But, for high values of p $\left(p(2-p) > \frac{2p_G}{p_B} \text{ or } p > \sqrt{\frac{2p_G}{p_B}}\right)$ the non-contingent contract is preferred to contingent contracts.[20] This is the case since an increase in p rises the divergence in workers' beliefs and increases the cost of implementing a truthful-telling PBE_b under contingent contracts. The cost of implementing a truthful-telling PBE_b increases when self-serving biases rise since then teams are less likely to be formed given that $P[(\boldsymbol{\sigma}_1, \boldsymbol{\sigma}_2) \in \Sigma]$ increases as p rises. Proposition 5 stresses that fixed allocation rules may be commonly observed because of the presence of self-serving workers that are unable to identify their learning errors from their coworkers. This proposition emphasizes that there exist psychological limitations on contracting activities. This result is related to the growing literature that analyzes the effects of social preferences such as inequity aversion and fairness on the design of optimal contracts (Dur and Glaser 2006, Englmaier and Wambach 2006, Bartling and von Siemens 2007). These authors introduce inequity aversion à la Fehr and Schmidt (1999) and show that non-contingent contracts can be optimal in that case. Fehr, Klein and Schmidt (2007) provide experimental evidence that implicit bonus contracts perform better than explicit incentive contracts in the presence of fair-minded individuals.

Our approach is also connected to models involving incomplete contracts. For example, Hart and Moore (2006) consider that consummate performance defined as per-

[19] $P[(\boldsymbol{\sigma}_1, \boldsymbol{\sigma}_2) \in \Sigma]$ decreases as p goes down.

[20] Such conditions may be satisfied for consulting partnerships if we take into account that experts tend to be more self-confident than non-experts (Griffin and Tversky 1992).

formance within the spirit of the contract is not legally enforceable. They find in that context that rigid contracts may be preferred to flexible contracts as they tend to limit aggrievement and retaliation between buyers and sellers. This is the case because rigid contracts that fix the price of a good exante will work as a reference point for individuals' feelings of entitlements and this will reduce the possibility of disagreements among buyers and sellers. In our framework the only element that is not contractible is the unconscious mental process used by workers in order to build a positive self-image. If this mental process were contractible then workers could not develop a positive view of themselves. We do not need to assume that performances are not contractible in order to show that rigid contracts can be preferred to contingent contracts

5 Robustness of the analysis

5.1 Self-serving learning

We generate self-serving biases by introducing errors in the processing of information but self-serving biases could also be modelled as the result of memory imperfections in the spirit of Bénabou and Tirole (2002). However, this distinction between the different origins of learning biases is not central to our results and to their implication.

Another feature of the learning process is that individuals update their coworker's abilities without biases. However, one can argue that workers that form a team together are inclined to perceive their coworkers' abilities positively. We can introduce this consideration in our model by assuming that with some probability workers perceive positively the ability of their coworker. The *teams inefficiency result* continues to hold in that case as long as workers learn more positively about themselves than about

their coworkers.[21]

5.2 Individual and team production functions

The *teams inefficiency result* can be generalized to the case in which the individual production function is not a Bernoulli process associated to Beta prior distributions. This extension of the model is developed in Appendix B.

More importantly, the assumption of linearity of the team production function is not decisive to establish the *teams inefficiency result*. This result is robust to general team production functions (Appendix B).[22] In particular, a sufficient condition for the *teams inefficiency result* is that team production functions are continuously differentiable.

6 Applications

In this section, we first analyze cooperation in the academic profession. We then study the more general case of organizations with a special focus on the differences between Japanese and US firms.

6.1 Coauthorship

6.1.1 The issue of cooperation among researchers

There exists evidence that research institutions and academic departments over-reward joint works. McDowell and Smith (1992) reject the hypothesis according to which the weighting of coauthored articles in the promotion of academics is equal to the inverse of the number of coauthors. The authors use answers to a questionnaire given to 378 Economics researchers in 20 of the most important US institutions from 1968 to 1975.

[21] This analysis is conducted in Corgnet (2007).
[22] This includes O-Ring production functions (Kremer 1993).

They find that each author of a paper with n coauthors is rewarded more than $\frac{1}{n}$ of the credits given to a single authored paper of the same quality. Schinski, Kugler and Wick (1998) using a survey of 140 Finance academics in 1995 confirm the results of McDowell and Smith (1992). Similar conclusions have been obtained by Liebowitz and Palmer (1983) and by Long and McGinnis (1982) in other fields than Economics. The rules used by research institutions can be interpreted as a mechanism to provide incentives for researchers to write joint papers. This may reveal a concern for insufficient coauthorship among researchers.

6.1.2 An explanation based on self-serving biases

As a direct application of our model, we consider the decision of two researchers to write a joint paper. Researchers, similarly to other individuals, appear to suffer from self-serving tendencies. In particular, Caruso, Epley and Bazerman (2005a, 2005b) find that researchers tend to overestimate their contribution to joint papers. When coauthors were asked to assess their relative amount of work in the team output (in percentage terms), the sum of the estimated contributions typically summed up to a number higher than one.[23] If self-serving biases are present, the $teams\ inefficiency\ result$ implies that researchers may not want to write a joint paper even if it would be optimal to do so under a rational perspective.

6.1.3 A solution: find the optimal coauthor

In order to limit the negative effects of self-serving inference, researchers could select their coauthors according to their degree of self-serving biases. A possibility is to use gender, nationality or self-esteem as selection criteria. There is empirical evidence of sig-

[23] This result can also be explained by assuming that agents have different priors about the probability of success on a given task (Van den Steen 2004).

nificant cultural and gender differences in the magnitude of self-serving biases. Japanese have been found to be particularly responsive to negative signals about their ability whereas North Americans tend to discount such evidence (Kitayama et al. 1997, Heine, Kitayama, Lehman, 2001). Beyer (1990) found that self-serving biases are stronger for men than for women. Another possibility is to select coauthors with low self-esteem since psychologists have found that individuals with low levels of self-esteem are equally likely to recall positive and negative self-relevant information (Kuiper and Derry 1982).

6.2 Applications to the organization

Cultural differences in the way people learn about themselves have been documented by psychologists. Japanese appear to be more self-critical than US and Canadian citizens (Kitayama et al. 1997, Heine et al. 1999, Heine, Kitayama, and Lehman 2001). In agreement with our model is the observation that the Japanese society characterized by self-criticism rather than self-serving attribution is associated with a corporate culture based on teamwork and cooperation (Abegglen 1958, Haitani 1990, Koike 1988). Florida and Kenney (1991) document that Japanese firms select their US employees taking into account their ability for teamwork. However, Sedikides, Gaertner and Vevea (2005) argue that Japanese people may be self-enhancing in certain contexts. Assuming that Japanese are more self-critical than North American in the context of teamwork is in agreement with the conclusion of the meta analysis completed by Sedikides, Gaertner and Vevea (2005) in which they emphasize that Japanese tend to self-enhance on attributes relevant to the ideal of collectivism.

As a consequence of self-serving biases, team members may be willing to hire a third individual that would be able to provide objective and informed assessments about

workers' abilities. Such an individual would be asked to design team contracts based on objective beliefs about workers' abilities. According to our theory of team formation, the need for such a third party is likely to be more pervasive when team workers are highly self-serving. This may explain why self-managed teams are less often observed in US organizations than in Japanese organizations (Koike 1988, Haitani 1990).

7 Conclusion

This paper explored the conditions for team formation when workers have the possibility to learn about their abilities. In particular, we analyzed the case of individuals learning positively about themselves. This process is what psychologists refer to as self-serving learning or biased self-attribution. Interestingly, we showed that even if we considered sharing rules that are contingent on workers' relative abilities, learning has a negative impact on team formation. The intuition is that learning biases generate differences in beliefs about workers' abilities that may render impossible the design of an allocation rule that leads both workers to feel better-off working as a team. We established the robustness of the *teams inefficiency result* to sophisticated individuals. We confirmed the negative effects of self-serving biases on team formation in the case of coworkers willing to overcome their biases by communicating through a revelation game. In the analysis of team contracts we showed that fixed allocation rules may be preferred to contingent contracts. We interpreted this result as the existence of psychological limitations on contracting.

We applied our model to the academic profession and concluded that too little cooperation among researchers may occur as a result of self-serving biases. Our model was finally used to understand organizational differences in Japan and in the US. In

particular, Japanese organizations are characterized by the intensive use of teamwork. We argued that self-criticism of Japanese employees can account for the extensive use of teams.

Also, we want to emphasize that solutions to insufficient cooperation may be very different whether we explain limited cooperation by individuals' self-serving biases or by asymmetry of information among individuals. For example, in the former case it may be optimal to hide information to individuals whereas in the latter case information should always be released. As a result, we argue that it is important to identify whether inefficiencies have a psychological or an informational origin in order to select the adequate policies.

Finally, our work, by establishing the negative impact of learning biases on cooperation in the workplace, challenges the view of researchers emphasizing the beneficial role of positive self-image.[24] It is important to stress how positive self-image, despite its possible positive effects on individuals' motivation or mental health, can harm the society by undermining cooperation. To capture the possible negative effects of biased self-attribution on the society as a whole, one may want to extend our model to more complex teams. A possible direction of research is to analyze the impact of learning biases on the formation of networks. A related investigation would be to assess the impact of these biases on the optimal organizational structure of firms.

[24] Many authors have focused on how biased self-perception can increase motivation and lead agents to work harder. At a theoretical level we can refer to the works of Bénabou and Tirole (2002) and Gervais and Goldstein (2006). At the empirical level, Felson (1984) found that a positive view of oneself was associated to working harder and longer on tasks.

8 Appendix

Appendix A: proofs

Proof of Proposition 1. The proposition follows from the conditions for team formation at $t = 1$ under the relative ability allocation rule. By comparing expected payoffs associated to team projects and individual projects, simple algebra implies that workers form a team at $t = 1$ whenever $\gamma \geq 1$. As a result, at $t = 0$, workers form a team whenever $\gamma \geq 1$. This is equivalent to say that the $efficient\ teams\ outcome$ is achieved.

In addition to the subgame-perfect Nash equilibrium considered in Proposition 1, the other subgame-perfect equilibria are as follows. By backward induction we obtain the following equilibria. 1) No workers form a team at $t = 1$ and teams are formed for $\gamma \geq 1$ at $t = 0$. 2) No workers form a team at $t = 0$ and at $t = 1$. 3) Teams are formed at $t = 1$ and no teams are formed at $t = 0$. These equilibria involve weakly dominated strategies. In addition they involve strategies that prevent any cooperation in at least one of the two periods. ■

Proof of Proposition 2. We show here that it is impossible to design allocation rules at $t = 1$ that lead workers to form a team whenever $\gamma \geq 1$.

$i)$ At $t = 1$, if only one coworker suffers from self-serving biases and the performances are (B, B), the most favorable allocation rule for workers' cooperation, derived using the same reasoning as in the main text, is $\eta = \frac{1}{2}$. In that case team formation arises for $\gamma \geq \frac{\gamma_{BG}+1}{2} > 1$ since $\gamma_{BG} = \frac{2q_G}{q_B+q_G} > 1$.

$ii)$ If worker 1 [worker 2] suffers from learning biases and the history of signals is (B, G) $[(G, B)]$, the most favorable conditions for workers' cooperation, derived using the same reasoning as before, are such that $\eta = \frac{2\alpha+1}{3\alpha+3}$. In that case, workers form a team for $\gamma \geq \frac{1}{2} + \frac{q_G}{q_B+q_G}(\equiv \Theta_b) > 1$.

iii) If both workers suffer from learning biases and the history of signals is (B, B), the most favorable conditions for workers' cooperation are such that a team is formed for: $\gamma \geq \frac{2q_G}{q_B+q_G}(\equiv \Theta_{bg}) > 1$. As a result, even selecting the allocation rule that maximizes workers' cooperation, the conditions for team formation at $t = 1$ are more demanding in terms of synergies than an *efficient teams equilibrium* since $\Theta_b > 1$ and $\Theta_{bg} > 1$. ■

Proof of Corollary 1. It follows directly from Propositions 1 and 2 since the *efficient teams outcome* is achieved in the absence of self-serving biases under a relative ability allocation rule . ■

Proof of Proposition 3. We denote $\boldsymbol{\sigma}_1 \equiv (\sigma_{11}, \sigma_{12})$ and $\boldsymbol{\sigma}_2 \equiv (\sigma_{21}, \sigma_{22})$, and we take p_G $[p_B]$ to be the expected probability given information at $t = 0$ that $X_i = G$ $[X_i = B]$.

i) First, we show that an *efficient teams equilibrium* is only possible if it is a truthful-telling equilibrium. In a truthful-telling PBE_b workers reveal their observed signals: $\mathbf{m}_i = \boldsymbol{\sigma}_i$ so that beliefs in equilibrium are $P[(X_1, X_2) = (m_{12}, m_{21})] = 1$. Let the payoffs at $t = 0^{'}$ be $(x_1, x_2) = (B, B)$ and let individuals suffer from self-serving learning (*i.e.* $\boldsymbol{\sigma}_1 = (G, B)$ and $\boldsymbol{\sigma}_2 = (B, G)$). We argue that the *efficient teams outcome* can only be achieved if workers' beliefs converge in the revelation game. As long as individuals' beliefs diverge, Proposition 2 shows that an *efficient teams equilibrium* is not attainable. The only way beliefs can converge in the case mentioned above ($(x_1, x_2) = (B, B)$; $\boldsymbol{\sigma}_1 = (G, B)$; $\boldsymbol{\sigma}_2 = (B, G)$) is when both workers tell the truth. In that case, both workers learn that they performed poorly in the first period. As a result, an *efficient teams equilibrium* has to be truthful-telling.

ii) Second, we prove that a truthful-telling PBE_b cannot implement the *efficient teams outcome*. This is the case since efficient teams ($\gamma \geq 1$) may not be formed at $t = 1$ for $\gamma < \frac{2q_G}{q_B+q_G}$. A truthful-telling equilibrium exists if workers cannot be worse-off by playing $\mathbf{m}_i \neq \boldsymbol{\sigma}_i$. These conditions generate a system of 8 inequations that lead to the following

unique solution $\eta(\mathbf{m}_1, \mathbf{m}_2) = \bar{\eta}$, for $(\mathbf{m}_1, \mathbf{m}_2) \in S^4$. The lower bound for achieving team formation is then $\gamma \geq \frac{2q_G}{q_B+q_G}$ and corresponds to the case $\bar{\eta} = \frac{1}{2}$. Since $\frac{2q_G}{q_B+q_G} > 1$, we get the impossibility result stated in Proposition 3. ■

Proof of Proposition 4. We use the following notations: $p_{kl} = E(P[X_1 = k; X_2 = l \mid I_0])$ where $(k, l) \in S$ and I_0 is the information set at $t = 0$, that is the prior information on workers' abilities.

i) To prove the first part of the proposition we can check that, given $\eta(\mathbf{m}_1, \mathbf{m}_2) = \bar{\eta}$, the following strategies form a pooling equilibrium of our game : play $m_1 = (G, B)$ and $m_2 = (B, G)$, where the beliefs in equilibrium and out of the equilibrium are the same as the prior beliefs. Workers form a team at $t = 1$ for $\gamma \geq \hat{M} \equiv Max\left\{\frac{\hat{q}_G}{\bar{\eta}(q_B+\hat{q}_G)}; \frac{\hat{q}_G}{(1-\bar{\eta})(q_B+\hat{q}_G)}\right\}$, where $\hat{q}_G = wq_G + (1-w)q_B$ with $w = \frac{p_G}{p_G+pp_B}$. As a result, the lowest bound for which uninformative PBE_b always lead to the formation of a team at $t = 1$ at $t = 1$ is $\gamma \geq \frac{2\hat{q}_G}{q_B+\hat{q}_G}$. For $\gamma < \frac{2\hat{q}_G}{q_B+\hat{q}_G}$, a team is formed at $t = 1$ in the uninformative PBE_b when workers' performances in the first period project are identical and no biases have occurred (this occurs with probability $(1-p)^2 p_{BB} + p_{GG}$).

ii) From the proof of Proposition 3, we know that teams are always formed in a truthful-telling PBE_b for $\gamma \geq \frac{2q_G}{q_B+q_G}$ given that $\bar{\eta} = \frac{1}{2}$. For $\gamma < \frac{2q_G}{q_B+q_G}$, truthful-telling PBE_b imply that workers form teams when performances are identical at $t = 1$ (this occurs with probability $p_{BB} + p_{GG}$) whereas a team is formed only when performances are identical at $t = 1$ and no biases have occurred (this occurs with probability $(1-p)^2 p_{BB} + p_{GG}$) in the uninformative PBE_b. ■

Proof of Proposition 5. We consider truthful-telling PBE_b. A truthful-telling equilibrium is such that $\mathbf{m}_i = \boldsymbol{\sigma}_i$, where the beliefs in equilibrium are $P[(X_1, X_2) = (m_{21}, m_{12})] = 1$.

i) **Definition of contracts**

a) Non-contingent contract (NC)*:*

We define (NC) as the non-contingent contract $\bar{\eta} = \frac{1}{2}$.

From Proposition 4 we know that (NC) is the non-contingent contract that maximizes workers' expected payoffs.

b) Contingent contracts (C) *and* (C')*:*

- Contingent contract (C) is defined such that workers form a team at $t = 1$ for $(\boldsymbol{\sigma}_1, \boldsymbol{\sigma}_2) \in S^4 \backslash \{(B,B,B,G);(G,B,B,B);(G,B,B,G)\}$.

$$(C) \Leftrightarrow \begin{cases} \gamma\eta_{GBGB}(q_B+q_G) \geq q_G,\ \gamma(1-\eta_{GBGB})(q_B+q_G) \geq q_B \\ \gamma\eta_{GBBB}2q_B < q_B,\ \gamma\eta_{GBBG}2q_B < q_B,\ \gamma\eta_{BBBG}2q_B < q_B \\ \eta_{GBGG} = \eta_{GBGB},\ \gamma\eta_{BGBG}(q_B+q_G) \geq q_B \\ \gamma(1-\eta_{BGBG})(q_B+q_G) \geq q_G \\ \eta_{BGBG} = \eta_{GGBG},\ \gamma\eta_{GGGG}2q_G \geq q_G \\ \gamma(1-\eta_{GGGG})2q_G \geq q_G,\ \gamma\eta_{BBBB}2q_B \geq q_B \\ \gamma(1-\eta_{BBBB})2q_B \geq q_B,\ \eta(\mathbf{m}_1,\mathbf{m}_2) = 0, \forall(\mathbf{m}_1,\mathbf{m}_2) \notin W \end{cases}$$

$$\Leftrightarrow \begin{cases} \eta_{GBGB} \in \left[\frac{q_G}{\gamma(q_B+q_G)}, 1-\frac{q_B}{\gamma(q_B+q_G)}\right],\ \eta_{GBGG} = \eta_{GBGB} \\ (\eta_{GBBB}, \eta_{GBBG}, \eta_{BBBG}) \in A^3, \text{ where } A \equiv \left[0, \frac{1}{2\gamma}\right) \\ \eta_{BGBG} \in \left[\frac{q_B}{(q_B+q_G)\gamma}, 1-\frac{q_G}{\gamma(q_B+q_G)}\right],\ \eta_{GGBG} = \eta_{BGBG} \\ (\eta_{GGGG}, \eta_{BBBB}) \in B^2, \text{ where } B \equiv \left[\frac{1}{2\gamma}, 1-\frac{1}{2\gamma}\right] \\ \forall(\mathbf{m}_1,\mathbf{m}_2) \notin W, \eta(\mathbf{m}_1,\mathbf{m}_2) = 0 \end{cases}$$

Where:

$$W \equiv \left\{ \begin{array}{c} (G,B,G,B);(G,B,G,G);(B,G,B,G);(G,G,B,G);(G,G,G,G); \\ (B,B,B,B);(B,B,B,G);(G,B,B,G);(G,B,B,B) \end{array} \right\}$$

The contract (C) leads to team formation with probability $p_{GG}+p_{BG}+p_{GB}+(1-p)^2 p_{BB}$.

- We consider an alternative contingent contract (C') that leads to team formation for $(\boldsymbol{\sigma}_1, \boldsymbol{\sigma}_2) \in S^4 \backslash (G, B, B, G)$ for $\gamma \geq \frac{q_B+3q_G}{2(q_B+q_G)}$.

For $\gamma \geq \frac{q_B+3q_G}{2(q_B+q_G)}$, the contingent contract (C') is defined such that workers form a team at $t = 1$ for $(\boldsymbol{\sigma}_1, \boldsymbol{\sigma}_2) \in S^4 \backslash (G, B, B, G)$.

$$(C') \Leftrightarrow \begin{cases} \eta_{GBGB} \in \left[\frac{q_G}{\gamma(q_B+q_G)}, 1 - \frac{1}{2\gamma}\right] \\ \eta_{BGBG} \in \left[\frac{1}{2\gamma}, 1 - \frac{q_G}{\gamma(q_B+q_G)}\right] \\ \eta_{GBGG} = \eta_{GBBB} = \eta_{GBGB}, \eta_{GGBG} = \eta_{BBBG} = \eta_{BGBG} \\ (\eta_{GGGG}, \eta_{BBBB}) \in B^2, \text{ where } B \equiv \left[\frac{1}{2\gamma}, 1 - \frac{1}{2\gamma}\right] \\ \eta_{GBBG} \in \left[0, \frac{1}{2\gamma}\right), \forall (i, j, k, l) \notin W, \eta_{ijkl} = 0 \end{cases}$$

ii) **There exist no contingent-contracts that are preferred to** (C) **and** (C')**.**

To end the proof of Proposition 5, we need to show that there does not exist a contingent contract improving (C) and (C'). We show below how contingent contracts cannot achieve team formation for all $\boldsymbol{\sigma} = (\boldsymbol{\sigma}_1, \boldsymbol{\sigma}_2) \in Z \equiv \{(B, G, B, G); (G, B, G, B); (G, B, B, G)\}$ when $\gamma < \frac{2\hat{q}_G}{q_B+\hat{q}_G}$. This allows us to show that no contracts can be preferred to (C) and (C'). The issue is that, for $\gamma < \frac{2\hat{q}_G}{q_B+\hat{q}_G}$, workers form a team for all $(\boldsymbol{\sigma}_1, \boldsymbol{\sigma}_2) \in Z$ only if the allocation rule obtained when $\boldsymbol{\sigma} = (B, G, B, G)$ is different from the allocation rule following $\boldsymbol{\sigma} = (G, B, G, B)$. We show this impasse below in the three possible cases a), b) and c).

a) Worker 1 plays a different message after $\boldsymbol{\sigma}_1 = (B, G)$ and $\boldsymbol{\sigma}_1 = (G, B)$ whereas worker 2 plays the same message $(\hat{m})$. Given $(x_1,x_2) = \boldsymbol{\sigma}_1 = (B, G)$, and ensuring team formation for all $\boldsymbol{\sigma} \in Z_1 \equiv \{(G, B, B, G); (B, G, B, G)\}$ where $Z_1 \subset Z$, we need $\eta_{BG\hat{m}} = \eta_{GB\hat{m}}$. However, for $\eta_{BG\hat{m}} = \eta_{GB\hat{m}}$ no teams can be formed for both $\sigma = (G, B, G, B)$ and $\sigma = (B, G, B, G)$ when $\gamma < \frac{2\hat{q}_G}{q_B+\hat{q}_G}$.

b) Worker 2 plays a different message after $\sigma_2 = (B, G)$ and $\sigma_2 = (G, B)$ whereas worker 1 plays the same message. Using the same reasoning than above we can show that, for

$\gamma < \frac{2\hat{q}_G}{q_B+\hat{q}_G}$, team formation is not possible for all $\boldsymbol{\sigma} \in \{(G,B,B,G);(G,B,B,B)\}$ when workers form a team for $\boldsymbol{\sigma} \in \{(G,B,G,B);(B,G,B,G)\}$.

c) Worker 1 [2] plays a different message after $\boldsymbol{\sigma}_1 = (B,G)$ $[\boldsymbol{\sigma}_2 = (B,G)]$ and $\boldsymbol{\sigma}_1 = (G,B)$ $[\boldsymbol{\sigma}_2 = (G,B)]$. If we want teams to be formed for all $(\boldsymbol{\sigma}_1, \boldsymbol{\sigma}_2) \in Z_2$, where $Z_2 \equiv \{(G,B,B,G);(B,B,B,G);(G,B,B,B)\}$ then we need to impose $\eta_{BGBG} = \eta_{GBBG} = \eta_{GBGB}$. However, for $\eta_{BGBG} = \eta_{GBBG} = \eta_{GBGB}$ team formation is not possible for all $\boldsymbol{\sigma} \in \{(G,B,G,B);(B,G,B,G)\}$ when we impose team formation for $\boldsymbol{\sigma} = (G,B,B,G)$. If we impose team formation only for $\boldsymbol{\sigma} \in \{(G,B,B,B);(B,B,B,G)\}$, we can get team formation as well for $(x_1,x_2) \in \{(G,B);(B,G)\}$ as long as $\gamma \geq \frac{q_B+3q_G}{2(q_B+q_G)}$.

iii) **Comparing contracts** (NC), (C) **and** (C')**.**

It follows from *ii*) that for $\gamma < \frac{q_B+3q_G}{2(q_B+q_G)}$, the contract that maximizes workers' expected payoffs is either (NC) or (C), and for $\gamma \geq \frac{q_B+3q_G}{2(q_B+q_G)}$, it is either (NC) or (C'). For $\gamma < \frac{q_B+3q_G}{2(q_B+q_G)}$, workers prefer (C) to (NC) if:

$$\left\{\begin{array}{l}\text{Probability of team formation at } t=1 \text{ under } (C) \geq \\ \\ \text{Probability of team formation at } t=1 \text{ under } (NC)\end{array}\right\} \Leftrightarrow (p^2-2p)\,p_B + 2p_G \geq 0$$

Similarly, for $\gamma \geq \frac{q_B+3q_G}{2(q_B+q_G)}$, (C') is preferred to (NC) if $-p^2 p_B + 2p_G \geq 0$.

The non-contingent contract (NC) is dominated by contingent contracts, respectively by (C) and (C'), for $p\,(2-p) \leq \frac{2p_G}{p_B}$ and $p \leq \sqrt{\frac{2p_G}{p_B}}$. ■

Appendix B: robustness analysis

Generalization of the *teams inefficiency result*. We relax Assumptions 1 to 3 as follows.

Assumption 1' (Individual production function)

If worker i decides to work alone, his expected payoffs are determined by $q_i \equiv E[X_i]$, where $X_i \sim \chi$ is the random payoff associated to the individual project undertaken by Worker i and q_i is interpreted as the ability of worker i.

Assumption 2' (Team production function)

The team production function is defined as $f(a, X_{1,2}, X_{2,2}, X_{1,1}, X_{2,1})$, for $a \in \mathbb{R}$.

We denote $\hat{f} \equiv \hat{f}(a, X_{1,2}, X_{2,2}, x_{1,1}, x_{2,1}) \equiv E[f(a, X_{1,2}, X_{2,2}) \mid x_{1,1}, x_{2,1}]$,

And: $q_{X_i} \equiv E[q_i \mid x_{i,1}]$.

We consider the existence of expected positive synergies for working in a team, that is $\hat{f} > q_{X_1} + q_{X_2}$.

We assume that $\hat{f}$, q_{X_1} and q_{X_2} are differentiable and $\frac{\partial \hat{f}}{\partial x_{1,1}}, \frac{\partial \hat{f}}{\partial x_{2,1}}, \frac{\partial q_{X_1}}{\partial x_{1,1}}, \frac{\partial q_{X_2}}{\partial x_{2,1}}$ are continuous and strictly positive.

Assumption 3' (Learning about abilities)

Workers' abilities follow a prior distribution: $q_i \sim F$.

Assumption 4' (Self-serving biases)

Worker i suffers from self-serving biases at $t = 1$ if $\sigma_{ii} > x_{i,1}$.

Proposition 2'. *Under Assumptions 1', 2', 3', 4' and 5a, as long as $p > 0$ there exists no $PQBE_a$ that implements the efficient teams outcome.*

Proposition 3'. *Under Assumptions 1', 2', 3' and 5b, as long as $p > 0$ there exists no PBE_b that implements the efficient teams outcome.*

Proof of Proposition 2'. Self-serving biases undermine team formation if (R) holds, where system (R) corresponds to the case in which workers form an efficient team in the absence of self-serving biases but do not form a team when learning biases occur. We denote η_1 $[\eta_2]$ the share of the group outcome given to the first [second] worker that allows teams to be formed in the absence of learning biases. We maintain the assumption of budget-balanced allocation rules so that $\eta_2 = 1 - \eta_1$. We denote $\tilde{\eta}_1$ the allocation rule that is most favorable to team formation when learning biases are present. Worker i's self-serving biases imply that he perceives $x_{i,1}$ to be higher than its true value.

$$(R) \Leftrightarrow \begin{cases} \eta_1 \hat{f}_1 \left(a, X_{1,2}, X_{2,2}, x_{1,1}, x_{2,1}\right) \geq q_{X_1} \\ \eta_2 \hat{f}_2 \left(a, X_{1,2}, X_{2,2}, x_{1,1}, x_{2,1}\right) \geq q_{X_2} \\ \text{There exists } i \in \{1;2\} \text{ such that: } \tilde{\eta}_i \left[\hat{f} + \frac{\partial \hat{f}}{\partial x_{i,1}}\right] < q_{X_i} + \frac{\partial q_{X_i}}{\partial x_{i,1}} \end{cases}$$

If we take the limit of expected synergies to 0, (R) becomes $\left(\hat{R}\right)$:

$$\left(\hat{R}\right) \Leftrightarrow \begin{cases} \eta_1 \hat{f}_1 \left(a, X_{1,2}, X_{2,2}, x_{1,1}, x_{2,1}\right) = q_{X_1} \\ \eta_2 \hat{f}_2 \left(a, X_{1,2}, X_{2,2}, x_{1,1}, x_{2,1}\right) = q_{X_2} \\ \text{There exists } i \in \{1;2\} \text{ such that: } \eta_i \frac{\partial \hat{f}}{\partial x_{i,1}} < \frac{\partial q_{X_i}}{\partial x_{i,1}} \end{cases}$$

The first two equations are satisfied as long as workers are paid according to their relative expected abilities at $t = 1$. A consequence of the convergence of expected synergies to 0 is the convergence of $\tilde{\eta}_1$ to η_1.

As a result, Proposition 2' holds for an arbitrarily small level of expected synergies as long as the expected synergy function is not too steep with respect to performances. In particular, the *teams inefficiency result* holds for a set of team production functions for which there exists $i \in \{1;2\}$ such that $\frac{\partial \hat{f}_i}{\partial x_{i,1}}$ is continuous around $x_{i,1}$ as it is stated in Assumption 2'. ■

Proof of Proposition 3'. *i)* The first part of the proof of Proposition 3 continues to hold under Assumptions *1', 2', 3', 4'*. That is, an *efficient teams equilibrium* has to be truthful-telling.

ii) Second, we prove that a truthful-telling PBE_b cannot implement the *efficient teams outcome*. In order to implement the *efficient teams outcome*, the team contract $\eta_i(m_{11}, m_{12}, m_{21}, m_{22})$ has to be decreasing in m_{ij} for $i \neq j$. If the contract does not depend on m_{ij} then workers cannot be rewarded according to their updated relative abilities. And if workers are not rewarded according to their relative abilities the *efficient teams outcome* is not attainable. However, if $\eta_i(m_{11}, m_{12}, m_{21}, m_{22})$ is decreasing in m_{ij} for $i \neq j$ a PBE_b cannot be truthful-telling. Indeed, worker i will have incentives to deviate and release $m_{ij} < \sigma_{ij}$ for $i \neq j$ in order to obtain a greater share of the group outcome. As a result, a truthful-telling equilibrium requires that $\eta(\mathbf{m}_1, \mathbf{m}_2) = \bar{\eta}$ for $(\mathbf{m}_1, \mathbf{m}_2) \in S^4$. But, given a non-contingent contract the *efficient teams outcome* is not implementable so that Proposition 3' holds. ■

9 References

Abegglen, J. 1958. *The Japanese factory,* Cambridge, MA, MIT press.

Babcock, L., Loewenstein G., Issacharoff S., and C. Camerer. 1995. "Biased judgments of fairness in bargaining." *American Economic Review,* 85(5): 1337-1443.

Babcock, L., G. Loewenstein. 1997. "Explaining bargaining impasse: the role of self-serving biases." *The Journal of Economic Perspectives,* 11(1): 109-126.

Bartling B., F. von Siemens. 2007. "The Intensity of incentives in firms and markets: moral hazard with envious individuals." University of Munich Working Paper.

Bénabou, R., J. Tirole. 2002. "Self-confidence and personal motivation." *Quarterly Journal of Economics,* 117(3): 871-915.

Bernardo, A., I. Welch. 2001. "On the evolution of overconfidence and entrepreneurs." *Journal of Management, Economics and Strategy*, 10: 301-330.

Beyer, S. 1990. "Gender differences in the accuracy of self-evaluations of performance." *Journal of Personality and Social Psychology*, LIX: 960-970.

Blanes i Vidal, M. Möller. 2007. "Why should leaders share information with their subordinates?" *Journal of Economics and Management Strategy*, 16(2): 251-283.

Box, G., G. Tiao. 1973. Bayesian inference in statistical analysis, Reading MA: Addison Wesley.

Bradley, G. W. 1978. "Self-serving biases in the attribution process: a reexamination of the fact or fiction question." *Journal of Personal and Social Psychology,* 36: 56-71.

Brown, J. D. 1986. "Evaluations of self and others; self-enhancement biases in social judgements." *Social Cognition*, 4: 353-376.

Camerer, C., D. Lovallo. 1999. "Overconfidence and excess entry: an experimental approach." *American Economic Review*, 89: 306-318.

Caruso, E. M., Epley, N., and M., Bazerman. 2005a. "Leader of the packed: unpacking, egocentrism, and the costs and benefits of perspective taking in groups." Harvard University Working Paper Harvard University 05-035.

Caruso, E. M., Epley, N., and M., Bazerman. 2005b. "The good, the bad, and the ugly of perspective taking in groups." Harvard University Working Paper 05-036.

Che, Y., S. Yoo, 2001. "Optimal incentives for teams." *American Economic Review,* 91: 525-541.

Cooper, A., Woo, C., W. Dunkelberg. 1988. "Entrepreneurs' perceived chances for success." *Journal of Business Venturing*, 3: 97-108.

Corgnet, B. 2007. Optimistic learning and friendship in team formation, Working Paper, SSRN.

Dur, R., A. Glaser. 2006. "Optimal contracts when a worker envies his boss." *Journal of Law, Economics, and Organization*, forthcoming.

Englmaier, F., A. Wambach. 2006. "Optimal incentives contracts under inequity aversion." IZA Working Paper 1643.

Epstein, S. 1983. "The unconscious, the preconscious, and the self-concept." In J. Suls and A. Greenwald (Eds.), Psychological perspectives on the self, 2: 220-247, Hillsdale, NJ: Erlbaum.

Farrell, J. S., S. Scotchmer. 1988. "Partnerships." *Quarterly Journal of Economics,* 103(2): 279-297.

Fehr, E., K. Schmidt. 1999. "A theory of fairness, competition, and cooperation." *Quarterly Journal of Economics*, 114(3): 817-868.

Fehr, E., Klein, A., and K. Schmidt. 2007. "Fairness and contract design." *Econometrica*, 75(1): 21-154.

Felson, R. B. 1984. "The effects of self-appraisals of ability on academic performance." *Journal of Personality and Social Psychology,* 47: 944-952.

Fiske, S. T., S. E. Taylor. 1991. *Social cognition*, McGraw-Hill, 2nd edition.

Florida, R., M. Kenney. 1991. "Transplanted organizations: the transfer of Japanese industrial organizations to the US." *American Sociological Review,* 56: 381-398.

Gervais, S., I. Goldstein. 2006. "The effects of biased self-perception in teams." The Fuqua School of Business Working Paper.

Greenwald, A. G. 1980. "The totalitarian ego: fabrication and revision of personal history." *American Psychologist,* 35: 603-618.

Griffin, D., A. Tversky. 1992 "The weighing of evidence and the determinants of overconfidence." *Cognitive Psychology,*24: 411-435.

Haitani, K. 1990. "The paradox of Japan's groupism: threat to future competitiveness?" *Asian Survey,* 30: 237-250.

Hamilton, B., Nickerson, J., and H. Owan. 2003. "Team incentives and worker heterogeneity: an empirical analysis of the impact of teams productivity and participation." *Journal of Political Economy,* 111(3): 465-497

Hart, O., J. Moore. 2006. "Contracts as reference points." Harvard University Working Paper.

Heine, S. J., Lehman, D. R., Markus, H. R., and S. Kitayama. 1999. "Is there a universal need for positive self-regard?" *Psychological Review,* 106(4): 766-794.

Heine, S. J., Kitayama, S., D. R. Lehman. 2001. "Cultural differences in self-evaluation: Japanese readily accept negative self-relevant information." *Journal of Cross-Cultural Psychology,* 32(4): 434-443.

Holmstrom, B. 1982. "Moral hazard in teams." *Bell Journal of Economics,* 13: 324-340.

Holmstrom, B., P. Milgrom. 1991. "Multitask principal-agent analyses: incentive contracts, asset ownership and job design." *Journal of Law, Economics and Organization* VII , 24-52.

Itoh, H. 1991. "Incentives to help in multi-individual situations." *Econometrica,* 59(3): 611-636.

Kandel, E., E. P., Lazear. 1992. "Peer pressure and partnerships." *Journal of Political Economy,* 100: 801-817.

Kitayama, S., Markus, H. R., Matsumoto, H., Norasakkunkit V. 1997. "Individual and collective processes in the construction of the self: Self-enhancement in the United States and self-criticism in Japan." *Journal of Personality and Social Psychology,* 72: 1245-1267.

Koike, K. 1988. *Understanding industrial relations in modern Japan*, New York, St Martin's.

Korner, I. 1950. "Experimental Investigation of some aspects of the problem of repression: repressive forgetting." N_0.970. New York, NY: Bureau of Publications, Teachers' College, Columbia University.

Kremer, M. 1993. "The O-ring theory of economic development." *Quarterly Journal of Economics*, 108(3): 551-575.

Kuiper, N. A., P. A. Derry. 1982. "Depressed and nondepressed content self-reference in mild depression." Journal of Personality, 50: 67-79.

Kuiper, N. A., M. R. McDonald. 1982. "Self and other perception in mild depressives." *Social Cognition,* 1: 233-239.

Kuiper, N. A., Olinger, L. J., McDonald M. R., B. F. Shaw. 1985. "Self-schema processing of depressed and nondepressed content: the effects of vulnerability on depression." *Social Cognition;* 3: 77-93.

Lee, P. M. 1997. *Bayesian statistics: an introduction*, 2nd edition, London: Arnold.

Levin, J., S. Tadelis. 2005. "Profit Sharing and the Role of Professional Partnerships." *Quarterly Journal of Economics*, 120(1): 131-172

Lewinsohn, P. M., Mischel, W., Chaplin, W., R. Barton. 1980. "Social competence and depression: the role of illusory self-perceptions." *Journal of Abnormal Psychology,* 89: 203-212.

Liebowitz, S., J. Palmer. 1983. "Assessing assessments of the relative quality of Economics departments." *Quarterly Review of Economics and Business,* 28(2): 88-113.

Long, J. S., R. McGinnis. 1982. "On adjusting productivity measures for multiple authorship." *Scientometrics,* 4(5): 379-387.

Malmendier, U., G. Tate. 2005. "CEO overconfidence and corporate investment." *Journal of Finance*, 60: 2661-2700.

McDowell, J., J. Smith. 1992. "The effect of gender-sorting on propensity to coauthor: implications for academic promotion." *Economic Inquiry,* 30: 68-82.

Miller, D. T., M. Ross. 1975. "Self-serving biases in the attribution of causality: fact or fiction?" *Psychological Bulletin,* 82: 213-225.

Mischel, W., Ebbesen, E. B., A. R. Zeiss. 1976. "Determinants of selective memory about the self." *Journal of Consulting and Clinical Psychology*, XLIV: 92-103.

Nisbet, R. E., L. Ross. 1980. *Human inference: strategies and shortcomings of social judgments*, Englewood Cliffs, NJ: Prentice-Hall.

Pronin, E., Lin, D. Y., L. Ross. 2002. "The bias blind spot: perceptions of bias in self versus others." *Personality and Social Psychology Bulletin,* 28: 369-381.

Rabin, M. 2002. "Inference by believers in the law of small numbers", *Quarterly Journal of Economics,* 117(3): 775-816.

Rotemberg, J. 1994. "Humans relations in the workplace." *Journal of Political Economy,* 102: 684-717.

Santos-Pinto, L, J. Sobel. 2005. "A model of positive self-image in subjective assessments." *American Economic Review,* 95(5): 1386-1402.

Schinski, M., Kugler, A., W. Wick. 1998. "Perceptions of the academic Finance profession regarding publishing and the allocation of credit in coauthorship situations." *Financial Practice and Education,* 8(1): 60-68.

Sedikides, C., Gaertner, L., J. L. Vevea. 2005. "Pancultural self-enhancement reloaded: a meta-analytic reply to Heine." *Journal of Personality and Social Psychology,* 89: 539-551.

Silverman, I. 1964. "Self-esteem and differential responsiveness to success and failure." *Journal of Abnormal and Social Psychology,* 69: 115-119.

Svenson, O. 1981. "Are we all less risky and more skillful than our fellow drivers?" *Acta Psychologica,* 47: 143-148.

Van den Steen, E. 2004. "Rational overoptimism (and Other Biases)." *American Economic Review,* 94: 1141-1151.

Zuckerman M. 1979. "Attribution of success and failure revisited or, : the motivational bias is alive and well in attribution theory." *Journal of Personality,* 47: 245-285.