

Essays on incentives and behavioral issues in accounting

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M. Sc. Max-Frederik Neubert
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Betreuer und Gutachter:	Prof. Dr. Jens Robert Schöndube
Zweiter Gutachter:	Prof. Dr. Stefan Wielenberg
Vorsitzender der Prüfungskommission:	Prof. Dr. Kay Blaufus
Weiteres Mitglied (beratend):	Dr. Svetlana Katolnik
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Meiner Familie.

Abstract

Managerial decision making and control contain various challenges. One aspect that is increasingly becoming the focus of accounting research is the fact that individuals tend to behave differently than predicted by “homo oeconomicus” models. Selected examples of psychological issues and other-regarding preferences influencing managerial decision making and control in the context of accounting are examined in this dissertation.

The dissertation is cumulative and consists of four essays. In particular, the essays analyze

- how to design incentive contracts, when decision makers bear the psychological pressure of knowing that they are held accountable for their performance regarding project selection and project implementation;
- the determinants of accountability and perceived justification pressure, i.e., if there are differences in the decision making when deciders know that they are held accountable for either the project selection or the outcome of a project selection, and to what degree performance-based bonuses or information about the preferences of superiors/firm owners change this decision making;
- the type and extent of earnings management in family firms during changes in ownership and control, when the decision maker is sensitive to socioemotional wealth and has to choose between different succession scenarios;
- whether leniency in subjective evaluations can be explained by reciprocally acting employees and how discretion over the performance measure can be used to influence profit.

Keywords

agencies, contracts, incentives, behavioral accounting, experiments, project selection, accountability, earnings management, family firm succession, inheritance taxation, subjective performance evaluation, reciprocity.

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Preface

The purpose of an accounting system is to provide information to various users inside and outside the firm. Accounting information generates knowledge that is used to facilitate decision-making and helps to control behaviors and to coordinate processes. There are several challenges related to the management of an accounting system and its information. For example, ensuring that the right information is provided to a particular user at a specific time can already be a difficult task. It becomes more complex if one intends to anticipate incentives and consequences that result from providing an information. These and other issues are extensively investigated in the accounting literature. Usually, (analytical) accounting research relies on economic theory, which assumes that individuals follow the principles of the “homo oeconomicus”, i.e., act as purely self-interested Bayesian information processors with stable preferences.¹ In recent years, however, the focus of accounting has widened and the awareness has increased that there are challenges, which might not be captured and solved by the classic approach. One example is, that the processing of accounting information can be impaired by cognitive errors or might create emotion that influences decisions. Taking into account that individuals, groups or even organizations may be prone to these kinds of psychological issues, as well as to other-regarding preferences, is important, as effectiveness and efficiency of accounting methods, processes, and instruments may be crucially affected.

“Behavioral accounting” is an approach that combines psychology, sociology, and accounting in order to address these additional challenges. It relaxes the assumptions of the “homo oeconomicus” and, thus, examines effects when users of accounting information show “limitations and complications”.² So far, the majority of behavioral accounting research is based on empirical and experimental methods, fewer studies apply analytical approaches.

This cumulative thesis examines selected accounting issues where incentives arise due to

¹ See p. 660 in Rabin, M. (2002). “A perspective on psychology and economics”. *European Economic Review*, 46 (4-5), 657–685.

² The wording is based on Mullainathan, S. and R. H. Thaler (2001). “Behavioral economics”. *International Encyclopedia of Social Sciences*, 1st edition, 1094-1100.
For definitions and overviews of behavioral accounting see Birnberg, J. G. (2011). “A proposed framework for behavioral accounting research”. *Behavioral Research in Accounting*, 23 (1), 1-43; or Trotman, K. T., Tan, H. C. and N. Ang (2011). “Fifty-year overview of judgment and decision-making research in accounting”. *Accounting and Finance*, 51 (1), 278–360.

behavioral influences. The essays apply concepts from psychology and sociology to either predict how managerial decision making might be influenced or to add explanations for patterns already identified in accounting practice or theory. The thesis mainly focuses on behavioral management accounting, however, one essay also considers some aspects of behavioral financial and tax accounting, respectively. The research methodology used is analytical and experimental. In the following an overview of the contents is provided.

Essay I

It is common practice to align interests of the firm and managers by means of performance-based compensation contracts. Another way of influencing managerial behavior is to implement reporting regimes, where the decision maker is held accountable under specific conditions. However, knowing that one is held accountable can lead to cognitive dissonance with various effects on the quality of decisions.³ Regarding project management, two specific tasks might be affected: the selection of a project and the implementation of the project once it is chosen. So far, the literature on project management has either addressed these two issues separately or without relating them to accountability.

The analytical model of Essay I examines accountability and its effects on project choice, project implementation and contract design. In particular, it is analyzed how ex post accountability for project performance influences the ex ante selection of a project and the provision of effort in the project. Accountability is modeled as the psychological cost of having to justify oneself, that affects the manager whenever a predetermined project outcome benchmark is not reached.

It is shown, that accountability has two effects: firstly, it incentivizes the manager to select projects with a low risk and return because these projects usually cause lower justification pressure than visionary projects with higher risk-return profiles. Secondly, once the project is chosen accountability increases the effort provided in implementing the project, as this decreases the probability for lower outcomes that would make a justification necessary. However, it can be impossible to induce a value-maximizing project choice by means of an outcome-based contract, as well as it could take a bonus rate that is higher than the

³ Examples are McMackin, J. and P. Slovic (2000). "When does explicit justification impair decision making?". *Applied Cognitive Psychology*, 14 (6), 527–541.; or Vieider, F. M. (2009). "The effect of accountability on loss aversion". *Acta psychologica*, 132 (1), 96–101.

optimal project-specific rate would be.

In summary, the model suggests that accountability might have both advantageous and disadvantageous effects. It also provides an explanation for high bonuses, e.g., in the financial sector. Consequently, firms should consider psychological issues of accountability, especially when designing compensation contracts and/or reporting regimes.

Essay II

There is consensus view that managerial decision making is affected when the corresponding individuals or groups know that they might be held accountable. However, there are ambiguous findings concerning the factors that determine how accountability influences decision making.⁴

Essay II continues the analysis of Essay I in that it addresses further issues around the topic of accountability by means of laboratory experiments. Content wise, it investigates effects of justification pressure on investment choices, as well as determinants of perceived justification pressure and instruments to encounter effects of accountability. The essay distinguishes itself from other experimental studies in that it considers different incentive structures (exogenously given asymmetric payoffs) and also introduces instruments to control investment decisions.⁵

In each experiment an agency situation is created where pairs of subjects interact over several decision sets. Subjects responsible for undertaking the investments (the managers) choose from a set of projects. The projects differ in terms of risk and return. An instrument that may influence managerial decision making in that it might change the effects of accountability are the payoffs from the available projects. In order to analyze their influence payoffs vary over the decision sets. Another means that might control investments to a particular extent is to establish that firm owners are able to communicate their preferred business strategies to the managers before the investments are undertaken. This is also taken into account by means of upfront recommendations, which are communicated

⁴ An overview is given by, e.g., Lerner, J. S. and P. E. Tetlock (1999). "Accounting for the effects of accountability". *Psychological Bulletin*, 125 (2), 255–275.

⁵ For a comparison see Pahlke, J., S. Strasser, and F. M. Vieider (2012). "Risk-taking for others under accountability". *Economics Letters*, 114 (1), 102–105.; or Pollmann, M. M. H., J. Potters, and S. T. Trautmann (2014). "Risk taking by agents: the role of ex-ante and ex-post accountability". *Economics Letters*, 123 (3), 387–390.

to subjects in the role of a manager. Accountability is incorporated in two ways: either the manager has to justify any decision that is made (decision accountability) or when project choices turn out to generate low profits (outcome accountability). This allows for examination of how the reporting regimes interact with upfront recommendations, i.e., whether there are differences in compliance.

It is found that accountability increases the probability of investments in projects with low risk-return profiles. However, to a particular extent this effect can be mitigated by the following controlling instruments: a higher profit share induces the manager to choose value-maximizing investments. Even more effective is to ensure the firm owner communicates the preferred investment strategy, which also reduces perceived justification pressure significantly. Moreover, it seems to hold that the higher the frequency with which agents are held accountable, the lower the perceived justification pressure, i.e., effects of accountability may diminish with familiarity of being in a justification situation. Regarding the different types of accountability, results indicate that a higher compliance with investment preferences is reached with a stricter reporting regime, i.e., employers should hold employees accountable for each decision, not for bad outcomes.

Essay III

There is considerable evidence that family firms are involved in different earnings management strategies than publicly listed firms.⁶ A commonly mentioned explanation for these differences is that family firms are less affected by agency problems, as ownership and control are not separated. However, more recent literature also considers the behavioral concept of socioemotional wealth (SEW) to explain differences.⁷ The theory describes how family members derive utility from non-economic aspects of the business. Two important elements of SEW are altruism between family members and dynastic motivations for inter-generational sustainability.⁸ Given the economic impact of family firms and the

⁶ For example, Jiraporn, P. and P. J. DaDalt (2009). “Does founding family control affect earnings management?” *Applied Economics Letters*, 16 (2), 113–119.

⁷ See Achleitner, A.-K., N. Günther, C. Kaserer, and G. Siciliano (2014). “Real earnings management and accrual-based earnings management in family firms”. *European Accounting Review*, 23 (3), 431–461.

⁸ See Gómez-Mejía, L. R., C. Cruz, P. Berrone, and J. de Castro (2011). “The bind that ties: socioemotional wealth preservation in family firms”. *The Academy of Management Annals*, 5 (1), 653–707.; and Berrone, P., C. Cruz, and L. R. Gómez-Mejía (2012). “Socioemotional wealth in family firms: theoretical

fact that there is no analytical accounting research on earnings management of family firms, it appears reasonable to address the issue.⁹ Of particular interest is to examine earnings management incentives during the transition of ownership and control. Firstly, this is because the risk of misconduct is generally increased during these periods. Secondly, it opens the door for considerations with respect to inheritance taxation.

Correspondingly, Essay III investigates earnings management practices of family firms during changes in ownership and control, how SEW relates to the decision making, and whether incentives change in different succession scenarios. A two-period model is considered, in which a SEW sensitive firm founder can engage in real and accrual earnings manipulations before the succession takes place. Besides determining the extent of earnings management, the founder has to decide whether the firm is owned and managed by a family member in the following period, or just owned by the family member while an external manager has control over the operational business.

The main result is that earnings management is driven by SEW in that it induces the founder to shift earnings in the period after the succession, in which a family member is the new owner of the firm. The motivation behind this is to lower the inheritance tax payment of the succeeding family member. For the same reason, the founder overinvests in the capital stock, which also increases earnings in the post-succession period. If operations after the succession are run by an external manager, the investment level decreases. Finally, besides the productivity of the person in charge after the succession, inheritance taxation and SEW may affect the founder's decision which succession scenario is implemented. In summary, the model shows that SEW is able to increase the time horizon of decision-makers and, by this, also explains some empirical patterns.

Essay IV

An important psychological driver of action is fairness. This is also true for managerial decisions and the perceived fairness of an accounting system.¹⁰ When incentive compensation

dimensions, assessment approaches, and agenda for future research". *Family Business Review*, 25 (3), 258–279.

⁹ Information about the prevalence of family firms is given by, e.g., Anderson, R. C. and D. M. Reeb (2006). "Founding-family ownership and firm performance: evidence from the S&P 500". *The Journal of Finance*, 58 (3), 1301–1328.

¹⁰See Libby, T. (2001). "Referent cognitions and budgetary fairness: a research note". *Journal of Man-*

is implemented through subjective performance measures, it is often true that discretion over the evaluation result is accompanied by inaccuracies that impair the quality of the assessment. A phenomenon observable in practice is the so-called leniency bias. Although it might be beneficial in terms of compensation or career perspectives, leniency can also affect the fairness perception of the one who is evaluated. As the topic is a recurring issue in business practice, accounting research is examining it closely.¹¹

Essay IV adds an explanation for leniency in subjective performance evaluations. It investigates analytically if and how leniency might be related to fairness considerations and, furthermore, examines determinants and economic consequences of the bias. More precisely, it is assumed that the evaluator anticipates a reaction from the evaluated manager, which is partly based on fairness perception. Thus, besides facing the classic incentive-risk trade off, the evaluator has to deal with the additional obstacle of reciprocal behavior, which might affect the outcome of a project. The analytical model considers both positive and negative reciprocal reactions, i.e., productive (rewarding) and unproductive (punishing) actions.

It is shown that biasing the evaluation can be the rational choice for an evaluator if s/he is the residual claimant of the project payoff. Moreover, it is found that the manipulation of the evaluation result has diverse effects on the manager's motivation to reciprocate. However, through the right bias an evaluator can provoke a positive reciprocal reaction from the manager, which increases payoff compared to the case without fairness considerations and reciprocity. The reason is that the bias serves as an additional device in the optimization of the payoff and, thus, allows to provide incentives more precisely. However, in the model at hand the bias is not able to decrease agency cost.

In summary, the essays provide the following conclusions:

- Firms should be aware that post decision accountability may lead to behavioral complications with respect to project selection and implementation. The psychological pressure of being held accountable for deviations from a predetermined performance

agement Accounting Research, 13 (1), 91–105.

¹¹See, e.g., Bol, J. C. (2008). "Subjectivity in compensation contracting". *Journal of Accounting Literature*, 27, 1–24.

threshold can have both negative and positive effects. Contracts are not always able to induce desired decision making effectively or efficiently. Therefore, the effects of accountability on the mindset of managers should not be underestimated, as it may result in an increased cost of incentive provision.

- Perceived justification pressure of ex post accountability influences investment choices significantly. Instruments that influence the effects of accountability on project choice are bonus contracts and communication policies. Effects change for repeated accountability. Compliance with firm policies is higher under stricter reporting regimes.
- Socioemotional concerns of family firm founders are able to create incentives for real and accrual-based earnings management prior to changes in ownership and control. If the utility from altruistic and/or dynastic socioemotional wealth of founders is sufficiently high, it leads to investment strategies and earnings management practices that reduce the future inheritance tax base of the successor. The extent to which a founder engages in these activities depends on whether the firm is led by an external party or by a family member.
- Leniency in subjective performance evaluations might be the result of a conscious and rational decision. If employees are affected by fairness considerations when being evaluated, biasing the result of the evaluation may motivate them to engage in rewarding reciprocal responses, which might positively affect payoff.

As a closing remark it should be noted that three out of the four essays in this thesis have an analytical methodology. Only in one case some implications derived from a model are validated by means of laboratory experiments. It is, thus, suggested that, in order to ensure valuable insights in terms of internal and external validity, future research may control the remaining analytical conclusions on behavioral incentives in managerial accounting decisions by using different approaches and methods.

Essay I

Title

Accountability in an agency model: project selection, effort incentives, and contract design

Co-authors:

Christian Lukas, Jens Robert Schöndube

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Accountability in an agency model: project selection, effort incentives, and contract design

Abstract

We analyze an agency model of project choice and implementation where the agent is held accountable for his performance. We show that implementation of the ex ante efficient project may be impossible, irrespective of how the principal sets fixed wage and bonus rate. If it is possible, the principal may be forced to increase the bonus rate above the optimal project-specific rate. The higher profit share compensates the agent for pressure he faces when he has to justify/explain his performance.

Keywords:

agency; project selection; accountability; behavioral accounting

JEL-Classification:

C72, D01, D81, M40, M52

1 Introduction

Managerial services to a company consist, among others, of two important tasks: (1) managerial effort to supervise ongoing projects and (2) selection of new projects (Penrose, 2009, (ch. 3); Ross, 2014). The latter implies that managers have responsibilities to influence the environment in which their companies operate. Agency literature usually considers only the first task. This is somewhat surprising given the evident interrelation between (1) and (2); and given that the critique of focusing on only (1) is not new. As Kaplan, (1984, p. 405) notes, “[agency theory] misses the options for entrepreneurial managers to make major changes in their environment [...]”.

A common means to control behavior of managers are outcome controls. In addition, accountability may be effective in that respect. According to Lerner and Tetlock, (1999, p. 255), “accountability refers to the implicit or explicit expectation that one may be called on to justify one’s beliefs, feelings, and actions to others”. To provoke a justification it takes the joint presence of three factors (Nippa and Petzold, 2005): (i) decision ambiguity, i.e., the optimal decision or course of action is not obvious and there is substantial uncertainty; (ii) dependence of the decision maker on third parties; and (iii) demand of justification, i.e., the decision maker expects that third parties actually call for a justification.

Being required to justify performance to superiors, shareholders, or the public is a common phenomenon and mirrors real-life experiences of managers. It may impose a substantial pressure on them. For example, Elon Musk is explicit about this pressure in his announcement to take Tesla private: “Being public [...] puts enormous pressure on Tesla to make decisions that may be right for a given quarter, but not necessarily right for the long-term”.¹ As a consequence, the pressure to possibly justify a decision ex post certainly influences decisions ex ante. Decision making may improve because on second thought the optimal decision could differ from what was initially thought to be optimal (Vieider, 2009; Pahlke et al., 2012; Pollmann et al., 2014). However, accountability could also deteriorate judgment and decision making (Weigold and Schlenker, 1991; McMackin and Slovic, 2000). One possible reason is the shift of attention “from good performance

¹ https://www.tesla.com/de_DE/blog/taking-tesla-private; accessed: 2018-08-14

to good *justification* of performance”.² It is the objective of the present paper to analyze the effect of justification on managers’ project choice and effort provision.

In this paper, we develop a model where the agent selects one project from a set of projects and then manages the chosen project by providing effort. Incentivizing effort is captured by a standard hidden action model with limited liability protection for the agent. Additional frictions may arise from the agent’s project choice. The innovative feature of our model is that it incorporates accountability on the agent’s side. Therefore, when selecting a project and providing effort the agent knows that he will be held accountable for the results. This pressure of being obligated to justify poor performances is modeled as a psychological cost imposed on the agent. The cost eventually incurred by the agent depends on the deviation of the actual outcome from a threshold outcome and a project-specific pressure parameter. Considering linear incentive contracts (fixed payment plus bonus) we analyze two types of contracts: project-specific contracts and outcome-based (non-project specific) contracts.

In our model, projects differ in terms of mean and variance of profitability and with respect to pressure the agent faces when held accountable for the outcome. The accountability effect may distort the agent’s project choice. As a novelty we show that there can be both an “impossibility result” and a “money buys efficiency result”. The former means that there exist cases where, irrespective of how the principal sets fixed pay and bonus rate, the agent never prefers the project the principal finds optimal. The latter shows that in order to induce the value-maximizing project choice, the principal may need to offer the agent a larger profit share than an otherwise optimal contract would require. Notice that a higher justification pressure *ceteris paribus* induces a higher effort and therefore decreases the optimal project-specific bonus rate. However, to induce the agent to select a highly profitable project with strong justification pressure, the principal has to increase the bonus rate above the optimal project-specific rate. Only a sufficiently high bonus rate incentivizes the wealth-constrained agent to incur the high psychological costs of accountability related to the project.

Our paper is related to and contributes to three streams of literature. In analytical models of project choice (Lambert, 1986; Hirshleifer and Suh, 1992; Sung, 1995; Flor et al., 2014) the compensation contract usually serves the dual purpose of inducing effort and

² Ashton (1990, p. 156), italics in original.

of selecting the optimal project. Two findings of these models stand out: First, principal and agent may prefer different projects so that the agent possibly takes excessive risk or too little risk (Lambert, 1986). Second, the jeopardy of improper project choice can lead to limiting the variable pay component in some form. For example, in Sung (1995) low sensitivities of variable pay to outcome from ongoing operations can turn out to be optimal because otherwise the agent selects only low-risk/low-return projects. Flor et al. (2014) find that setting an upper limit for compensation prevents excessive risk taking on the agent's side. Accountability and its effect on project choice and contract design has to our best knowledge not been analyzed analytically. Therefore, our novel analytical model contributes to the literature on project choice by incorporating accountability in an agency context. The effect of accountability or justification pressure is different from the risk effect. While the risk-incentive trade-off calls for a low pay-performance sensitivity to induce risky project choices, we show that high pay-performance rewards might be optimal if accountability exists.

The present paper also contributes to the growing literature on analytical research in behavioral contract theory and behavioral accounting. In these models psychological phenomena and their effects on decision making and contract design are analyzed. Examples include identity or engagement with the firm (Akerlof and Kranton, 2000, 2005; Heinle et al., 2012) or utility from status (Marino and Ozbas, 2014). Both identity and status incentives can help the principal to reduce expected costs of implementing a given action. Other work considers reference-dependent preferences (Englmaier and Wambach, 2010; Herweg et al., 2010; Ockenfels et al., 2015), e.g. contracting with loss averse agents.³ In our model, risk-neutrality paired with justification pressure that depends on the deviation from a threshold creates a utility function which resembles the one that characterizes loss aversion (Tversky and Kahneman, 1991; Herweg et al., 2010). However, the evaluation of risky alternatives is fundamentally different. For a loss-averse agent any possible (probability weighted) difference in outcomes matters. In our setting only the (expected) deviation from the threshold is relevant.

Finally, our paper is also related to the job assignment literature, in particular to the literature that investigates a trade-off between providing effort incentives and job assignment.

³ See Köszegi (2014) for a review on behavioral contract theory.

In the presence of this trade-off what is usually considered as being inefficient in task assignment may turn out to be beneficial. For example, Holmström and Milgrom (1991) show that increasing the bonus and allowing the agent more personal business may be beneficial because the agent's focus is directed more to his main task. Koch and Nafziger (2012) demonstrate that to induce employees to work hard it may be optimal to promote them to jobs for which they are less talented.⁴ We, in contrast, show that "inefficiently" high bonus rates may be optimal to ensure optimal project selection.

The paper is structured as follows. Section 2 introduces the model. In the following sections we present the first-best solution (section 3) and the second-best solution (section 4). Section 5 discusses the model assumptions and the final section concludes.

2 The model

We consider a principal-agent model with hidden action and limited liability. A manager (agent) is responsible for project selection and implementation, i.e., after deciding which project to initiate the manager provides effort to turn the project into a success. There are two projects $\{P_A, P_B\}$ available. The agent can at most select one of them. If he does not select a project the firm's gross payoff from the agency is zero. The returns from the projects (e.g., net present values) are x_A and x_B , respectively, with

$$x_i = \theta_i e_i \tag{1}$$

where $e_i \geq 0$ is the agent's effort in project i . Providing effort is costly to the agent, the cost is given by $c(e_i) = \frac{1}{2}e_i^2$. The marginal contribution per unit of effort in project P_i is $\theta_i > 0$. The parameter θ_i is a random variable a priori. Its realization is unknown at the time the contract is signed. Both the density and the distribution function of θ_i , $f_i(\theta_i)$ and $F_i(\theta_i)$, respectively, are common knowledge a priori. We assume that θ_A and θ_B are stochastically independent. After a project selection but before choosing his effort e_i , the agent privately observes the realization of θ_i for the selected project (*private pre-decision information*).

⁴ Further papers that analyze the interrelation of job assignment and incentive provision include Schöttner (2008), Ratto and Schnedler (2008), and Rohlfling-Bastian and Schöttner (2017).

The agent is accountable for his decision making, or, in other words, faces pressure by investors or the public to take responsibility for the firm's performance. The (dis)utility from accountability depends on the deviation of the actual outcome from an exogenously specified threshold outcome $\bar{x}_i > 0$ for each project. Formally, it is defined as

$$JP_i = (\bar{x}_i - x_i)\varphi_i,$$

with $0 < \varphi_i < 1$.⁵ Intuitively, investors' expectations of a firm's performance are to some extent exogenous; or, the firm's profit target breaks down to targets for individual divisions and employees so that the threshold is exogenous to the contractual relation between employee and immediate superior.⁶

Similar to psychological costs from deviating from norms (Akerlof and Kranton, 2000, 2005; Heinle et al., 2012), accountability can be interpreted as a psychological cost imposed on the agent.⁷ It is a cost that goes beyond possible monetary costs of justification by documenting available project options. If the actual outcome exceeds the threshold, $x_i > \bar{x}_i$, JP_i becomes negative, which means the manager realizes a psychological benefit from outperforming the benchmark. This can be interpreted as *self-enhancement*.⁸

Each project may have a specific performance level \bar{x}_i such that the pressure comes into being if the actual performance realization x_i is below the threshold \bar{x}_i . Furthermore, the projects may differ in how strong one unit deviation from the threshold \bar{x}_i influences the perceived pressure, i.e. $\varphi_A \neq \varphi_B$. For example, justifying poor performance if a visionary strategy has been chosen may put more pressure on the agent than explaining low profits

⁵ Note that $\frac{\partial JP_i}{\partial e_i} = -\varphi_i\theta_i < 0$. The term $\varphi_i\theta_i$ represents the reduction in the justification pressure per unit of effort. We have to assume $\varphi_i \leq 1$. Otherwise the marginal impact of one unit of effort on the reduction of pressure would be higher than the agent's marginal project productivity θ_i .

⁶ We do not consider an endogenous determination of the threshold. Given our assumptions, the agent would select the lowest possible threshold and the principal could enforce any project choice by properly setting project-specific thresholds. To have the agent or principal determine a threshold or reference point based on past expectations about future outcomes (Kőszegi and Rabin, 2006) would have required additional assumptions.

⁷ Regular investor calls or annual shareholders' meetings are examples for this. More generally, any employee who will be held accountable for her/his performance may face justification pressure if poor performance has to be explained to superiors, investors, or the public.

⁸ Self-enhancement is a psychological pattern of causal reasoning where favorable outcomes are attributed to oneself. Self-serving attributions constitute a form of retrospective rationality which serves to maintain one's ego and cognitive functioning (see e.g. Staw and Ross, 1978; Bettman and Weitz, 1983; or Staw et al., 1983).

if the standard strategy (“wisdom of the crowd”) has been adopted. In our model different settings can be captured by different combinations of (\bar{x}_i, φ_i) for $i = A, B$.

Both contracting parties are risk neutral. The agent is protected by limited liability. Because effort is unobservable, the principal motivates the agent by offering output-dependent compensation. We analyze two different kinds of linear compensation contracts in the model: project-specific contracts and outcome-based (non project-specific) contracts.⁹ A project-specific contract $S = (S_A, S_B)$ consists of a menu of two linear contracts which are defined by

$$S_i = w_i + v_i x_i$$

for each project $i = A, B$ that will potentially be chosen. w_i is a fixed payment and v_i is the incentive rate, i.e., v_i determines the share of profit that the agent receives as variable compensation. Project-specific contracts would require (i) ex ante a single contract for all possible projects and (ii) ex post verification of the project actually chosen. In practice, (i) could easily amount to a considerable number of contracts which might be too costly to implement, and (ii) could be impossible. For this reason, we also consider outcome-based contracts that rely only on the final outcome $x \in \{x_A, x_B, 0\}$,

$$S = w + vx.$$

Outcome-based contracts do not require ex post verification of the particular project chosen. In the sense of Hirshleifer and Suh (1992) we assume that the principal is not able to select the project herself.¹⁰

Due to his limited liability the agent only accepts contracts with $w_i, v_i \geq 0$ or $w, v \geq 0$, respectively. This assumption captures real compensation contracts by assuming that the agent is neither willing to pay an up-front payment to the principal, nor does he accept negative bonus coefficients. Formally, non-negativity of the contracting variables ensures that “selling the firm to the agent” is not a solution to the incentive problem. The agent’s reservation utility is normalized to zero. We also make the standard assumption that if the

⁹ The approach is similar to Hirshleifer and Suh (1992), who distinguish between observable project choice and unobservable project choice. Observable project choice allows for project-specific contracts, unobservable project choice does not.

¹⁰We discuss project selection by the principal in Section 5.

agent is indifferent with regard to an act he decides in the best interest of the principal.

At the beginning of the game the principal offers a compensation contract to the agent. If the agent accepts the offer he makes his project decision. He selects a particular project only if the contract warrants positive expected compensation for that project. After the agent has selected a project i he privately observes the project's true productivity θ_i . In the next step the agent decides about his effort e_i and at the end of the game the project outcome will be realized and the agent will be compensated according to the compensation contract in place.

3 Benchmark solution

As we focus on the consequences of accountability on effort incentives, project choice, and contract design, we consider a benchmark solution where accountability is absent. Stated differently, our benchmark is the basic hidden action agency model with risk neutrality and limited liability combined with a project decision. Provided the agent has selected project P_i and observed θ_i he chooses effort e_i to maximize his expected utility:

$$\begin{aligned} \max_{e_i} U_i(e_i, \theta_i) &= E[S_i|\theta_i] - c(e_i) \\ &= v_i\theta_i e + w_i - \frac{e_i^2}{2}. \end{aligned}$$

Optimizing this expression for e_i , the agent's optimal effort decision is given by

$$e_i(\theta_i) = v_i \cdot \theta_i. \quad (2)$$

The agent's effort is increasing in both the incentive rate v_i and the productivity θ_i which is similar to the result in standard linear models (see e.g. Baker, 1992).

For a given project P_i the principal sets the incentive rate v_i and fixed payment w_i so that her expected net surplus is maximized given (2), that is:

$$\begin{aligned} \max_{v_i, w_i} V_i &= E[\theta_i e(\theta_i) - (w_i + v_i \theta_i e(\theta_i))] \\ &= (1 - v_i) H_i \cdot v_i - w_i \end{aligned} \quad (3)$$

with $H_i \equiv E(\theta_i^2) = E(\theta_i)^2 + Var(\theta_i)$, subject to a participation constraint,

$E(U_i(e_i(\theta_i), \theta_i)) \geq 0$ for all i , and a limited liability constraint, $w_i, v_i \geq 0$ for all i . We denote H_i as the aggregate risk-return measure of project i . In general, higher returns are associated with higher risk. The measure H_i is increasing in both risk - as measured by $Var(\theta_i)$ - and return - as measured by $E(\theta_i)^2$. However, the model also captures situations where one project has a higher return and lower risk than the other. H_i critically influences the equilibrium payoffs of the principal and the agent. Interestingly, the principal's surplus of a given project is increasing in the variance of the agent's productivity. This is because ex ante the value of information with regard to θ_i is the higher the higher the dispersion of θ_i . For small values of $Var(\theta_i)$, observing θ_i before the effort decision has only little value compared to an effort decision based on $E(\theta_i)$.

The solution to (3) is standard: Assuming a binding liability constraint - otherwise there is no friction in this incentive problem - the fixed payment is zero, $w_i^{BM} = 0$, so that $v_i^{BM} = \frac{1}{2}$ and $e_i^{BM} = \frac{1}{2}\theta_i$. The principal's expected net surplus from project i amounts to

$$V_i^{BM} = \frac{1}{4}H_i$$

so that the principal always prefers the project with the higher risk-return measure. The agent's expected payoff equals

$$U_i^{BM} = E \left[v_i^{BM} \theta_i e_i^{BM} + w_i^{BM} - \frac{(e_i^{BM})^2}{2} \right] = \frac{1}{8}H_i$$

which implies the agent also prefers the project with the higher risk and return - and there is no conflict of interest concerning project choice.

To summarize the benchmark case, the optimal incentive rate does not depend on project parameters and the expected payoff for both principal and agent is increasing in the project's measure for risk and return so that efficient project choice is ensured. So far, in this section, we considered project-specific contracts. However, the result extends to an outcome-based contract, too. The reason is that independently of the project, the optimal project-specific incentive rate equals $\frac{1}{2}$ such that the optimal incentive rate with an outcome-based contract must equal $v^{BM} = \frac{1}{2}$, too.

4 Justification pressure and optimal contracts

In this section, we determine optimal bonus contracts in the presence of accountability. In section 4.1 we assume the principal offers a menu S of two contracts, each contract specifying a linear contract S_i based on the outcome of project i . If the agent accepts S the project choice determines the final contract S_i .

4.1 Project-specific contracts

Derivation of contracts

We proceed similar to the benchmark solution. The agent's utility with project i after having observed θ_i now also comprises the accountability term $JP_i = (\bar{x}_i - \theta_i e_i)\varphi_i$ and is given by

$$U_i(\theta_i, e_i) = w_i + v_i \theta_i e_i - \frac{e_i^2}{2} - (\bar{x}_i - \theta_i e_i)\varphi_i. \quad (4)$$

He chooses effort to maximize utility in (4) which implies

$$e_i(\theta_i) = (v_i + \varphi_i)\theta_i. \quad (5)$$

It is apparent from a comparison of (2) and (5) that being held accountable leads to a higher optimal effort level. Given the optimal effort choice, the agent's utility then denotes

$$U_i(\theta_i, e_i(\theta_i)) = w_i + \frac{1}{2}\theta_i^2(v_i + \varphi_i)^2 - \bar{x}_i\varphi_i \quad (6)$$

As the project choice must be made before θ_i is observed, we build expectations over θ_i which leads to

$$U_i = w_i + \frac{1}{2}H_i(v_i + \varphi_i)^2 - \bar{x}_i\varphi_i. \quad (7)$$

U_i is the agent's expected payoff from project i at the project-choice stage, anticipating the optimal effort choice (5) connected with project i .

The principal's problem is to determine contract-specific payments so that the expected

surplus is maximized:

$$\max_{v_i, w_i} V_i = E(x_i) - w_i - v_i E(x_i) \quad (8)$$

subject to

$$e_i(\theta_i) = (v_i + \varphi_i)\theta_i \quad (9)$$

$$w_i + \frac{1}{2}H_i(v_i + \varphi_i)^2 - \bar{x}_i\varphi_i \geq 0 \quad (10)$$

$$v_i, w_i \geq 0 \quad (11)$$

To generate frictions in the model, in what follows we again assume that the limited liability constraint with regard to the fixed payment is binding at the optimum: $w_i^* = 0$. This is true if and only if $\frac{1}{2}H_i\left(\frac{1}{2}(1 + \varphi_i)\right)^2 - \bar{x}_i\varphi_i \geq 0$ holds true for $i = A, B$. This assumption implies that the participation constraint (10) is also fulfilled at the optimum. By inserting the agent's effort choice into the principal's objective function V_i , the principal's objective function can now be written as

$$V_i = E(x_i)(1 - v_i) = (v_i + \varphi_i)H_i(1 - v_i).$$

This expression is maximized for

$$v_i^* = \frac{1 - \varphi_i}{2}. \quad (12)$$

v_i^* is the optimal incentive rate set by the principal for project i if she would induce the choice of project i . We call v_i^* the project-specific optimal incentive rate (for project i). It is apparent from (12) that the incentive rate is decreasing in φ_i , a higher accountability reduces the optimal incentive rate. For $\varphi_i = 0$, it follows $v_i^* = v_i^{BM}$. Substituting (12) into (5) gives the optimal action $e^*(\theta_i) = \frac{1 + \varphi_i}{2}\theta_i$.

The principal's corresponding payoff with project i is

$$V_i^* = V_i(v_i^*) = H_i\left(\frac{1}{2}(1 + \varphi_i)\right)^2$$

and the agent's equilibrium payoff is

$$U_i^* = U_i(v_i^*) = \frac{1}{2}H_i\left(\frac{1}{2}(1 + \varphi_i)\right)^2 - \bar{x}_i\varphi_i.$$

Project selection

The principal prefers project i over project j if

$$V_i^* = H_i \left(\frac{1}{2}(1 + \varphi_i) \right)^2 > H_j \left(\frac{1}{2}(1 + \varphi_j) \right)^2 = V_j^* \quad (13)$$

holds. Without loss of generality we assume $H_B > H_A$. To simplify the analysis we further assume $\varphi_B \geq \varphi_A$.¹¹ The project with the higher risk-return measure entails a justification pressure rate that is at least as high as for the project with the lower risk-return measure. Intuitively, we assume that justification of low performance given that a risky strategy was chosen is not “easier” than justifying low performance if a low-risk strategy was chosen. Moreover, to give account for high performance resulting from a visionary strategy is at least as self-enhancing as reporting high performance resulting from the standard strategy. Empirical evidence that ambiguity aversion increases in peer effects and accountability pressure (Trautmann et al., 2008) supports our assumption if one interprets the visionary strategy as an ambiguous choice.

Given $H_B > H_A$ and $\varphi_B \geq \varphi_A$, the principal always prefers project B over project A . In particular, if both projects had the same risk-return measures $H_B = H_A$, the principal would like the manager to select the project with the higher justification pressure rate φ_i . The reason is that a higher justification pressure rate makes the agent’s effort less costly and the non-controllable pressure parameter $\Gamma_i \equiv \bar{x}_i \varphi_i > 0$ is not carried by the principal in equilibrium.

The agent prefers project B over project A

$$\frac{1}{2} \left(\frac{1}{2}(1 + \varphi_B) \right)^2 H_B - \Gamma_B \geq \frac{1}{2} \left(\frac{1}{2}(1 + \varphi_A) \right)^2 H_A - \Gamma_A.$$

As stated above, the principal always prefers project B over project A . She can induce the optimal project choice via setting $v_A = 0$.

We summarize our results from the analysis of project-specific contracts in the following proposition:

¹¹Conditions can be derived such that the results can still hold if $\varphi_B < \varphi_A$. In this paper we focus on the case that appears empirically most relevant.

Proposition 1:

- a) Under project-specific contracts the principal always prefers the project with the higher risk-return measure H_i and the higher pressure rate φ_i (that is P_B in our setting).
- b) The optimal project decision can always be induced by setting no incentives ($v_{-i} = 0$) for the non-preferred project $-i$ and $v_i = v_i^*$ for the preferred project i .
- c) The optimal incentive rate is decreasing in φ_i and the equilibrium effort is increasing in φ_i .

4.2 Outcome-based contract

Assuming a single bonus rate v on the final outcome x and making use of the derivations from the previous section, we obtain expected surpluses for the principal and the agent from a specific project i as:

$$\begin{aligned} V_i(v) &= (v + \varphi_i)H_i(1 - v) \\ U_i(v) &= \frac{1}{2}H_i(v + \varphi_i)^2 - \Gamma_i \end{aligned}$$

The principal wants the agent to select the project with the highest expected surplus for her. Let

$$\Delta V(v) = V_B(v) - V_A(v) = (1 - v)[(v + \varphi_B)H_B - (v + \varphi_A)H_A].$$

By assumption $H_B > H_A$ and $\varphi_B > \varphi_A$. It follows $\Delta V(v) > 0$ for all $v \in (0, 1)$ – the principal prefers project B over project A for any v . When does the agent select project B ? Again, let

$$\begin{aligned} \Delta U(v) &= U_B(v) - U_A(v) \\ &= \frac{1}{2}H_B(v + \varphi_B)^2 - \Gamma_B - \left(\frac{1}{2}H_A(v + \varphi_A)^2 - \Gamma_A \right) \\ &= \frac{1}{2}(H_B - H_A)v^2 + (H_B\varphi_B - H_A\varphi_A)v + \frac{1}{2}(\varphi_B^2 H_B - \varphi_A^2 H_A) - \Delta\Gamma \end{aligned} \tag{14}$$

where $\Delta\Gamma = \Gamma_B - \Gamma_A$.

The following lemma derives the incentive compatibility constraint for the agent's project decision by relating the bonus rate to a specific project decision:

Lemma 1:

The agent selects P_B for all $v \in (0, 1)$ unless

$$H_B\varphi_B - H_A\varphi_A < \sqrt{D}$$

holds with $D = H_B H_A (\varphi_B - \varphi_A)^2 + 2\Delta\Gamma (H_B - H_A) > 0$. In this case there exists a critical value \hat{v} such that the agent selects P_A for $0 \leq v < \hat{v}$ and P_B for $v \geq \hat{v}$. The critical incentive coefficient is given by

$$\hat{v} = \frac{\sqrt{D} - (H_B\varphi_B - H_A\varphi_A)}{H_B - H_A}.$$

Proof: See the Appendix. ■

Proposition 2:

With an outcome based contract the optimal bonus rate is given by

$$v^* = \begin{cases} \frac{1-\varphi_B}{2} & (a) \text{ if the agent selects } P_B \text{ for all } v \in (0, 1), \text{ or if } \hat{v} < \frac{1-\varphi_B}{2} \\ \hat{v} & (b) \text{ if } 1 > \hat{v} > \frac{1-\varphi_B}{2} \\ \frac{1-\varphi_A}{2} & (c) \text{ if } \hat{v} \geq 1. \end{cases}$$

v^* induces the agent to select P_B in cases (a) and (b), and P_A in case (c).

Proof: See the Appendix. ■

Given our assumption $H_B > H_A$ and $\varphi_B \geq \varphi_A$, the higher v the higher the agent's surplus difference, $\Delta U(v) = U_B - U_A$. Proposition 2 distinguishes three cases of exogenous parameter constellations. In the first condition of case (a) the uncontrollable part of accountability Γ_A from project A is significantly higher than from project B , Γ_B , such that $U_B > U_A$ for all $v \in (0, 1)$ holds. As the principal prefers project B the optimal bonus rate is given by the project-specific optimal incentive rate for project B , $\frac{1-\varphi_B}{2}$. If the uncontrollable part of justification pressure from project B , Γ_B , becomes higher relative to Γ_A there exists a critical value \hat{v} such that $\Delta U(\hat{v}) = 0$. For all $v < \hat{v}$, the agent selects project A , and for all $v \geq \hat{v}$, the agent selects project B . If $\hat{v} \leq \frac{1-\varphi_B}{2}$ the optimal incentive rate is still $\frac{1-\varphi_B}{2}$; this is the second condition of part (a). However, \hat{v} may be

larger than $\frac{1-\varphi_B}{2}$. For $1 > \hat{v} > \frac{1-\varphi_B}{2}$ (case b)), the principal sets the minimum incentive rate that induces choice of project B , $v^* = \hat{v}$. Due to the concavity of her surplus function every higher v would lead to a higher deviation from the optimal project B -related surplus. Thus, the principal has to raise the bonus rate over its project-specific optimal level in order to induce a proper project choice. If $\hat{v} \geq 1$ applies (case (c)), the principal would have to set $v \geq 1$ to induce the agent to select P_B which would lead to a negative surplus. Hence, the principal induces selection of project A via the corresponding project-specific optimal incentive rate $\frac{1-\varphi_A}{2}$. Since the principal cannot implement project B in this case we call the result the “impossibility result”.

Case (b) of Proposition 2, which we label the “money buys efficiency result”, is of special interest. If a potentially highly profitable project with correspondingly high justification pressure (in case it fails) is to be induced, it requires ceteris paribus a higher bonus rate. The result is noteworthy for two reasons: first, a higher bonus rate increases the agent’s expected payoff for *both* projects; second, higher potential justification pressure ceteris paribus *lowers* the optimal bonus rate (see (12)): From the analysis of project specific contracts we know that for a given project a higher justification pressure comes along with a lower incentive rate to control effort optimally. However, delegation of the project choice to the agent under outcome-based contracts necessitates an increase in the bonus rate so that the agent is willing to select the project with the higher justification pressure. The increase in the bonus rate enhances the gross profit for the principal but it leaves her with a smaller share of it such that the net surplus relation $V_B(\hat{v}) < V_B(v_B^*)$ holds because V_B is maximized at $v_B^* = \frac{1-\varphi_B}{2}$.

To exemplify the three parts of Proposition 2 we present three numerical examples, which are depicted in Figure 1.

The first example focuses on the second condition of part (a) of Proposition 2, $\hat{v} \leq \frac{1-\varphi_B}{2}$. Let $H_B = 9, H_A = 6, \varphi_B = 0.3, \varphi_A = 0.25, \Gamma_B = 1.8$, and $\Gamma_A = 1$. For these parameters we obtain the project-specific optimal incentive rate for project B as $\frac{1-\varphi_B}{2} = 0.35$ and for the critical value we obtain $\hat{v} = 0.3405$. Thus, the agent prefers project A for $v < 0.3405$ and project B for $v \geq 0.3405$. The principal in contrast always prefers project B . Hence, the optimal bonus rate is $v^* = 0.35$. In the second example, the “money buys efficiency result” reflecting part (b) of Proposition 2, let $H_B = 21, H_A = 18, \varphi_B = 0.13, \varphi_A = 0.1, \Gamma_B = 3.25$, and $\Gamma_A = 1.9$. Now $\hat{v} = 0.6585 > \frac{1-\varphi_B}{2} = 0.435$. Here the optimal bonus rate is

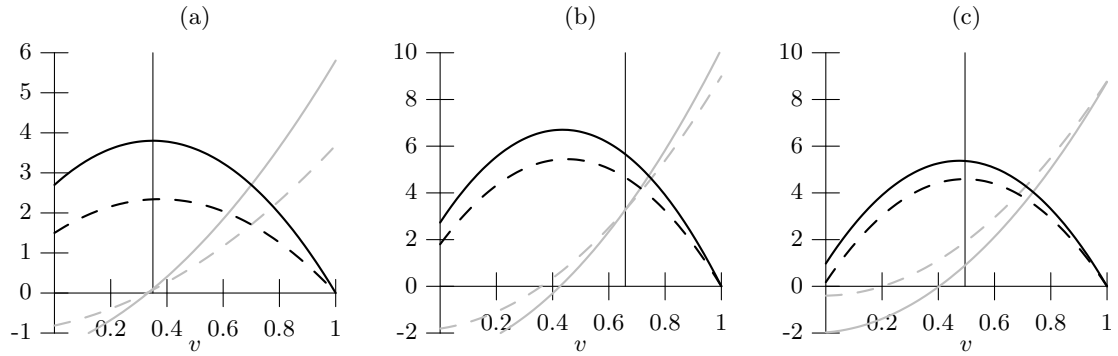


Figure 1: Surplus functions of agent (U_i , in gray) and principal (V_i , in black) contingent on project A (dashed) or B (solid)

$v^* = \hat{v} = 0.6585$. In the last example, the “impossibility result” reflecting part (c) of Proposition 2, assume $H_B = 19.5$, $H_A = 18$, $\varphi_B = 0.05$, $\varphi_A = 0.01$, $\Gamma_B = 2$, and $\Gamma_A = 0.4$. Now we have $\hat{v} = 1.0137$, i.e., the agent can only be induced to select P_B for a bonus rate $v \geq 1.0137$ which would lead to a negative surplus for the principal. Thus, the principal induces selection of P_A via $v = \frac{1-\varphi_A}{2} = 0.495$. Here project B is marginally advantageous over project A with respect to risk-return measure H and marginal reduction of pressure via effort, φ . However, the non-controllable part of justification pressure Γ_B is significantly higher than Γ_A . As the agent has to carry the cost of the non-controllable justification pressure, only for very high incentive rates he would be ready to select project B .

5 Discussion of model assumptions

In our model we assume linear incentive contracts. However, also in a contracting framework with a more general compensation function $s(x)$ (under outcome-based contracts) the main frictions of our model still arise. In our setting frictions stem from the agent’s limited liability. Due to this liability constraint the agent receives a rent that decreases in the accountability parameter Γ_i . The effect of Γ_i on the agent’s utility may distort his project choice. Furthermore, the limited liability constraint induces inefficient effort incentives.¹² Now consider the setting with a general compensation function $s(x)$. If the

¹²Due to the limited liability constraint, the principal’s equilibrium payoff $V_B^* = H_B \left(\frac{1}{2}(1 + \varphi_B)\right)^2$ if she chooses the desired project B (or, equivalently, if she induces it via project-specific contracts) does not correspond to the first-best surplus. In the first-best solution there is no incentive constraint. Thus, there always exist values $v \geq 0$ and $w \geq 0$ such that the agent’s participation constraint has no slack

limited liability constraint, $s(x) \geq 0$ for all x , makes the agent's participation constraint slack, the principal does not completely internalize the agent's costs from accountability. Thus it may become costly or impossible to induce the desired project.

We also assume in our model that the agent chooses the project. In real world firms, often divisional managers decide on smaller projects while larger projects lie in the responsibility of corporate management or the board of directors (Marshuetz, 1985; Taggart, 1987; Alonso and Matouschek, 2007). Marshuetz (1985), for instance, describes which levels of managers have the authority to approve investment projects at American Can. For example, for projects larger than \$3 million the board of directors is responsible for the project decision. Consequently, if we assume large projects and the divisional manager is the agent in our model, the principal should be responsible for the project decision. If she chooses the project the optimal solution from the analysis of project-specific contracts results under outcome-based contracts. The reason is that under project specific contracts the principal can always induce the agent to choose the desired project without any agency costs related to the project decision. Given the optimal project can be induced, the only thing that matters is the incentive problem with regard to the agent's effort. However, separating selection and implementation of projects may have effects on accountability - is a bad outcome the consequence of a bad selection or implementation? Furthermore, the optimal project selection by the board would in turn pose a contracting problem for the owners that bears similarity to the problem we analyze in this paper.

Finally, we assume that the agent learns his effort productivity θ_i for project i after the project choice but before his effort choice. If the agent can observe his effort productivity in both projects θ_A and θ_B before the project choice, he can condition his project decision on this information. As before, for a given project i the agent selects his effort as $e(\theta_i) = (v + \varphi_i)\theta_i$. His corresponding utility is again given by (6) which for an outcome-based contract with $w = 0$ results as $U_i(\theta_i, e_i(\theta_i)) = \frac{1}{2}\theta_i^2(v + \varphi_i)^2 - \Gamma_i$. Similarly, the principal's utility from project i conditional on θ_i anticipating $e(\theta_i)$ is given by $V_i(\theta_i) = \frac{1}{4}\theta_i^2(v + \varphi_i)^2$. Thus, the principal prefers always the project with the higher actual marginal effort productivity. Assume $\theta_i > \theta_j$. Then the agent selects project i for

at the optimum. In the first-best solution optimal effort for project B is $e_B^{FB} = \theta_B(1 + \varphi_B)$ and the principal's corresponding surplus is $V_B^{FB} = \frac{1}{2}H_B(1 + \varphi_B)^2 - \Gamma_B$. Due to our assumptions about the parameters that lead to frictions in the model, $V_B^{FB} > V_B^*$.

all values of the incentive rate v if $\Gamma_i \leq \Gamma_j$. If, in contrast, $\Gamma_i > \Gamma_j$ holds, the agent may select project j for some v or it might be even impossible to induce the desired project. Thus, with regard to the project decision, similar insights as in our model setting can be derived. The main difference, however, is that as the project decision can be conditioned on θ_A and θ_B the principal's preferred project also depends on these values. As θ_A and θ_B are the agent's private information, the incentive rate cannot be made contingent on them. Thus, to solve for the optimal v we need to specify the probability distributions of θ_A and θ_B .

6 Conclusion

In this paper we develop a novel agency model to analyze effects of accountability and justification pressure on project choices and implementation effort. Justification becomes necessary when the agent's project choice turns out to generate low profits. It is modeled as a psychological cost the agent has to bear. Accountability has two distinct effects in the model: on the one hand it pushes project choices towards those with a low risk and return (because these projects usually come along with lower justification pressure); on the other hand accountability reduces the costs of effort implementation because the agent would like to avoid low outcomes he has to justify. The principal's contract offer needs to accomplish both proper selection and proper implementation of a project. High costs of accountability decrease the agent's incentives to select a particular project. The agent needs to be compensated for the potential justification pressure, and the principal can achieve that through proper determination of variable pay (instead of fixed pay). Raising the variable component of pay induces the agent to choose the principal's preferred project ("money buys efficiency result"). However, this may not work in every instance; it may be impossible for the principal to induce the agent to select the principal's preferred project ("impossibility result"). Both results imply that accountability pressure may not lead to lower costs of incentive provision. This is noteworthy because in light of high bonuses in, e.g., financial institutions some argued that committed, responsible employees should be hired who do not focus too narrowly on monetary incentives. Our analysis shows that project selection and accountability may interact in disadvantageous ways. Even committed employees with high susceptibility to accountability pressures need to be paid high bonuses to induce proper project or strategy choice.

Overall our results suggest that firms should be aware of post decision routines that might affect ex ante decision making. Since accountability affects both project selection and effort concluding reporting procedures should be conducted with care. More precisely, perceived pressure at the stage of finding and initiating a project might harm entrepreneurial thinking as managers focus on strategies that bear the least risk. However, once a project is implemented exerting pressure increases effort and performance. Therefore, with responsibility of project selection being a crucial factor, accountability may be desirable or undesirable.

As our model considers an aggregate measure for risk and return, experimental research could examine more closely how the obligation to justify project outcomes is related to the selection of specific risk-return profiles and if incentive pay is able to mitigate potential adverse effects. In addition to that it could be analyzed how accountability interacts with communication policies and if variations in accountability change compliance with these policies.

Appendix

Proof of Lemma 1

Assume $H_B - H_A > 0$ and $\varphi_B \geq \varphi_A$. The equation $\Delta U(v) = av^2 + bv + c = 0$ with $a = \frac{1}{2}(H_B - H_A) > 0$, $b = (H_B\varphi_B - H_A\varphi_A) > 0$ and $c = \frac{1}{2}(\varphi_B^2 H_B - \varphi_A^2 H_A) - \Delta\Gamma$ has two (one, no) solution(s) iff $D = b^2 - 4ac > (=, <) 0$. If $D < 0$ one of the two parabolas $U_B(v)$ and $U_A(v)$ is located strictly above the other. Then the agent chooses the upper one, which must be the one which has the higher slope $dU_j/dv = (v + \varphi_j)H_j$ for all $v \in (0, 1)$, i.e. the one where $H_j\varphi_j - H_i\varphi_i > 0$. This is U_B in our setting. If $D > 0$ the equation has two real solutions, namely

$$v_1 = \frac{-b + \sqrt{D}}{H_B - H_A}, v_2 = \frac{-b - \sqrt{D}}{H_B - H_A}.$$

As each parable $U_B(v)$ and $U_A(v)$ has its minimum at $v = -\varphi_j < 0$ at least one of the solutions (v_1, v_2) has to be negative. Since $H_B - H_A > 0$ and $v_2 < v_1$ hold, it follows that $v_2 < 0$. Thus, if there is an intersection of U_B and U_A (a positive null of ΔU), then it is $\hat{v} = \frac{-b + \sqrt{D}}{H_B - H_A}$. A special case is $D = 0$ where $v_1 = v_2 = \hat{v}$.

Now assume $D \geq 0$ and $b \geq \sqrt{D}$. Then $\hat{v} \leq 0$ and the agent selects P_B for all $v \geq 0$ as right from the intersection the parable with the higher slope $U_B(v)$ leads to a higher surplus for the agent. If $D \geq 0$ and $b < \sqrt{D}$, $\hat{v} > 0$ holds and $U_B(v) > U_A(v)$ for $v > \hat{v}$ and $U_B(v) < U_A(v)$ for $0 \leq v < \hat{v}$. ■

Proof of Proposition 2

(a) According to Lemma 1 for $D < 0$ and for $b \geq \sqrt{D}$ the agent chooses P_B for all $v \in (0, 1)$. Here the principal sets the incentive coefficient that maximizes $V_B(v) : v^* = \frac{1 - \varphi_B}{2}$. If $b < \sqrt{D}$ according to Lemma 1 the agent selects P_A for $0 \leq v < \hat{v}$ and he selects P_B for $v \geq \hat{v}$ with $\hat{v} = \frac{\sqrt{D} - b}{H_B - H_A}$. Thus, while the principal prefers project B for all $v \in (0, 1)$ the agent prefers project B only for $v \geq \hat{v}$. If $v_B^* = \frac{1 - \varphi_B}{2} \geq \hat{v}$ the optimal incentive coefficient is $\frac{1 - \varphi_B}{2}$.

(b) If \hat{v} exists and $v_B^* < \hat{v} < 1$, the optimal incentive coefficient is \hat{v} as for $v < \hat{v}$ the agent would select P_A but the principal prefers P_B for all $v \in (0, 1)$ and $V_B(v)$ is a strictly concave function with a unique maximum at v_B^* .

(c) If \hat{v} exists and $\hat{v} \geq 1$ holds true, there is no $v \in (0, 1)$ such that the agent can be

induced to select P_B ; the principal could not earn any positive surplus via inducing P_B . Thus, the best the principal can do is to set the incentive coefficient $v^* = v_A^* = \frac{1-\varphi_A}{2}$ that maximizes V_A and induces selection of P_A . ■

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Essay II

Title

Experimental evidence on project choice and accountability

Co-authors:

Christian Lukas, Jens Robert Schöndube

Experimental evidence on project choice and accountability

Abstract

We investigate how decision making is affected when the decider knows s/he is held accountable for the decision or outcome. In a series of laboratory experiments we analyze different treatments where agents have to make an investment decision from a set of projects. In one setting agents face pressure to justify their project choice if profits are too low. In another setting agents have to justify their decisions irrespective of the project outcome. We test hypotheses derived from a simple model and find support for them: accountability reduces the likelihood of value-maximizing project choices though the extent depends on the type of accountability; however, higher profit shares for the agent or a project recommendation by the principal can offset that effect.

Keywords:

agency; project selection; accountability; behavioral accounting; incentives; experiment

JEL-Classification:

C72, C91, D81, M40, M52

1 Introduction

It is commonplace that managers or companies are held accountable for their decisions and the results of their decisions. Accountability refers to a decision maker's expectation that he or she may be obliged to justify his/her decisions to others (Lerner and Tetlock, 1999). Accountability may be effective both *ex post* and *ex ante*, i.e., after a decision has been made or before it. Self-serving attributions represent an example of an *ex post* effect and they can be found both at the level of the individual (Ilgen, 1980) and at the corporate level (Bettman and Weitz, 1983). An *ex ante* effect occurs if the expectation to justify a decision itself influences the decision-making process. This influence can be ambiguous. Knowing that one is held accountable could lead to better decisions (or more effort in carrying out a task) because of more rigorous deliberation before taking action (DeZoort et al., 2006; Vieider, 2009; Rausch and Brauneis, 2015; Xiao, 2017). However, accountability entails an adverse influence if it shifts the focus from optimal decisions to decisions that can be easily justified; as, for example, in Weigold and Schlenker (1991) or McMackin and Slovic (2000).

It is the objective of our paper to investigate effects of accountability on investment decisions and to identify factors that affect perceived justification pressure. For this purpose, we conduct a series of computerized laboratory experiments. We define an agency situation where the agent is responsible for investment choices. The agency incorporates accountability on the agent's side, i.e., the agent knows *ex ante* that he will be required to justify either the project performance if it falls below a predetermined level or the project choice itself.

In the experiments there are two projects, a visionary project with a higher mean return and variance than a second (standard) project. Intuitively, visionary projects can (but do not need to) lead to higher justification pressure than standard projects. On the basis of a simplified version of the analytical model in Lukas et al. (2019), we derive the hypothesis that justification pressure may prevent optimal project choices from the principal's point of view. This hypothesis finds support in the experiment.

Pairs of principal and agent are formed who interact over several decision rounds. In each round the agent selects one out of the two projects. The *ex ante* efficient (visionary) project entails a loss for the principal if the bad state of nature realizes. There are three manipulations in the experiments: firstly, we vary payoffs from the available projects;

secondly, we alter the need to justify decision making or performance; and thirdly, - as a novel feature - we change the principal's opportunity to recommend a project choice to the agent. Varying payoffs for agent and/or principal allows us to get further insights into the impact of payoff differences on project choice. We find support for our hypothesis that a higher profit share induces the agent to choose value-maximizing projects. And, as predicted, the principal's recommendation moderates justification pressure and fosters efficient project choice. The recommendation turns out to be more effective if the agent is held accountable for decisions instead of being held accountable for poor outcomes. It suggests that the type of accountability matters.

There is a growing literature on accountability. Early contributions include Bettman and Weitz (1983) and Staw et al. (1983), who show that corporations use self-serving patterns of attributions when they explain their performance to shareholders. Recent contributions include, for example, Aerts et al. (2013) who show that the way chosen to justify performance depends on the institutional setting; Aerts and Zhang (2014) demonstrating that firms use causal reasoning to influence investors' interpretation of the firms' performance; or Zhang and Aerts (2015) documenting a link between causal language intensity and the jeopardy of not meeting performance targets. Besides these field studies of accountability (effects) at the corporate level there are numerous experimental studies at the individual level. They document positive effects of accountability. For example, justification pressure may reduce loss aversion (Vieider, 2009; Pahlke et al., 2012), preference reversals (Vieider, 2011), overconfidence or order-effects (Ashton, 1990; Jermias, 2006), and inaccurate judgments (Ashton, 1992); or, Xiao (2017) finds that subjects are more likely to conform to audience expectations when justification is required, which may lead to less selfish behavior (even in the absence of negative consequences for violations). Moreover, Webb (2002) and Arnold (2015) investigate the effect of perceived pressure to justify decisions or financial pressure on budgeting decisions. They find that it reduces slack and increases cooperation. Stated differently, accountability increases the likelihood for efficient decisions that may entail losses. Finally, responsibility effects may be sensitive to loss or gain frames of decisions under consideration (Pahlke et al., 2015).¹

¹ DeZoort and Lord (1997) review research on pressure effects in accounting which includes but is not limited to justification pressure effects.

Our paper contributes to the experimental literature on accountability for choices of risky alternatives. In studies that investigate justification pressure effects on loss aversion or risk aversion (Vieider, 2009; Chakravarty et al., 2011; Pahlke et al., 2012; Polman, 2012; Pollmann et al., 2014; Andersson et al., 2016) payoffs are symmetric; this means the payoffs for the person who decides and for the other passive person are the same for each potential choice. In our experiment we introduce asymmetric payoffs in an accountability context. Asymmetric payoffs mirror a characteristic feature of managerial investment decisions: variable pay arrangements typically award management a different share of the investment returns than owners receive.² In contrast to prior literature, we find that justification pressure (i.e., accountability) reduces the likelihood of efficient decisions. Furthermore, to the best of our knowledge, there seems to be little specific work on methods and devices that lead to desired decision making under accountability. One example is Ashton (1992), who finds that people are (partially) reluctant to rely on recommendations of technical aids (e.g., key performance indicators (KPIs)). With respect to investment decisions and post-decisional accountability, we introduce upfront communication of firm policies/preferences as an alternative device. We find that managers comply with the recommendations and that this process offsets justification pressure to some extent. Finally, since we compare two closely related experimental settings, we are able to analyze how differing justification/reporting regimes and incentive contracts change the way accountability influences investment decisions. Therefore, our paper also contributes to ongoing research on controlling investment decisions (e.g., Reichelstein, 2000; Pfeiffer and Schneider, 2007; Ortner et al., 2017). Besides the choice of performance measures or particular depreciation schedules (e.g., Reichelstein, 1997; Rogerson, 1997) a more or less stringent reporting regime may be effective as well.

The paper is structured as follows. Section 2 introduces a simple model that allows us to derive testable hypotheses. The experiment and its results are presented in sections 3 and 4. The final section concludes.

² Pollmann et al. (2014) also utilize asymmetric payoffs but the agent's material payoff depends on the principal's decision to reward the agent after the project choice.

2 The model

Let x_i be the outcome of Project $i = A, B$. Each project has two possible outcomes such that $x_i \in \{L_i, H_i\}$ with $H_i > L_i$. The probability that the high outcome is realized is 0.5 under both projects. In what follows we distinguish between the two projects as follows: we call Project A the "standard project" and Project B the "visionary project". We assume that Project B has the higher expected outcome but at the same time also the higher outcome variance. Hence,

$$\begin{aligned} E(x_A) &= 0.5(H_A + L_A) < 0.5(H_B + L_B) = E(x_B) \\ \text{Var}(x_A) &= 0.5(H_A - L_A)^2 < 0.5(H_B - L_B)^2 = \text{Var}(x_B). \end{aligned}$$

We further assume that $L_A \geq 0$ and $L_B \leq 0$. Thus, (only) the visionary Project B leads with a probability of 50 percent to a negative outcome.

The agent's wage w_i is partly project-specific: The agent obtains a fixed payment f that is not contingent on the project choice; in addition he receives a project-specific bonus $v_i H_i$ if the high project outcome is realized under project i . The factor v_i can be interpreted as the agent's share of the high project outcome under project i . Thus, the agent's expected compensation if he chooses project i is given by

$$E(w_i) = f + 0.5v_i H_i.$$

As the agent is responsible for the project choice, he is held accountable for bad project performance and/or for the project choice itself. This justification pressure is captured as a psychological cost JP_i on the agent's side. For example, if he has to justify the project choice, JP_i may be considered as a deterministic variable depending on the characteristics of the project. Therefore, the visionary Project B might have a higher justification pressure than Project A , $JP_B > JP_A$. JP_i may also depend on the firm's strategy and its communication. If, however, the agent has to justify the bad outcome (L_i), JP_i could be considered as an expected "value" of the justification pressure, where the psychological cost only occurs if L_i is realized. Incorporating the justification pressure into the agent's preference function, the agent's overall surplus U_i from selecting project i consists of his

expected compensation less the justification pressure

$$U_i = f + 0.5v_iH_i - JP_i.$$

The principal's surplus V_i if project i has been selected consists of its expected outcome $0.5(H_i + L_i)$ less the agent's expected compensation. Thus,

$$V_i = 0.5(H_i + L_i) - f - 0.5v_iH_i = (1 - v_i)0.5H_i - 0.5L_i - f.$$

We assume that the agent is protected by limited liability such that $v_i \geq 0$ and $f \geq 0$ need to hold true.

Which project does the agent select? Notice that if the bonus coefficients v_i are equal for both projects, the expected compensation for the agent is higher under Project B . Nonetheless, the agent may prefer the choice of Project A if JP_B is significantly higher than JP_A . However, the choice of Project B might be incentivized by raising the share v_B the agent receives from the good outcome of Project B ; or it may be encouraged by reducing justification pressure JP_B by means of communicating the preferred investment strategy (Project B) to the agent.

3 Design of the experiments and derivation of hypotheses

We conduct the experiments in order to examine if and how investment decisions are affected by accountability. We test the assumption that accountability causes negative utility on the agent's side and therefore could lead to decisions that do not maximize total surplus. We also extend the basic framework of our model and investigate how justification pressure and a firm's investment strategy might interact. More precisely, we add project recommendations from the principal to the experiments. These recommendations can be seen as a potential remedy for justification pressure.

Our main experiment shows a 6x2x2 factorial design with between-subject and within-subject analyses. We manipulate the existence of accountability (no obligation to justify the result or the decision; obligation to justify the result or decision) and the information about the principal's preferred project (no recommendation to agent; recommendation to agent). To study effects of differing bonuses, we vary the payoff schemes in the decision

rounds within each treatment. Table 1 gives an overview of all treatments.

	No justification	Justification
No recommendation	BL	JP
Recommendation	REC	JP-REC

Table 1: Treatments

At the beginning of the experiment, pairs of principal and agent are formed.³ Pairs remain unchanged in six decision sets (fixed matching). We vary the order of the payment schemes over the six decision rounds.⁴ The agent selects one of two projects, Project *A* or Project *B*, at the beginning of each decision round. There are two equally likely states of nature, state 1 and state 2. Depending on the state, each project yields a project-specific low outcome (in state 1) or a high outcome (in state 2). The payoff characteristics of the two projects follow the description in the previous section. Given the agent’s limited liability, the principal absorbs any negative outcome. High outcomes are shared between principal and agent. The sharing rule is specific for each decision round, however, it always ensures that Project *B* leads to a higher expected compensation for the agent than Project *A* and that Project *B* leads to a higher surplus for the principal than Project *A*. Table 5 in the appendix gives overview of the payoff schemes.

The majority of our analyses is based on the agents’ individual frequencies for selecting Project *B*. In business life, investment choice can be thought of as a repeated decision problem and repeated interaction between management and owners. The individual frequency of selecting Project *B* can be interpreted as the “type” of manager where type describes the inclination to select the (visionary) value-maximizing project instead of the less risky standard project.

In our baseline treatment (BL), the setting is tested without any additional features. If both principal and agent are expected payoff-maximizers they both prefer *B* over *A*. In all treatments with justifications (JP and JP-REC), the agent is held accountable

³ In all sessions we use neutral language and refer to the agent as “Player 1”, and to the principal as “Player 2”. The investment projects are accordingly labeled “Alternatives”. The appendix contains complete instructions.

⁴ Within each treatment, approximately half of the principal-agent pairs face payoff schemes in ascending order (payoff schemes 1 to 6 in the sets 1 to 6), the other half in descending order (payoff schemes 6 to 1 in the sets 1 to 6). For the purpose of statistical analyses the decision sets with the same payoff schemes are matched.

after decision making is done and project outcomes have been observed. Agents are held accountable for (bad) project outcomes, i.e., they are obliged to justify the outcome whenever the principal suffers a financial loss. Consequently, it is only Project *B* that bears the risk of being held accountable. This mirrors the phenomenon in business life that in many cases bad outcomes and especially losses need to be justified but not bad project choices (as long as outcomes are satisfactory).⁵ Accountability is implemented by a computer chat between principal and agent, where the agent must enter her/his justification and the principal has the option to reply to the justification. We believe that participants feel a sufficient extent of discomfort when they have to justify poor project outcomes, although it is very clear from our design, that poor results are the sole consequence of a selection decision and an act of nature.

Besides accountability, investment decisions by managers may be influenced by a number of other factors. One factor very likely to influence decisions is the “preference” of owners. Owners can communicate their preferred business strategy to managers by, for example, stating that they want the management to pursue innovative projects. If owners prefer a visionary strategy, it should be less stressful to report low outcomes that are due to selecting higher-risk projects. Contrary to this situation, if managers know owners prefer standard projects, it might be less pleasant to report bad outcomes for visionary projects, and it might also require “better” explanations why higher-risk projects instead of standard projects have been chosen.⁶ Hence, we expect that the communication of the owners’ investment preference can moderate the justification pressure for managers and increases the probability that the preferred project is chosen. In order to gain some practical insights on this aspect, we vary the assumption that agents are uninformed about the principal’s preferences at the time of the decision, i.e., we allow for upfront communication of the owners’ investment preferences. We implement this as follows: in treatments REC and JP-REC the principal recommends a project to the agent before the agent selects a project. The agent is free to follow the recommendation or to disregard it.

⁵ We believe that outcome accountability, where only bad outcomes need to be justified, is a realistic scenario. However, in order to determine specific characteristics of accountability and its effects (e.g. differences in the threat potential), we also consider decision accountability, where agents have to explain themselves independently from the outcome, at a later stage (see Hypothesis 5).

⁶ Here the implicit assumption is that the actual implementation works without problems, so that a potentially insufficient implementation is not the cause for a low outcome.

The experiment features symmetric information about available projects. We choose this approach because it simplifies the entire recommendation process. Another characteristic of our experiments is, that bonus rates/payoff shares are not determined by the principal but exogenously given. By doing so we can ensure variation in incentives. Moreover, implementing the same variation within each treatment increases comparability.

On the basis of our model and the arguments above, we expect that accountability reduces the frequency of Project *B*-choices in all conditions, and we expect that communication of the preferred project influences project selection. We state this formally in Hypotheses 1 and 2.

Hypothesis 1 *Being held accountable for a (bad) project outcome leads to a less frequent choice of Project B compared to a situation without accountability.*

Hypothesis 2 *a) If principals prefer Project B, communication of that preference leads to Project B being chosen more often. b) The more often Project B is recommended over the course of the experiment the lower the perceived justification pressure.*

Another factor that influences managers' decisions is the compensation contract. Compensation contracts are designed to give managers incentives for value-maximizing investment decisions. According to our model there may be situations in which the principal needs to raise the bonus rate to incentivize the agent to select the efficient project. To test this effect in the experiment we vary the payoff shares the agent receives if Project *B* is chosen (see Table 5). The increasing outcome share accruing to the agent mirrors the rise in the bonus rate that is necessary to induce efficient project choice. Following our theoretical model we predict a moderating effect of variable pay on project choice. This is stated in Hypothesis 3.

Hypothesis 3 *Raising variable pay mitigates the effect of justification pressure on project choice and leads to Project B being chosen more often.*

A different question in terms of accountability is how its effects change over time. Does a manager get used to the procedure of justifying herself/himself the more often s/he faces such a situation? Does accountability, thus, lose its threat potential? Or does it hold that managers perceive more pressure when the number of justifications increases, as each justification could, for example, damage the manager's reputation even more? We believe

that both scenarios can be true. Therefore, increasing the number of occasions where an agent is held accountable in our experiment might result in two opposing effects. On the one hand, perceived justification pressure decreases because the agent becomes familiar with the situation to justify his decision making. One could describe this as something like a habituation effect. On the other hand, being held accountable persistently might also lead to increased discomfort. As a consequence, we are not able to formulate a directional hypothesis, so we state it in null form.

Hypothesis 4 *Increasing the frequency with which an agent is held accountable for a bad project outcome leads to no effect in terms of perceived justification pressure.*

According to Hypothesis 2 it should hold that the chance of a Project *B*-choice increases if the corresponding investment preference is communicated by the principal. However, it is still an open question whether the will to follow a recommendation (i.e., the compliance rate) would change if accountability is implemented in a different way. An alternative type of accountability would be, for example, a reporting regime where agents have to justify their decisions (and not the outcomes). Does this lead to a higher or lower compliance? In order to provide an answer to that question, we conduct an additional experimental study. The major difference between our first experiment and the second one is that agents instead of being held accountable for bad outcomes are now being held accountable for their decision independent from the actual project result.⁷

We believe that the general impact of decision accountability on project choice is not different to the effect of outcome accountability. However, we expect that being held accountable for each and every decision results in an even higher compliance than being held accountable for bad project results only. The reason for our expectation is, that the former is a more stringent reporting regime than the latter, which might be perceived similarly to a stronger monitoring. We correspondingly build the following hypothesis.

Hypothesis 5 *Being obligated to justify project choices leads to a higher compliance with Project *B*-recommendations than being held accountable for bad project outcomes.*

⁷ In the following, we label our main study as Experiment 1. The additional experiment for decision accountability is called Experiment 2. Experiment 2 comprises two treatments, BL and JP-REC. The incentive structure in Experiment 2 (see Table 6) is slightly different from the one in Experiment 1. This appears innocuous given that decisions in treatment BL do not differ between Experiment 1 and Experiment 2.

To increase the level of internal validity we also implement several additional control measures via computerized pre- and post-experimental questionnaires. Firstly, a risk attitude test from the German Socio Economic Panel (SOEP)⁸ is applied to be able to distinguish effects of our independent variables from influences of differences in risk attitudes. Secondly, since other-regarding preferences could affect decision making in our experiment, a test for inequality aversion is incorporated as another measure. We use the test from Fortin et al. (2007) to categorize participants into three classes of inequality aversion (low, medium, and high) and are thus able to control for this influence. Thirdly, we test our subjects regarding their “big 5 personality traits”. The corresponding measures are again based on a test from the German SOEP and capture the extent of the following character traits: conscientiousness, extraversion, agreeableness, openness, and neuroticism.⁹ Other influences which have to be considered result from the repeated interaction of the participants (several decision sets, fixed matching). The first such influence could be reputation building. Since agent participants are the only players who make payoff-relevant decisions we do not expect reputation effects here (similar to the situation in a repeated dictator game). The second influence could be that participants are able to engage in cooperative or retaliatory behavior in treatments with chat communication. To detect collusions or retaliations and to distinguish them from behaviors induced by accountability, recommendations, and the pay scheme, we analyze chat contents.

After arriving in the lab participants are randomly assigned a seat. A video film is played in which an experimenter (who is not present during the experiment) reads the complete instructions and explains screenshots from the upcoming experiment. Then participants are asked to read the written instructions at their seats. Clarifying questions are answered at participants’ seats. Before the actual experiment starts, participants have to answer a number of control questions to make sure every participant has a sound understanding of the experimental situation. The subjects of our experiments are compensated by means of an initial endowment (30 Taler in Experiment 1 and 25 Taler in Experiment 2)¹⁰ and

⁸ Further information about the German Socio Economic Panel and its measures can be found in, e.g., Wagner et al. (2007) or Richter et al. (2013).

⁹ All questionnaires for the control variables can be found in the appendix.

¹⁰The experimental currency Taler has an exchange rate of 3 Taler per 1 Euro in Experiment 1, and 2.5 Taler per 1 Euro in Experiment 2.

the payoff of one specific decision round. Paying one round instead of all rounds prevents “wealth effects” (see Charness et al., 2016). This payoff-relevant round is publicly and randomly selected after the experiment. The initial endowment for each participant ensures that the sum of initial endowment and the payoff in the relevant decision round cannot become negative, i.e., no participant could suffer a loss in the experiment.

4 Results of the experiments

Both experiments were conducted in the Leibniz Laboratory of Experimental Economics of the Leibniz Universität Hannover. For organization and administration processes the software hroot (Bock et al., 2014) was used, and the experiments were programmed by means of the software zTree (Fischbacher, 2007). In total 304 undergraduate and graduate students (218 students in Experiment 1 and 86 students in Experiment 2) from various fields of study participated. The average age of participants was 23.3 years. Experimental sessions lasted approximately 60 minutes and earnings average 13.22 Euro.

We present a descriptive analysis of the experiments and results of statistical tests and regressions. Non-parametric statistical tests follow Siegel (1957). Test results are labeled statistically significant whenever $p \leq 0.1$ in two-sided tests. In order to account for the repeated interactions of pairs of subjects, our regressions are specified such that intra-group dependencies are considered (clustered errors).

Figure 1 summarizes the major results concerning the agents’ Project *B*-choices in our main Experiment 1.¹¹

Two effects are apparent: firstly, if justification pressure is present, agents more often select the less risky standard Project *A*. Secondly, the principals’ recommendations seem to have an effect on the choices of the agents. Adding recommendations increases the frequency at which Project *B* is chosen. This appears to be true also in the absence of justification pressure.

To see whether those differences among the treatments reach a statistically significant level we conduct non-parametric analyses (Wilcoxon-Mann-Whitney test, two-sided - WMW

¹¹A detailed list of round-by-round results can be found in the appendix (see Table 7)

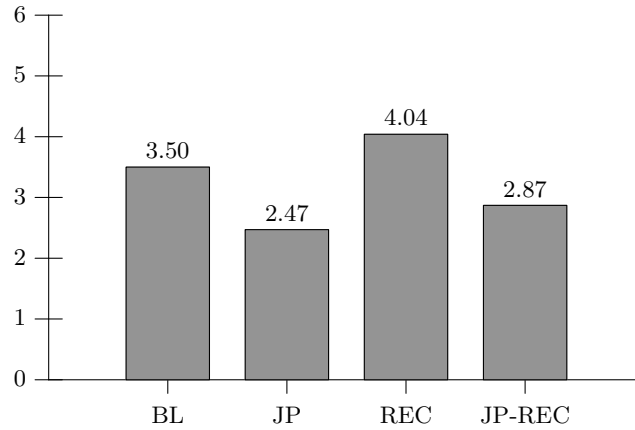


Figure 1: Average frequencies of Project *B*-choices, Experiment 1

and/or Robust Rank Order test, two-sided - RRO).¹²

Regarding Hypothesis 1, which tests the effects of outcome accountability on project choice, we find that agents select Project *B* less often in treatment JP as opposed to treatment BL to a statistically significant extent (WMW: $p=0.0302$; RRO: $p=0.0247$). Corresponding tests for the comparison between treatment REC and JP-REC show significant differences as well (WMW: $p=0.0072$; RRO: $p=0.0045$). The difference between REC and JP-REC is not driven by different types of recommendations because there is no statistically significant difference between the distribution of individual recommendations between these treatments (WMW: $p=0.4336$; RRO: $p=0.4508$). Regarding the extent to which justification pressure affects project choices we find medium-sized effects (Glass’s Delta, BL vs. JP: 0.6041; REC vs. JP-REC: 0.7891).

If we control for underlying recommendations the picture does not change. Figure 2 shows that if Project *B* is recommended in the JP-REC treatment (JP-REC B), the average rate at which agents follow this recommendation is significantly lower (WMW: $p=0.0051$) compared to the REC treatment (REC B). Even though justifying the project outcome is easier after a Project *B*-recommendation (“I only followed your recommendation”), a significant part of agents still struggles to actually choose Project *B*. Consequently, justification pressure is not eliminated by recommendations but only mitigated. In summary, the results confirm that the effect of accountability for project outcomes is unambiguous, it decreases the likelihood of Project *B* being chosen.

¹²See Fligner and Policello (1981) as well as Feltovich (2003) for more information about the RRO test.

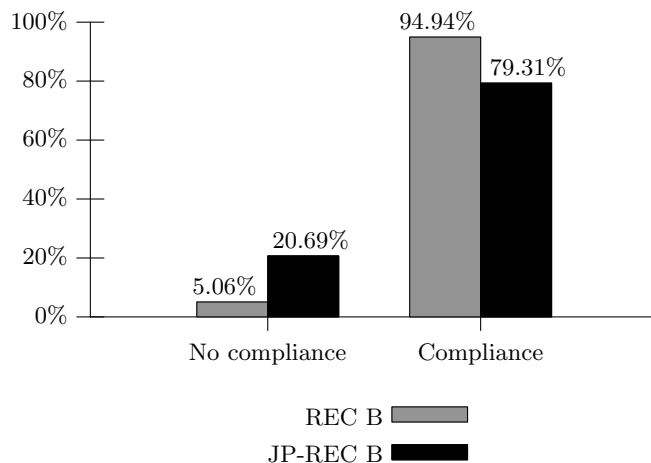


Figure 2: Compliance with Project *B*-recommendations, Experiment 1

To get a more detailed understanding of the underlying drivers for the agents' decisions we conduct a series of regressions. Firstly, we run logit random effects regressions containing data of all treatments, using a dummy variable (*JustPresDum*) to identify agents that operate under accountability. Table 2 gives an overview of the regression results.¹³ Outcome accountability affects the agents' choices negatively to a quite considerable extent. Expressing regression equation (1) in odds we find an odds ratio of 0.397 for *JustPresDum*. This means under accountability we expect to find only 0.397 agents who would select Project *B* for every agent choosing Project *A*. Other factors strongly influencing the agents' decisions are recommendations to choose Project *B* from the principals (*RecB*) and the percentage share the agent receives from total project payoff if Project *B* is chosen and state 2 realizes (*PercShareB*).

In order to assess the quality of these results, recall that the justification situation in our setting is described in neutral language, completely anonymous and takes place via computer chat. Therefore, the chances of creating psychological stress, i.e., justification pressure, are rather small compared to a context-rich setting or a real business-life situation, where the involved person reports a) face-to-face and b) to probably more than one supervisor, shareholder, etc. However, we still find some significant coherence between fewer Project *B*-choices and justification pressure, which is a strong argument. More context likely increases justification pressure (Haynes and Kachelmeier, 1998) and would

¹³A detailed description of variables used in tests and regressions can be found in the appendix.

ChoiceB	(1)	(2)	(3)	(4)	(5)	(6)	(7)
JustPresDum	-0.923*** (0.351)		-0.853*** (0.326)		-0.476* (0.288)		-0.595* (0.313)
RecB	3.768*** (0.760)		3.686*** (0.750)		3.692*** (0.737)		3.657*** (0.735)
JustPresDum_RecB	-0.899 (1.003)		-1.070 (0.993)		-1.251 (0.975)		-1.163 (0.966)
PercShareB	4.592*** (1.247)		4.576*** (1.242)		8.407*** (2.313)		8.454*** (2.323)
WillRisk		0.151** (0.074)	0.177** (0.085)		0.102 (0.070)		0.065 (0.067)
InequAveLevF		-0.429** (0.193)	-0.527** (0.221)		-0.376* (0.204)		-0.360* (0.209)
Age		-0.013 (0.020)	-0.003 (0.022)		-0.002 (0.026)		0.000 (0.023)
Male		0.641** (0.288)	0.499 (0.329)		0.449* (0.268)		0.358 (0.295)
Semester		0.053 (0.037)	0.044 (0.043)		0.057 (0.039)		0.050 (0.038)
MaxOwnPay				0.272*** (0.057)	0.251*** (0.058)		0.243*** (0.060)
MaxOtherPay				-0.040 (0.073)	-0.064 (0.068)		-0.074 (0.071)
PaySchemVar				0.004 (0.002)	-0.009** (0.005)		-0.009** (0.005)
PartnPaySchemVar				-0.001*** (0.000)	0.001* (0.000)		0.001* (0.000)
Open						0.007 (0.042)	-0.012 (0.040)
Conscient						-0.150** (0.077)	-0.035 (0.074)
Extraver						0.016 (0.078)	0.053 (0.078)
Agree						0.064 (0.078)	-0.043 (0.059)
Neuro						-0.168*** (0.065)	-0.108 (0.067)

Standard errors in parentheses

$N = 654$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Random effects logit regressions, all treatments, Experiment 1

probably lead to even stronger results (see also Lerner and Tetlock, 1999).

Given the evidence from non-parametric tests and regressions we consider outcome accountability to be a crucial factor in the decision making of the agents. With respect to Hypothesis 1 we thus conclude:

Conclusion 1:

Experimental results give support for Hypothesis 1, i.e., outcome accountability reduces the likelihood of value-maximizing project choices independently from recommendations.

Our results regarding Hypothesis 1 are in line with Adelberg and Batson (1978). They find that only unaccountable agents make efficient decisions, as the desire for approval shifts focus away from outcomes to justifiability of outcomes.

Hypothesis 2a) states that communication of Project *B*-preferences increases the frequency with which agents select Project *B*. A first approach to test this is to compare Project *B*-choices in treatments JP and JP-REC and control for the underlying recommendations. Figure 3 shows the percentage of Project *B*-choices in the JP treatment which are

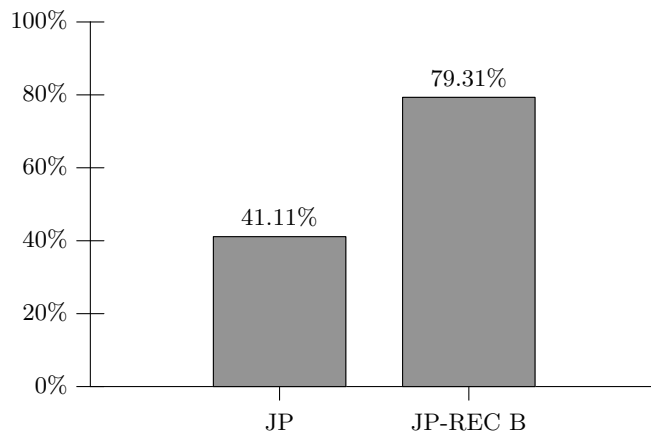


Figure 3: Frequencies of Project *B*-choices, Experiment 1

matched against Project *B*-choices of JP-REC, where the corresponding principals recommend Project *B* (JP-REC B). Although recommendations are by no means binding it is apparent that agents act on them. In the JP-REC treatment close to 80% select Project *B*, whereas only 41% choose Project *B* without a recommendation. As the number of agents choosing Project *B* is heavily increased compared to treatment JP, it indicates that the negative impact of justification pressure on the value-maximizing project choice is affected. However, there are still some agents selecting Project *A* although *B* was recommended. As mentioned earlier, the obvious reason for this is that justification pressure remains a crucial factor. The differences in individual frequencies of Project *B*-choices between treatments JP and JP-REC B are statistically significant (WMW: $p=0.0000$; RRO: $p=0.0000$). Effect sizes again reach a medium level (Glass's Delta: 0.6343). Thus, Project *B*-recommendations indeed shift project choices towards value-maximizing de-

cisions. Further evidence is provided by the regression outcome presented in Table 2. Project *B*-recommendations clearly outweigh almost all other decision drivers and, thus, affect the agents' decision making to a significant extent.

As Project *B*-choices are heavily increased by Project *B*-recommendations, it appears intuitive that recommendations reduce the impact of justification pressure. For example, consider a situation where an employee reports project results to higher hierarchical levels. Whenever a project fails to reach a predetermined benchmark, the employee's perceived stress from justifying the outcome decreases heavily if the preceding project decision accords with recommendations of the superiors as the recipients of the justification. The crucial point is that the agent's perceived responsibility for the project outcome falls short of the level in a situation where the agent decides without recommendation.

In order to test this more closely, we make use of a measure from a post-experimental questionnaire, which captures the agents' perceived justification pressure. Figure 4 presents a comparison of the average levels of perceived justification pressure in treatments JP and JP-REC. While the bar chart of the JP treatment considers all agents of the treatment, the bar chart of the JP-REC treatment shows average perceived pressure of agents who receive more than five consecutive Project *B*-recommendations.¹⁴

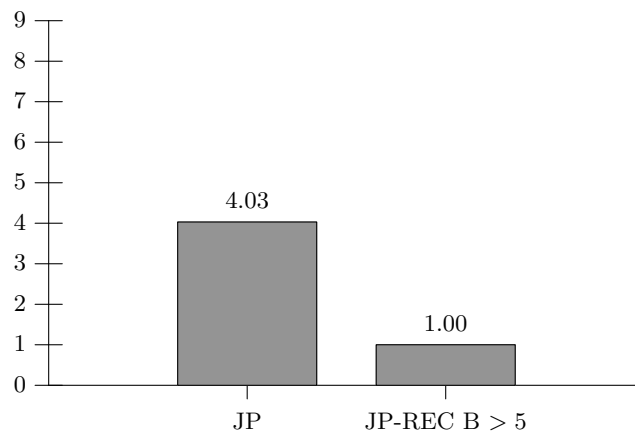


Figure 4: Perceived justification pressure with/without recommendations, Experiment 1

Apparently, an increased frequency of Project *B*-recommendations reduces the perceived justification pressure (WMW: $p=0.0677$; RRO: $p=0.0145$). Therefore, it is a first indica-

¹⁴We expect that the effect of a Project *B*-recommendation is particularly strong if it is given continuously. We thus consider only cases where agents receive recommendations for Project *B* more than five times (JP-REC > 5).

tion that Hypothesis 2b) finds support.

However, another reason for the high compliance could be uncertainty reduction. Since agents are aware of the principals' preferences after the recommendations are communicated, they can make their decisions with "clean conscience". Thus, in order to fully confirm Hypothesis 2b) one has to control for effects of uncertainty reduction. To do so, we conduct another analysis where we regress perceived justification pressure on the frequency of Project *B*-recommendations in the JP-REC treatment. The results are illustrated in Table 3. Recommendations indeed have significant impact on the perception of justification pressure. If the frequency of upfront Project *B*-recommendations is high, the log odds that the agent perceives lower justification pressure are high as well. In addition to that we find some cases in the computer chats where agents almost exactly argue in a way mentioned above ("I only followed your recommendation"). With respect to Hypothesis 2 we are therefore able to summarize the following:

Conclusion 2:

Experimental results support Hypothesis 2a) and 2b), principals' recommendations of Project B reduce justification pressure and increase the likelihood of value-maximizing project choices to a statistically significant extent.

The result is in line with, e.g., Tetlock (1983) and Tetlock et al. (1989) who conclude that conformity is the most efficient coping strategy. People simply adopt the position that is most likely to gain the favor of those to whom they are accountable and they also avoid unnecessary cognitive work (see also Lerner and Tetlock, 1999, p. 256).

Concerning Hypothesis 3 it is evident from Table 2 (variable PercShareB) that the agents' relative payoffs from Project *B* in the good state significantly incentivize them to select Project *B*. Since agents are protected by limited liability this result goes beyond the classical "more pay for more risk" argument. Quite the contrary, it seems to be the case that agents in our experiment show some reluctance to put the principals at risk. This effect, however, is reduced by increasing payoff shares, which mirrors the "money-buys-efficiency result" from Lukas et al. (2019). As regressions in the BL treatment showed significant effects as well, it seems that value-maximizing choices and the "willingness" to inflict potential losses on the principal depend on the agent's profit share even in the

JustPresScore	(1)	(2)	(3)	(4)
FreqRecB	-0.606** (0.306)	-0.860* (0.457)	-1.618*** (0.555)	-2.012** (1.002)
FreqJustReq	-0.831 (1.063)	-1.424 (1.370)	1.420 (1.548)	-4.187* (2.352)
FreqJustReq2	0.171 (0.254)	0.429 (0.347)	-0.270 (0.426)	0.639 (0.482)
FreqJustReq*NoCompl	0.178 (0.717)	-0.048 (0.812)	-0.406 (0.875)	4.279** (1.747)
InequAveLevF		0.320 (0.624)	1.165* (0.703)	-2.119 (1.389)
Age		0.208 (0.230)	0.438* (0.238)	0.057 (0.383)
Male		-0.103 (0.936)	-0.495 (0.987)	-4.227** (1.771)
Semester		-0.085 (0.110)	0.040 (0.107)	-0.384** (0.194)
WillRisk		-0.229 (0.281)	-0.528* (0.319)	-1.368* (0.751)
MaxOwnPay			1.294*** (0.437)	1.903** (0.857)
MaxOtherPay			-0.109 (0.328)	-0.583 (0.728)
Open				0.914** (0.370)
Conscient				0.569 (0.372)
Extraver				-1.898*** (0.578)
Agree				2.903*** (1.089)
Neuro				-1.137* (0.593)

Standard errors in parentheses
 $N = 23$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Ordered logit regressions, JP-REC, Experiment 1

absence of justification pressure and recommendations.¹⁵

Given the regression outcome we conclude as follows:

¹⁵These regression results are also available upon request.

Conclusion 3:

Experimental results give support for Hypothesis 3, a higher profit share for the agent mitigates negative effects of accountability and increases the likelihood of a value-maximizing project choice.

In order to analyze Hypothesis 4, we examine whether the perceived justification pressure is correlated with the number of occasions the agent is held accountable for a bad project outcome. Descriptive statistics in Figure 5 do not provide a very clear picture but indicate

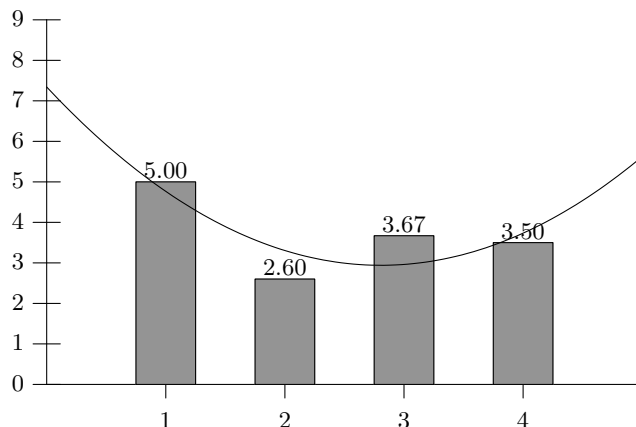


Figure 5: Perceived justification pressure, count of justifications, JP-REC, Experiment 1

that the two opposing effects we presume could exist.¹⁶ Perceived stress is the highest after one justification, it decreases when agents become familiar with the situation, and it increases again when agents are held accountable persistently. Consequently, there could be an u-shaped relationship between perceived justification pressure and the number of justifications that are required (as indicated by the trendline).

To come to a conclusion here we can refer to the regression analysis presented in Table 3. One can see that the number of justifications significantly reduces the perceived justification pressure. However, the regression fails to provide a clear significant effect for the positive influence of “FreqJustReq2” ($p=0.185$), which would have confirmed the u-shaped relation. Nevertheless, the coefficient points in the right direction. Another factor influencing perceived justification pressure significantly proves to be the number

¹⁶Recall that we expected 1) the more often an agent is held accountable for his/her decisions, the more likely it becomes a routine to justify poor results (diminished threat potential of possible justifications in the future); or 2) being held accountable persistently increases justification pressure due to, e.g., reputational concerns.

of justifications where the agent did not comply with the principal’s recommendation (FreqJustReq*NoCompl). Furthermore, male participants felt much less pressure than females. Similarly, participants with a higher willingness to take risks perceived less pressure than the respective counterparts. A strong intention to maximize the own payoff, in turn, leads to more perceived pressure. A possible interpretation of this result could be that the agents feel guilt if they pursue their own goals while ignoring the possible losses the principals are exposed to. It seems reasonable that feelings of guilt increase the stress in the justification process. With respect to Hypothesis 4 we thus conclude:

Conclusion 4:

Perceived justification pressure seems to decrease the more often an agent is held accountable. Regression results provide no significant results for an opposing effect.

Hypothesis 5 raises the question whether the type of accountability (for decisions vs. for outcomes) affects compliance with recommendations. Figure 6 provides descriptive statistics. It is clear to see that compliance rates in Experiment 2, where agents have to

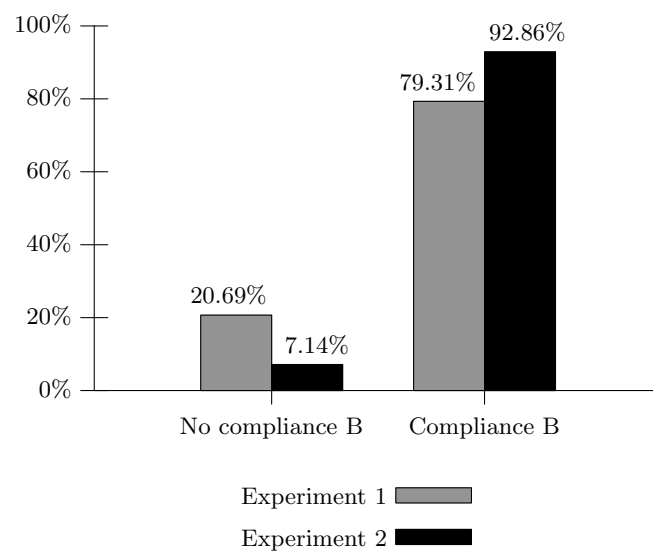


Figure 6: Compliance with Project B-recommendations, JP-REC, both experiments

justify each decision, are higher than compliance rates in Experiment 1, where bad project results have to be justified. As the difference is significant (WMW: p=0.0624), it seems that decision accountability is the more effective way of achieving compliance with respect to innovative/risky investment politics.

However, besides being affected by the type of accountability, compliance rates could

potentially be influenced by other factors. An example might be the respective payoff scheme (see Tables 5 and 6). We know from the results related to Hypothesis 3 that a higher bonus incentivizes agents to select Project *B* more often. Similarly, compliance with a Project *B*-recommendation might increase if the payoff of Project *B* is particularly high. As payoff schemes differ slightly between the two experiments compliance with a Project *B*-recommendation might be affected differently. Other possible influences can be related to the personal characteristics of the participants, which cannot be controlled for in the non-parametric test above. In order to examine possible effects from these factors, we run another regression analysis where the agents' compliance with Project *B*-recommendations is regressed on a selection of variables that (potentially) differ between the experiments.

ComplB	(1)	(2)	(3)	(4)
DecisionAcc	1.958 (1.631)	2.098 (2.005)	2.454 (2.186)	12.502 (9.944)
DeltaDiffBonusB		-0.011 (0.103)	-0.026 (0.111)	-0.523 (0.427)
WillRisk			-0.034 (0.459)	-0.892 (1.143)
InequAveLevF			1.203 (0.961)	1.213 (1.522)
Age			-0.553* (0.298)	-1.648 (1.103)
Male			1.178 (1.033)	1.178 (2.248)
Semester			0.454** (0.205)	1.146 (0.899)
MaxOwnPay				-0.514 (0.503)
MaxOtherPay				2.006 (1.234)
PaySchemVar				-0.043 (0.049)
PartnPaySchemVar				-0.004* (0.003)

Standard errors in parentheses
 $N = 94$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Random effects logit regressions, JP-REC, both experiments

The crucial variable in Table 4 is DecisionAcc, which is a dummy that identifies the agents of Experiment 2, where subjects are held accountable for their decisions. The influence of decision accountability on the compliance with a Project *B*-recommendation shows the

predicted direction; yet the influence only comes close to the conventional level of statistical significance ($p=0.124$). In the sense of Rosnow and Rosenthal (1989), the data gives at least some support for our hypothesis.¹⁷ Furthermore, we control for potentially deviating incentives from the payoff schemes by means of the variable “DeltaDiffBonusB”, which measures the difference between the payoffs of the Project *B*-choices in the respective decision rounds in Experiment 1 and 2. The corresponding coefficient indicates that differences in the compliance rates between Experiment 1 and 2 are not driven by the differences between the payment schemes. Effects on the compliance are found to result only from minor control variables (age, semester, and the variance in the partner’s payoff).¹⁸ Overall, we take the outcome of the non-parametric test and the regressions as an indication that Project *B*-compliance is driven by the type of accountability. Regarding Hypothesis 5 we thus conclude:

Conclusion 5:

Decision accountability leads to a higher compliance with Project B-recommendations than outcome accountability.

Our conclusion is in line with other studies examining differences between outcome accountability and decision accountability. For example, Simonson and Staw (1992) suggest that outcome accountability increases the need for self-justification and, thus, produces greater commitment to a prior course of action than decision accountability does. In our experiment, the agent’s preferred project could be interpreted to correspond to the prior course of action in Simonson and Staw (1992). Then the agent is more likely to stick to his preferred project under outcome accountability than under decision accountability. Stated differently, the agent’s willingness to accept recommendations from the principal is greater under decision accountability - and this is what we find. Similarly, Siegel-Jacobs and Yates (1996) find that outcome accountability increases judgmental inconsistency, which in our experiment can be understood as switching between the options instead of staying with the project choice that leads to the highest expected payoff (Project *B*).

¹⁷“God loves the 0.06 nearly as much as the 0.05” (Rosnow and Rosenthal, 1989, p. 1277).

¹⁸Note, that a regression of the big 5 personality traits was not possible.

5 Summary and conclusion

In this paper we analyze effects of justification pressure on project choices. A justification becomes necessary either when the agent's project choice turns out to generate low profits (outcome accountability) or when a decision is made (decision accountability). Justification pressure is modeled as a psychological cost the agent has to bear. Hypotheses derived from our model find support in the experimental results. Justification pressure reduces the likelihood of value-maximizing investment choices. Higher bonus rates can mitigate this effect to some extent. Recommendations from the principal are also effective in the hypothesized direction. Provided the effect carries over to a management-firm context, it could suggest that communicating preferences, e.g., the owners express their preferred investment strategy, is likely to be effective in directing management's investment decisions. It may partially offset the effect of justification pressure and work in favor of value-maximizing, risk-taking investment strategies. Results in terms of the frequency with which agents are held accountable seem to indicate that perceived justification pressure decreases the more often an agent is held accountable. Yet, the more effective way to reach a high compliance with preferences over risky investments is to implement a stricter reporting regime, i.e., employers should hold employees accountable for each decision, not only for bad outcomes. This, however, raises the question of how decision quality can be evaluated ex post. Finally, one should be aware that compliance with policies is the highest for investment alternatives, which are most profitable from the perspective of the decision maker. As justification pressure is the major driver behind our experimental results, future research could examine its determinants in more depth. For example, incorporating multiple and more sophisticated measures of (perceived) justification pressure in the experiment design would improve the understanding of its psychological perception and possible implications on decision making compliance with recommendations.

Appendix

Pre-experimental questionnaire (Experiment 1 and 2)

We kindly ask you to provide some demographic information:

1. How old are you?
2. Please tell us your gender.
3. What is your field of study? / What is the subject you are enrolled in (e.g. business administration, engineering, etc.)?
4. How many semesters have you studied so far?

Please use the following scale to indicate the reliability of your answers.

Notes (not visible to the subjects):

Answer 1 was used to build the variable “Age”.

Answer 2 was used to build the variable “Male”.

Answer 3 was used to gather information for descriptive statistics.

Answer 4 was used to build the variable “Semester”.

Questionnaire risk attitude (Experiment 1 and 2)

How do you see yourself:

Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?

Please tick a box on the scale, where the value 0 means: ‘risk averse’ and the value 9 means: ‘fully prepared to take risks’. You can use the values in between to make your estimate.

Questionnaire inequality aversion (Experiment 1 and 2)

It is your job to divide an amount of money between two persons. Personally you are not affected by the distribution!

You have three times the chance to choose among two kinds of distributions (either Alternative X or Alternative Y).

Which alternative do you prefer?

Set 1	Alternative X			Alternative Y		
	Share Player 1	Share Player 2	Total Profit	Share Player 1	Share Player 2	Total Profit
	50	50	100	55	65	120
Set 2	Alternative X			Alternative Y		
	Share Player 1	Share Player 2	Total Profit	Share Player 1	Share Player 2	Total Profit
	50	50	100	45	70	115
Set 3	Alternative X			Alternative Y		
	Share Player 1	Share Player 2	Total Profit	Share Player 1	Share Player 2	Total Profit
	50	50	100	35	85	120

Notes (not visible to the subjects):

Construction of an index (F) by means of three dummy variables (V_i). If Alternative X is chosen, then $V_i = 1$

Low Aversion:

$$F = 0: \quad \begin{array}{l} \text{If } V_1 = 0, V_2 = 0 \text{ and } V_3 = 0 \\ \text{If } V_1 = 0, V_2 = 0 \text{ and } V_3 = 1 \end{array}$$

High Aversion:

$$F = 2: \quad \begin{array}{l} \text{If } V_1 = 0, V_2 = 1 \text{ and } V_3 = 1 \\ \text{If } V_1 = 1, V_2 = 1 \text{ and } V_3 = 1 \end{array}$$

Average Aversion:

$$F = 1: \quad \text{All other combinations}$$

The total profit columns are not visible in the experiment

Questionnaire big 5 personality traits (Experiment 1 and 2)

Please use the scale to determine to what extent these statements apply.

1 means: “does not apply to me at all”

7 means: “applies to me perfectly”

With values between 1 and 7, you can express where you lie between these two extremes.

I see myself as someone who...

Dimension:

... is a thorough worker	conscientiousness (+)
... is communicative, talkative	extraversion (+)
... is sometimes somewhat rude to others	agreeableness (-)
... is original, comes up with new ideas	openness (+)
... worries a lot	neuroticism (+)
... is reserved	extraversion (-)
... is able to forgive	agreeableness (+)
... tends to be lazy	conscientiousness (-)
... is outgoing, sociable	extraversion (+)
... values artistic, aesthetic experiences	openness (+)
... gets nervous easily	neuroticism (+)
... does things effectively and efficiently	conscientiousness (+)
... is considerate and kind to others	agreeableness (+)
... has an active imagination	openness (+)
... is relaxed, handles stress well	neuroticism (-)

Notes (not visible to the subjects):

The categorization of questions into dimensions is not visible to the subjects.

Instructions Experiment 1

Welcome to the experiment!

You are participating in an experiment of economic research. Please read the instructions carefully. All participants receive the same instructions. If you have any questions raise your arm to get in touch with the instructor of your session. The experiment is conducted via computer. Please pay attention to the information on your screen.

Before the start of the experiment we kindly ask you to complete some questionnaires and to answer control questions. In order to assure that you understand the rules of the game, the experiment will not start until all control questions have been answered correctly.

The experiment consists of six decision rounds. At the beginning of the session all participants are grouped into pairs by the computer. You are assigned the role of either “Player 1” or “Player 2”. Pairing and role assignment are completely random and never change over the course of the experiment. You are informed about your role on the screen of your computer.

All players are initially endowed with 30 Taler (experimental currency). At the beginning of each decision round both players are informed about the payment schemes of two the alternatives A and B which are available for selection. An example for such payment schemes can be found below:

Alternative A			
State	Total Profit	Share Player 1	Share Player 2
1	5	5	0
2	20	10	10

Alternative B			
State	Total Profit	Share Player 1	Share Player 2
1	0	5	-5
2	40	20	20

The payments for Player 1 and Player 2 depend on the chosen alternative and the state of the world. State 1 occurs with a probability of 50 percent and with a residual probability of 50 percent state 2 occurs. In every decision round Player 1 chooses between the two alternatives A or B.

[*Treatments REC and JP-REC only:* Before that, Player 2 has the possibility to make a recommendation whether Player 1 should choose Alternative A or Alternative B. It is up to Player 1 whether he follows this recommendation or not.]

After Player 1’s decision, the computer determines the state of the world with the specified probabilities. You can identify the individual payoffs (in Taler) for Player 1 and 2 in the corresponding columns in table “Alternative A” if A has been chosen, and in table “Alternative B” if B has been chosen.

[*Treatments JP and JP-REC only:* Whenever Player 2 experiences a loss in a given round, Player 1 has to justify his decision to Player 2. In the example above this would be the case if state 1 realizes after Player 1 chooses Alternative B. The justification process is implemented by means of a chat. An input mask appears on the computer screens in which Player 1 must enter the justification. Player 2 has the option to reply.]

This sequence repeats in the following decision rounds. The profits of Alternative A and Alternative B for Player 1 and Player 2, respectively, may vary from round to round. At the end of each decision round you will receive an overview of the results so far. This means, you are informed about the alternative chosen by Player 1, the state which realized, as well as the corresponding total profit and your own profit (all in Taler).

Your total payoff in Taler at the end of the experiment is the sum of your initial endowment of 30 Taler and the profit in *one* randomly chosen decision round. For this purpose a dice is rolled publicly after the experiment. The total payoff in Taler is converted into Euro at the exchange rate 3 Taler per Euro. You will receive the amount in cash in a sealed envelope earmarked with your seat number.

Notes (not visible to the subjects):

Within a treatment, all players receive the same instructions. Instructions differ between treatments – information in brackets is given in specified treatments only. Participants are called “Player 1” if they are in the role of the agent, and “Player 2” if they are in the role of the principal.

Instructions Experiment 2

Welcome to the experiment!

You are participating in an experiment of economic research. Please read the instructions carefully. All participants receive the same instructions. If you have any questions raise your arm to get in touch with the instructor of your session. The experiment is conducted via computer. Please pay attention to the information on your screen.

Before the start of the experiment we kindly ask you to complete some questionnaires and to answer control questions. In order to assure that you understand the rules of the game, the experiment will not start until all control questions have been answered correctly.

The experiment consists of six decision rounds. At the beginning of the session all participants are grouped into pairs by the computer. You are assigned the role of either “Player 1” or “Player 2”. Pairing and role assignment are completely random and never change over the course of the experiment. You are informed about your role on the screen of your computer.

All players are initially endowed with 25 Taler (experimental currency). At the beginning of each decision round both players are informed about the payment schemes of two the alternatives A and B which are available for selection. An example for such payment schemes can be found below:

Alternative A				Alternative B			
State	Total Profit	Share Player 1	Share Player 2	State	Total Profit	Share Player 1	Share Player 2
1	5	5	0	1	0	5	-5
2	20	10	10	2	40	20	20

The payments for Player 1 and Player 2 depend on the chosen alternative and the state of the world. State 1 occurs with a probability of 50 percent and with a residual probability of 50 percent state 2 occurs. In every decision round Player 1 chooses between the two alternatives A or B.

[*Treatments REC and JP-REC only:* Before that, Player 2 has the possibility to make a recommendation whether Player 1 should choose Alternative A or Alternative B.]

After Player 1’s decision, the computer determines the state of the world with the specified probabilities. You can identify the individual payoffs (in Taler) for Player 1 and 2 in the corresponding columns in table “Alternative A” if A has been chosen, and in table “Alternative B” if B has been chosen.

[*Treatments JP and JP-REC only:* After the computer determined the state of the world, Player 1 has to justify his decision to Player 2. The justification process is implemented by means of a chat. An input mask appears on the computer screens in which Player 1 must enter the justification. Player 2 has the option to reply.]

This sequence repeats in the following decision rounds. The profits of Alternative A and Alternative B for Player 1 and Player 2, respectively, may vary from round to round. At the end of each decision round you will receive an overview of the results so far. This means, you are informed about the alternative chosen by Player 1, the state which realized, as well as the corresponding total profit and your own profit (all in Taler).

Your total payoff in Taler at the end of the experiment is the sum of your initial endowment of 25 Taler and the profit in *one* randomly chosen decision round. For this purpose a dice is rolled publicly after the experiment. The total payoff in Taler is converted into Euro at the exchange rate 2.5 Taler per Euro. You will receive the amount in cash in a sealed envelope earmarked with your seat number.

Notes (not visible to the subjects):

Within a treatment, all players receive the same instructions. Instructions differ between treatments – information in brackets is given in specified treatments only. Participants are called “Player 1” if they are in the role of the agent, and “Player 2” if they are in the role of the principal.

Payoff scheme in Experiment 1

Set 1:	State	Project A			State	Project B		
		Total Profit	Profit Agent	Profit Principal		Total Profit	Profit Agent	Profit Principal
	1	0	0	0	1	-10	0	-10
	2	10	5	5	2	30	6	24

Set 2:	State	Project A			State	Project B		
		Total Profit	Profit Agent	Profit Principal		Total Profit	Profit Agent	Profit Principal
	1	0	0	0	1	-10	0	-10
	2	10	5	5	2	30	9	21

Set 3:	State	Project A			State	Project B		
		Total Profit	Profit Agent	Profit Principal		Total Profit	Profit Agent	Profit Principal
	1	0	0	0	1	-10	0	-10
	2	10	5	5	2	30	12	18

Set 4:	State	Project A			State	Project B		
		Total Profit	Profit Agent	Profit Principal		Total Profit	Profit Agent	Profit Principal
	1	0	0	0	1	-30	0	-30
	2	10	5	5	2	60	12	48

Set 5:	State	Project A			State	Project B		
		Total Profit	Profit Agent	Profit Principal		Total Profit	Profit Agent	Profit Principal
	1	0	0	0	1	-30	0	-30
	2	10	5	5	2	60	18	42

Set 6:	State	Project A			State	Project B		
		Total Profit	Profit Agent	Profit Principal		Total Profit	Profit Agent	Profit Principal
	1	0	0	0	1	-30	0	-30
	2	10	5	5	2	60	24	36

Table 5: Payoff distributions in Experiment 1

Payoff scheme in Experiment 2

Set 1:	State	Project A			State	Project B		
		Total Profit	Profit Agent	Profit Principal		Total Profit	Profit Agent	Profit Principal
	1	5	5	0	1	0	5	-5
	2	15	10	5	2	30	15	15

Set 2:	State	Project A			State	Project B		
		Total Profit	Profit Agent	Profit Principal		Total Profit	Profit Agent	Profit Principal
	1	5	5	0	1	0	10	-10
	2	15	10	5	2	40	20	20

Set 3:	State	Project A			State	Project B		
		Total Profit	Profit Agent	Profit Principal		Total Profit	Profit Agent	Profit Principal
	1	5	5	0	1	0	15	-15
	2	15	10	5	2	50	25	25

Set 4:	State	Project A			State	Project B		
		Total Profit	Profit Agent	Profit Principal		Total Profit	Profit Agent	Profit Principal
	1	5	5	0	1	0	20	-20
	2	15	10	5	2	60	30	30

Set 5:	State	Project A			State	Project B		
		Total Profit	Profit Agent	Profit Principal		Total Profit	Profit Agent	Profit Principal
	1	5	5	0	1	0	25	-25
	2	15	10	5	2	70	35	35

Table 6: Payoff distributions in Experiment 2

Results of Experiment 1

Agents' Choices Frequencies	BL		REC		JP		JP-REC	
	Project A	Project B	Project A	Project B	Project A	Project B	Project A	Project B
Set 1	15 53.57%	13 46.43%	10 35.71%	18 64.29%	21 70.00%	9 30.00%	14 60.87%	9 39.13%
Set 2	13 46.43%	15 53.57%	8 28.57%	20 71.43%	16 53.33%	14 46.67%	9 39.13%	14 60.87%
Set 3	7 25.00%	21 75.00%	6 21.43%	22 78.57%	14 46.67%	16 53.33%	8 34.78%	15 65.22%
Set 4	14 50.00%	14 50.00%	12 42.86%	16 57.14%	19 63.33%	11 36.67%	13 56.52%	10 43.48%
Set 5	11 39.29%	17 60.71%	8 28.57%	20 71.43%	20 66.67%	10 33.33%	15 65.22%	8 34.78%
Set 6	10 35.71%	18 64.29%	11 39.29%	17 60.71%	16 53.33%	14 46.67%	13 56.52%	10 43.48%

Principals' Preferences Frequencies	BL		REC		JP		JP-REC	
	Project A	Project B	Project A	Project B	Project A	Project B	Project A	Project B
Set 1	7 25.00%	21 75.00%	10 33.33%	20 66.67%	12 42.86%	16 57.14%	13 56.52%	10 43.48%
Set 2	12 42.86%	16 57.14%	13 43.33%	17 56.67%	9 32.14%	19 67.86%	10 43.48%	13 56.52%
Set 3	10 35.71%	18 64.29%	14 46.67%	16 53.33%	11 39.29%	17 60.71%	11 47.83%	12 52.17%
Set 4	13 46.43%	15 53.57%	14 46.67%	16 53.33%	21 75.00%	7 25.00%	15 65.22%	8 34.78%
Set 5	17 60.71%	11 39.29%	15 50.00%	15 50.00%	17 60.71%	11 39.29%	14 60.87%	9 39.13%
Set 6	20 71.43%	8 28.57%	15 50.00%	15 50.00%	19 67.86%	9 32.14%	17 73.91%	6 26.09%

In the treatments BL and JP preferences of the principals are gathered without communicating them to agents.

Table 7: Project choices and preferences by round and treatment in Experiment 1

Results of Experiment 2

Agents' Choices Frequencies	BL		JP-REC	
	Project A	Project B	Project A	Project B
Set 1	7 31.82%	15 68.18%	8 38.10%	13 61.90%
Set 2	9 40.49%	13 59.09%	8 38.10%	13 61.90%
Set 3	7 31.82%	15 68.18%	9 42.86%	12 57.14%
Set 4	7 31.82%	15 68.18%	12 57.14%	9 42.86%
Set 5	8 36.36%	14 63.64%	13 61.90%	8 38.10%

Principals' Preferences Frequencies	BL		JP-REC	
	Project A	Project B	Project A	Project B
Set 1	9 40.91%	13 59.09%	11 52.38%	10 47.62%
Set 2	9 40.91%	13 59.09%	13 61.90%	8 38.10%
Set 3	8 25.00%	14 75.00%	10 47.62%	11 52.38%
Set 4	13 59.09%	9 40.91%	15 71.43%	6 28.57%
Set 5	10 39.29%	12 60.71%	14 66.67%	7 33.33%

In treatment BL preferences of the principals are gathered without communicating them to agents.

Table 8: Project choices and preferences by round and treatment in Experiment 2

Post-experimental questionnaire (Experiment 1 and 2)

Please use the scales to indicate how much you think a particular factor influenced your decision making:

1. It was important to me to maximize my own payoff.
2. It was important to me to maximize the payoff of my partner.
3. It mattered to me that the payoffs of my partner and me were as equal as possible.
4. It was important to me that the selection of Alternative B could result in losses for Player 2.

[*Treatments JP and JP-REC only:*

5. It mattered to me that the decision making had to be justified.]

Please use the following scale to indicate the reliability of your answers.

Notes (not visible to the subjects):

Answer 1 was used to build the variable “MaxOwnPay”.

Answer 2 was used to build the variable “MaxOtherPay”.

Answer 3 was used to build an alternative variable for inequality aversion (“InequAveScore”). It served as a comparison for the measure of Fortin et al. (2007).

Answer 5 was used to build the variable “JustPresScore”.

Variables in tests and regressions (Experiment 1 and 2)

Variable	Description
Age	Years of age
Agree	Self assessment score agreeableness SOEP (big 5 personality traits)
Choice	Subject's choice in the current decision round of the experiment (1 = Project A; 2 = Project B)
ChoiceB	Dummy variable = 1 if the agent chooses Project B in a specific decision round of the experiment
Compl	Does the agent follow the recommendation of the principal in the current decision round of the experiment (1 = yes; 0 = no)
ComplA	Does the agent follow a Project A-recommendation of the principal in the current decision round of the experiment? (1 = yes, 0 = no)
ComplB	Does the agent follow a Project B-recommendation of the principal in the current decision round of the experiment? (1 = yes, 0 = no)
Conscient	Self assessment score conscientiousness SOEP (big 5 personality traits)
DecisionAcc	Dummy variable that indicates if the subject is an experiment where decisions have to be justified (1 = decision accountability; 0 = outcome accountability)
DeltaDiffBonusB	Absolute amount to which the expected payoff of alternative B in the respective experiment exceeds the expected payoff of alternative B in the other experiment in a particular decision round (from the perspective of an agent in a particular experiment)
Experiment	Experiment the subject is part of (1 = main study; 2 = additional study)
Extraver	Self assessment score extraversion SOEP (big 5 personality traits)
FreqChoiceB	Frequency with which Project B was chosen (over all decision rounds of the experiment)
FreqJustReq	Frequency with which the agent is required to justify a project choice/project result
FreqJustReq*NoCompl	Frequency the agent is required to justify a project choice/project result after not following the principal's recommendation
FreqJustReq2	Squared frequency the agent is required to justify a project choice/project result

Variables in tests and regressions continued (Experiment 1 and 2)

Variable	Description
FreqRecB	Frequency of Project <i>B</i> being communicated to the agent [team partner] as the preference of the principal
InequAveLevF	Level of inequality aversion indicated by a measure from Fortin et al. (2007)
JustPresDum	Dummy variable = 1 if the agent is in a treatment with justification pressure (JP or JP-REC)
JustPresDum*RecB	Dummy variable = 1 if the agent is in a treatment with justification pressure and the corresponding principal recommends Project <i>B</i> in a specific decision round of the experiment
JustPresScore	Measure for perceived justification pressure in the treatments JP and JP-REC (self assessment score; scale range from 1 to 9)
Male	Dummy variable = 1 if agent = male
MaxOtherPay	Measure which indicates on a 9 point scale to what extent the agent's decision are based on the objective to maximize his/her partners (= principal) payoff
MaxOwnPay	Measure which indicates on a 9 point scale to what extent the agent's decision are based on the objective to maximize his/her own payoff
MeanComplA	Average frequency the agent complies with a Project <i>A</i> -recommendation of the principal
MeanComplB	Average frequency the agent complies with a Project <i>B</i> -recommendation of the principal
Neuro	Self assessment score neuroticism SOEP (big 5 personality traits)
Open	Self assessment score openness SOEP (big 5 personality traits)
OutcomeAcc	Dummy variable that indicates if the subject is an experiment where outcomes have to be justified (1 = outcome accountability; 0 = decision accountability)
PartnPaySchemVar	Variance of the principal's (= partner's) payoff scheme of Project <i>B</i> in the current decision round of the experiment
PaySchemVar	Variance of the agent's payoff scheme of Project <i>B</i> in the current decision round of the experiment
PercShareB	Agent's percentage share in Taler (experimental currency) if s/he chooses Project <i>B</i> and state 2 realizes
RecB	Dummy variable = 1 if the principal recommends Project <i>B</i> in a specific decision round of the experiment
Round	Decision round of the experiment
Semester	Current length of study measure in semesters
Subject	Role of the subject (1 = agent; 2 = principal)
Treatment	Treatment the subject is part of (1 = BL; 2 = JP; 3 = REC; 4 = JP-REC))
WillRisk	Risk attitude (willingness to take risks) measured by a 9 point scale where 0 is risk averse

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Essay III

Title

Earnings management during family firm succession:
an analytical perspective on the influence of socioemotional wealth

Co-authors:

Nicola Bethmann, Tim Dominik Hensel

Earnings management during family firm succession: an analytical perspective on the influence of socioemotional wealth

Abstract

In order to provide an analytical explanation for earnings management in family firms prior to a succession, we study a two-period agency setting in which a founder can invest in the future capital stock and may engage in earnings management. We examine two succession scenarios which differ in terms of who lead the firm in the second period. To capture dynastic and altruistic motives of the founder, we incorporate the behavioral concept of socioemotional wealth (SEW). Our model shows that SEW creates manipulation incentives. We find that the founder engages in both accrual-based and real earnings management in order to reduce inheritance tax payments for the offspring. We show how the successor's productivity, inheritance taxation, and internal monitoring influence the founder's choice between a family-member and an external manager as the future CEO.

Keywords:

Agency; earnings management; family firm succession; inheritance taxation; socioemotional wealth

JEL-Classification:

D91, G34, M12, M41

1 Introduction

There is considerable evidence that family firms make up a significant proportion of the total number of companies, the employed workforce, and the total value added (e.g., GDP). For example, La Porta et al. (1999) build a global sample out of 27 of the richest countries (in terms of market capitalization) and find that 50 percent of the firms within the sample are family-controlled. Similarly, in Western Europe about 44 percent of all firms are family-owned (Faccio and Lang, 2002) and in the US S&P 500 founding families are present in one-third of all firms, controlling over 18 percent of the shares on average (Anderson and Reeb, 2003). Given these proportions and the corresponding economic influence, it is worth to examine if decision making in family organizations differs in comparison to publicly held firms.

One particularly interesting field for analyses are turnover procedures. As these processes are often accompanied by policy revisions and restructurings, it is one of the greatest challenges for corporations to manage changes in ownership and control. This is especially true for family firms, where the implementation of such a process is also associated with additional family-related motivations. For this reason the inter-generational turnover in family-owned companies is one of the most often addressed issues in family business research. Several studies provide insights on how a family firm's inter-generational turnover is influenced by, e.g., inheritance taxation (Tsoutsoura, 2015), abilities of family members (Lee et al., 2003), or non-financial goals (Minichilli et al., 2014). The effects of these family-related aspects is widespread: examples are succession-related performance differences (Cucculelli and Micucci, 2008) or investment decisions and R&D activities (e.g., Block, 2012; Chrisman and Patel, 2012).¹ Following Gómez-Mejía et al. (2007), these family-related and non-monetary motivations can be aggregated to the concept *socioemotional wealth* (SEW). This concept argues that family members evaluate economic aspects with regard to their influence on the own socioemotional endowment, i.e., additional utility might come from belonging to the firm (Kepner, 1983), from continuing a dynasty (Kets de Vries, 1993), or from altruistic behaviors within the family (Schulze et al., 2003).²

¹ More detailed views on the idiosyncrasy of family firms can be found in Handler (1994).

² There are several other factors influencing SEW (see, e.g., Westhead et al., 2001; Habbershon and Pistrui, 2002).

Another argument for addressing succession in family firms is, that managerial turnover and the transition of ownership pose a high risk of misconduct. During a succession period opportunities to alter the own utility are expanded for the person in charge. Common practices are the manipulation of reports or diverging preceding/subsequent investment decisions, which can be summarized under the term *earnings management*. The field of earnings management is extensively analyzed in the accounting literature, but earnings management during a turnover in family firms has been less examined.³ For example, there is no analytical research on earnings management in family firms, as far as we are aware. Moreover, empirical work studying manipulation activities concentrate either on whether reporting practices of family firms are of lower or higher quality compared to non-family firms (Jaggi et al., 2009), or on the question whether founding families use their power at the expense of minority interests (Yang, 2010). There are only few empirical studies analyzing how earnings management behavior is affected by SEW (e.g., Stockmans et al., 2010) and there is apparently no literature addressing earnings management in family firms with respect to successions. Finally, the majority of the empirical literature on earnings management in family firms focuses predominately on accrual-based earnings management,⁴ which is mainly driven by short-term considerations.⁵ However, given the dynastic thoughts of long-term sustainability in family firms,⁶ it appears reasonable to examine long-term investment decisions of family companies and to investigate if there are practices affecting the firm value, that deviate from the economically optimal level, namely real earnings management activities.

Thus, the objective of this paper is to examine patterns of earnings management in family firms during the transition of ownership and control. By considering two different

³ Reviews to the state of research concerning earnings management in family firms can be found in Gómez-Mejía et al. (2014), Paiva et al. (2016), and Carrera (2017).

⁴ *Accrual-based earnings management* describes practices, where reporting methods are chosen in a way that they do not adequately reflect the firm's underlying economics. These activities have no direct cash flow consequences, instead they only change how transactions are recorded. *Real earnings management* in turn describes practices, which actually influence the firm's value, i.e., it changes the timing or structuring of real transactions (see Ewert and Wagenhofer, 2012).

⁵ To our knowledge, Achleitner et al. (2014), Razzaque et al. (2016), Tian et al. (2018), and Avabruth and Saravanan (2018) are the only exceptions differentiating between real and accrual-based earnings management.

⁶ There is a consensus view that family firms attempt to ensure inter-generational sustainability, see Berrone et al. (2012).

succession scenarios, we aim at providing theoretical evidence on how family-related socioemotional wealth, inheritance taxation and internal monitoring influence manipulation activities. The main questions to be answered by this paper are the following:

1. How do incentives for earnings management, right before a succession takes place, change in two different succession scenarios, namely family-internal succession and recruitment of an external manager?
2. How is earnings management affected by SEW?
3. How is the decision whether to hire an external manager to run the firm related to SEW, inheritance taxation, and the productivity of potential successors?

We develop a two-period agency model to compare two succession scenarios.⁷ The setting considers an owner-lead family firm where a SEW-sensitive principal/predecessor interacts with different agents/successors.⁸ For reasons of simplicity, we assume that all players are risk neutral and that they provide effort in the periods where they are in charge (the principal in the first period, the respective agent/successor in the second period). Additionally, it is the senior's task in the first period to make a decision about the succession scenario, i.e., she has to choose whether the junior or an external manager runs the firm. In terms of real earnings management, our focus is set on activities before the succession takes place. Thus, only the senior can invest in the capital stock which determines the long-term value of the firm. Accrual-based earnings management shifts earnings between periods and can be undertaken by all players.

We find that earnings management incentives are induced by SEW and inheritance taxation. In the internal succession scenario, where the junior obtains the senior's firm shares and assumes the management of the company, our analysis shows that the senior reduces the first-period accounting income by means of an earnings shift. This accrual manipulation is driven by the utility the senior gains from SEW. Since the junior has to pay inheritance taxes based on the first-period accounting income, it becomes important for

⁷ Insights on bequest games with an infinite horizon and inter-generational altruism can be found in, e.g., Leininger (1986), Bernheim and Ray (1987), Balbus et al. (2015).

⁸ We denote the predecessor (she) "senior". The successor (he) is either the "junior" or an "external manager".

the senior to lower the taxation basis in favor of the junior. Because it is costly and has no further benefit, the junior does not engage in accrual-based earnings management in period two. Regarding real earnings management, we find that, dependent on tax rate and SEW, the senior's activities either exceed (overinvestment) or are below the economically optimal level (underinvestment). Our results also show that the senior's investment in the firm increases whenever the junior possesses a high productivity and decreases if the junior is less productive. In the external scenario, the senior decides to hire an external manager to run the operational business after the company is inherited to the junior. While the junior aims to improve the economic earnings, the external manager chooses actions in order to increase his compensation, which leads to agency costs. Similar to the internal succession scenario, we find that accrual manipulation shifts earnings from the first into the second period. In terms of real earnings management, the senior's activities depend on inheritance taxation and SEW but also on the monitoring costs of the external manager. Compared to an internal succession, an overinvestment by the senior is less likely.

With our paper we contribute to the analytical earnings management literature. As indicated earlier, this literature is quite extensive and provides various evidence on causes and effects.⁹ However, most of these studies investigate either accrual manipulation or real earnings management.¹⁰ We, in turn, consider both types of activities and are thus able to formulate a suggestion on how the two types might be related. Moreover, a large part of the accounting literature considers contractual/agency settings where opportunistic earnings management arises due to managerial hidden action (moral hazard). This kind of motivation is also partly considered in our model. However, our main focus is set on earnings management incentives driven by socioemotional concerns. Therefore, we add a behavioral explanation to the question of how family firms might engage in earnings management during changes of ownership and control.

The rest of the paper is structured as follows: Section 2 introduces the analytical model, Section 3 analyzes two scenarios of succession, Section 4 compares the internal succession with the external scenario, and Section 5 concludes.

⁹ Common examples for earnings management relate to, e.g., incentive contract design (Dutta and Fan, 2014), capital market reactions (Fischer and Verrecchia, 2000), or career concerns (Nieken and Sliwka, 2015).

¹⁰ A notable exception is Ewert and Wagenhofer (2005).

2 Model setup

We consider a game-theoretical setting consisting of two periods and three risk-neutral players: the senior (s), her junior (j), and an available external manager (m).¹¹ In the first period, the senior exclusively holds all firm shares and manages the firm. At the end of period one, she transfers her shares to the junior. Whether the junior runs the firm as the CEO or controls the management as a member of the board, is determined by the senior's succession plan. This succession decision about the future management is chosen by the senior at the beginning of the game. Figure 1 displays the two different succession scenarios: We assume that, following the firm succession, the ownership remains

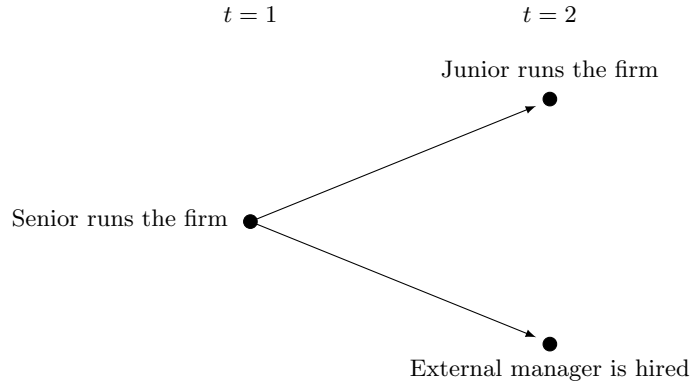


Figure 1: Succession scenarios

in the family. Here, a distinction is made between cases in which the junior takes over full responsibility for the company and cases where the operating business is delegated to an external manager.¹²

Economic earnings

True economic earnings at the end of the periods are given by:

$$x_1 = -d_{1,s} + K(d_0) (\delta_s e_{1,s} + \tilde{\theta}_1), \quad (1)$$

$$x_2 = K(d_{1,s}) (\delta_i e_{2,i} + \tilde{\theta}_2), \quad (2)$$

¹¹In the following, time is indicated by the subscript $t = (1, 2)$. Whenever one of the three players comes into play he/she is identified by a second subscript $i = (s, j, m)$.

¹²We also consider the possibility that the senior runs the company in both periods. However, this scenario only serves as our benchmark solution (see Section 3.1), which is not depicted in Figure 1.

with $X = x_1 + x_2$ being the terminal value of the firm. First-period earnings contain the capital stock $K(d_0) = k_0$, which is a positive constant that specifies the initial firm size. Similar to Bhattacharya and Ravikumar (2001), the capital stock is fully consumed after one period. Since the first period describes the situation before the succession takes place, the senior is the only possible decision maker. With her effort $e_{1,s}$ and her productivity δ_s , she manages the initial capital stock. Productivity and effort are substitutes, i.e., a low productivity can be balanced by a higher effort such that it is still possible to reach the same result. In the following, we assume that the productivity of the senior and the external manager is the same, i.e., $\delta_s = \delta_m = 1$. In turn, the junior's productivity is equal or below their productivity such that $\delta_j \in \{\frac{1}{2}, 1\}$. We make this assumption in order to capture differences in experience and to analyze how these differences interact with socioemotional concerns and the succession decision.¹³

Investment $d_{1,s}$ lowers current earnings but defines the size of the future capital stock. Correspondingly, the capital stock of period two is modeled as an increasing (concave) function of the previous investment $K(d_{1,s}) = \sqrt{d_{1,s}}$.¹⁴ Together with effort $e_{2,i}$ and productivity δ_i of the respective decision maker, it determines economic earnings of the second period. The economic earnings x_t are also affected by economic risk. The periodical economic risk $\tilde{\theta}_t$ is an independent and identically distributed random variable with $\tilde{\theta}_t \sim N(1, \sigma_{\tilde{\theta}}^2)$. The strength of the risk's impact on the economic earnings depends on the size of the capital stock.¹⁵

Accounting signals and inheritance taxation

At the end of each period, the current CEO has to disclose an accounting report which is based on the underlying economic earnings. The reported accounting signals are defined as follows:¹⁶

¹³This assumption corresponds to some empirical findings. For example, Cucculelli and Micucci (2008) show that the firm performance following a succession increases if an external manager becomes CEO. Bertoni et al. (2016) analyze internal successions and find a lower performance after the transition of control.

¹⁴To simplify the model, we exclude investment decisions in the second period.

¹⁵Keep in mind that capital stock $K(d_t)$ is multiplicatively linked to economic risk θ_t .

¹⁶Note, that the clean surplus principle does not hold in our model because we only consider two periods, i.e., the period right before and right after the succession. To make the clean surplus principle hold further future/past periods would have to be taken into account in order to balance accounting earnings.

$$y_1 = x_1 + b_{1,s} + \tilde{\epsilon}_1, \quad (3)$$

$$y_2 = x_2 - b_{1,s} + b_{2,i} + \tilde{\epsilon}_2, \quad (4)$$

where $\tilde{\epsilon}_t \sim N(0, \sigma_{\tilde{\epsilon}}^2)$ is again an independent and identically distributed random variable that represents accounting noise, which is uncorrelated to the economic risk $\tilde{\theta}_t$. Since the person in charge has discretion over the reported numbers, he/she is able to bias the accounting earnings, e.g., by using judgments in a principle-based accounting system. We assume that a bias in the current period reverses its effect in the following period. Consequently, $b_{1,s}$ is added (subtracted) in period one and subtracted (added) in period two. The same holds for the second-period bias $b_{2,i}$, however, due to the time horizon of our model, we do not illustrate its reversal in a third period. As underlying economic earnings are not affected by these shifting activities, this can be interpreted as accrual-based or accounting earnings management.

In our model, the accounting signals are used for two different purposes: for contracting with non-family managers and as a base for inheritance taxation. Economic earnings are not observable and, thus, not a reliable performance measure for contracting purposes. Therefore, an incentive contract must be based on publicly available accounting numbers.¹⁷ Furthermore, because of the transfer of firm shares between generations, inheritance taxation must be considered. In the context of a family firm succession, the inheritance taxation might have a strong influence on business decisions. Given by local law, inheritance tax has often to be paid by the person who is taking over the firm. For inheritance tax purposes, corresponding assets are valued at their open market value at the transfer date (see, e.g., Great Britain's Inheritance Tax Act, Part IV, Chapter I, Sections 160-170 or Germany's §11 and §12 ErbStG, as well as §§199-203 BewG). By these regulations, the accounting signals of the past 3 years serve as an indicator for the market value. For simplification, we consider a one-book accounting system (i.e., accounting signals are also used for taxation purposes) and assume that the first-period signal serves as the assessment base of the inheritance tax that results from the transfer of the firm shares.

¹⁷The use of accounting reports for the purpose of compensation is only relevant in the external scenario in Section 3.3.

In our model, the total tax liability amounts to $h \cdot y_1$ where h denotes the inheritance tax rate. In order to exclude implausible solutions, the range of the tax rate is $h \in [0, \frac{1}{2}]$.¹⁸

The players' utility functions

Independently of the respective succession scenario, the senior's utility function (where $i = s$) possesses the following structure:

$$U_s = x_1 - c_{1,s} + \underbrace{\Psi}_{SEW} U_j. \quad (5)$$

In both succession scenarios, the senior receives the economic earnings x_1 . However, her utility does not only depend on values coming from the first period where she is actively involved in the ongoing business. In addition, she receives utility from the second period, or more precisely, from SEW. In our model we consider two socioemotional aspects: Firstly, there is an effect which results from the dynastic character of the family firm. Here, socioemotional wealth increases in exercising personal authority, preserving a family dynasty (Gómez-Mejía et al., 2007), or ensuring transgenerational control (Zellweger et al., 2012). We label this as *dynastic SEW* and assume that the senior's utility is positively affected if firm's owner- and leadership remains in the family. Secondly, family members are also concerned about the welfare of relatives and show altruistic behavior towards each other (Schulze et al., 2003; Zahra and Sharma, 2004). Therefore, the future utility of the junior also generates positive value for the senior, which we label *altruistic SEW*. In our model both aspects are captured by $\Psi \in (0, 1]$.¹⁹ Furthermore, the senior suffers disutility as a result of her effort and possible manipulation activities in period one: $c_{1,s} = \frac{1}{2}(e_{1,s}^2 + \frac{b_{1,s}^2}{K(d_0)^2})$. The disutility for accrual-based earnings management depends on the size of the firm, i.e., the capital stock. Since a larger firm leads to higher complexity, it offers more possibilities for earnings management and makes it also more difficult for an external auditor to identify these manipulations.

¹⁸For simplicity, we only consider inheritance taxation. Effects coming from income taxes do not change our primary findings and, thus, are not subject of our work.

¹⁹Note that we do not cover a scenario where the firm is sold. In this case there would be no utility from SEW ($\Psi = 0$).

The utility function of the junior ($i = j$) depends on whether he manages and owns the firm or just owns the firm in the second period. This is depicted in the paths of Figure 1.

Thus, we have:

$$U_j = x_2 - hy_1 - \begin{cases} c_{2,j} & \text{if the junior runs the firm,} \\ w & \text{if the junior hires a manager.} \end{cases} \quad (6)$$

In both scenarios, the junior obtains the economic value x_2 and must pay the inheritance tax. However, in the first case, the junior also bears disutility $c_{2,j} = \frac{1}{2}(e_{2,j}^2 + \frac{b_{2,j}^2}{K(d_{1,s})^2})$ from running the firm. As before for the senior, the disutility comes from exerted effort and from manipulation activities.

In the second case, managing tasks are delegated and the junior has to pay the wage to an external manager. The corresponding contract is based on the accounting income of the second period such that $w = f + v \cdot y_2$ where f denotes the fixed salary and v denotes the incentive rate.

Finally, the utility function of the external manager ($i = m$) is given by:

$$U_m = w - c_{2,m}. \quad (7)$$

Recall that the manager's productivity is the same as for the senior, $\delta_m = 1$. However, in contrast to junior and senior, an additional parameter λ enters U_m such that $c_{2,m} = \frac{1}{2}(e_{2,m}^2 + \lambda \frac{b_{2,m}^2}{K(d_{1,s})^2})$. With the exogenous parameter λ , we take into account that manipulations of an owner-manager are only limited by external controls (e.g., external audit or accounting standards), whereas biasing activities of a non-family CEO might also be subject to internal controls (e.g., board monitoring), which makes manipulation activities for an external more costly.²⁰ This is expressed by $\lambda > 1$. The manager's reservation wage is set to zero without loss of generality.

²⁰We assume that manipulation costs of an external manager are strictly higher than costs of an owner-manager, who is not affected by internal controls.

Timeline

The following timeline summarizes the sequence of the player's actions:

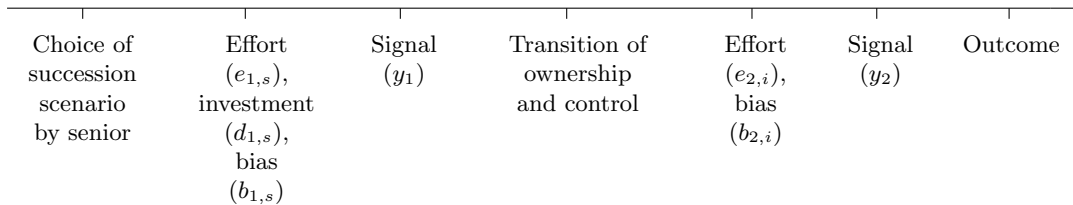


Figure 2: Timeline of events

3 Earnings management during firm succession

3.1 Benchmark solution

We start with the development of a benchmark solution where no transfer of firm shares takes place. Here, the senior stays for both periods in the firm where neither her actions nor her utility are affected by a succession. Thus, we are subsequently able to identify deviations from economically optimal behavior as a result of the different succession scenarios. While staying for two periods, the senior's objective is to optimize the total firm value. She simultaneously chooses optimal levels of effort and accrual-based earnings management for both periods and determines the optimal investment size in period one. We obtain the following optimization problem:

$$\begin{aligned}
 \max_{e_{1,s}, e_{2,s}, b_{1,s}, b_{2,s}, d_{1,s}} E[U_s] &= E[X - (c_{1,s} + c_{2,s})] \\
 &= E\left[-d_{1,s} + k_0(e_{1,s} + \tilde{\theta}_1) + \sqrt{d_{1,s}}(e_{2,s} + \tilde{\theta}_2) \right. \\
 &\quad \left. - \frac{1}{2}\left(e_{1,s}^2 + \frac{b_{1,s}^2}{k_0^2} + e_{2,s}^2 + \frac{b_{2,s}^2}{d_{1,s}}\right)\right]. \tag{8}
 \end{aligned}$$

The solution of the problem is presented in Lemma 1.

Lemma 1 *The benchmark levels of effort, investment and accrual-based earnings management are given by:*

$$e_{1,s}^B = k_0, \quad (9)$$

$$e_{2,s}^B = \sqrt{d_{1,s}^B}, \quad (10)$$

$$b_{1,s}^B = 0, \quad (11)$$

$$b_{2,s}^B = 0, \quad (12)$$

$$d_{1,s}^B = 1. \quad (13)$$

Proof: See the Appendix. ■

The results show positive efforts in both periods, whereas accrual-based earnings management does not take place. The reason for the latter is that the bias has no effect on underlying earnings but generates personnel costs. The investment level $d_{1,s}^B$ equals one and, in the following, we interpret deviations from this level, that are not driven by differences in the productivity, as real earnings management.²¹ Thus, whenever an investment level is above (under) the benchmark case (e.g., due to SEW considerations), the manager undertakes positive (negative) real earnings management.

3.2 Internal family succession

We now assume that the firm is owned and controlled by family members across generations. Thus, the senior allocates property rights and management tasks of the second period to the junior. In comparison to the benchmark solution, it is now the junior who runs the company in the second period. He benefits from the capital stock, which results from the senior's investment in the first period, but also has to bear disutility for the exerted effort and biasing activity in period two as well as for inheritance taxes coming from the inter-generational transfer of ownership.

²¹All *benchmark* levels are denoted with the superscript B .

To determine the optimal actions of the sub-game perfect equilibrium, we use backward induction. Thus, we first solve for the optimal levels of effort and accrual-based earnings management of the junior in the second period. Afterwards, we analyze the first period where the senior anticipates the actions of her junior, when deciding about the size of the investment, the level of effort, and the extent of earnings management. Given the junior's decisions in period two, the senior's optimization problem can be expressed by:²²

$$\max_{e_{1,s}, d_{1,s}, b_{1,s}} E[U_s(e_{2,j}^F, b_{2,j}^F)] = E[x_1 - c_{1,s} + \Psi U_j(e_{2,j}^F, b_{2,j}^F)]. \quad (14)$$

The corresponding solution to the problem is presented in Lemma 2.

Lemma 2 *Assume that the junior obtains the firm shares and manages the firm, then the optimal actions of junior and senior are given by:*

$$e_{2,j}^F = \delta_j \sqrt{d_{1,s}^F}, \quad (15)$$

$$b_{2,j}^F = 0, \quad (16)$$

$$e_{1,s}^F = k_0 (1 - \Psi h), \quad (17)$$

$$d_{1,s}^F = \frac{\Psi^2}{(2 - \Psi (2h + \delta_j^2))^2}, \quad (18)$$

$$b_{1,s}^F = -h \Psi k_0^2. \quad (19)$$

Proof: See the Appendix. ■

Apparently, the junior's effort of period two depends on the senior's investment in the previous period, as well as on his productivity $\delta_j = \{\frac{1}{2}, 1\}$. Another result is, that the senior's effort level is below the benchmark ($e_{1,s}^F < e_{1,s}^B$). This is caused by SEW Ψ , which tempts the senior to lower the effort the more she is interested in the junior's utility. The seemingly counter-intuitive result can be explained by the inheritance tax, which has to be paid by the junior. He pays inheritance taxes according to the company's accounting earnings of the first period. Therefore, by lowering her effort, the senior reduces the

²²Note that optimal levels of effort and earnings management in the *family* succession scenario are marked with the superscript F .

junior's tax base, which in turn increases both the junior's utility and (via Ψ) the senior's utility. This indirect effect of altruistic SEW on the senior's effort is accompanied by a negative direct effect of the tax rate, which is why tax rate h and SEW Ψ are substitutes. Regarding the level of investment, we find that it is also determined by SEW. However, the influence of Ψ on $d_{1,s}^F$ is ambiguous: Firstly, there is a *growth effect* coming from the capital stock. As returns are realized in the next period, a higher investment of the senior increases the capital stock of the junior. A higher capital stock in period two leads also to a higher effort of the junior and, consequently, an additional increase in the equilibrium surplus of the junior.²³ To which extent the junior is able to generate earnings from the capital stock through his effort, strongly depends on his productivity. Consequently, it is also the junior's productivity that influences the senior's investment decision via Ψ : the more productive the junior, the higher the investment level.²⁴ The second effect is again the *tax effect*. Following the argumentation from above, the senior can relieve the junior from the tax liability by lowering the tax base y_1 with her investment $d_{1,s}$. Bringing these results together, the core insight of the investment and effort choice is, that the senior renounces a part of her financial outcome x_1 in order to improve the junior's wealth.

The effects of different parameters on the senior's investment behavior is summarized in the following result.

Result 1 *Assume that $h \in [0, \frac{1}{2})$ and that the junior obtains the firm shares and manages the firm in the second period. Then the senior's first-period investment increases in*

1. *the senior's level of SEW Ψ ,*
2. *the junior's level of productivity δ_j ,*
3. *the inheritance tax rate h .*

Proof: See the Appendix. ■

²³Remember that $\tilde{\theta}_2$ has an expected value of one. Thus, the junior's expected returns without any effort are given by $\sqrt{d_{1,s}^F}$.

²⁴In our model, the future capital stock is implicitly determined by the productivity of the junior. A similar relation is found by Lucas (1978). He shows that the optimal firm size depends on exogenous talent or expertise of the manager (see also Aron, 1988).

Summarizing the earnings management behavior in the internal succession scenario, we can state that the junior does not engage in manipulation activities (see Equation (16)). The senior, in turn, undertakes earnings management as described in Result 2.

Result 2 *Assume that the junior manages the firm in period two. Then*

1. *the senior shifts earnings from the first into the second period,*
2. *the senior's investment behavior, in the context of real earnings management, critically depends on the senior's SEW and on the inheritance tax rate. Whenever the senior's altruism is sufficiently high (low), $\Psi > \hat{\Psi} = \frac{1}{h+1}$ ($\Psi < \hat{\Psi}$), the investment $d_{1,s}^F$ exceeds (is below) the benchmark $d_{1,s}^B$.*

Proof: See the Appendix. ■

The first part of the result shows that the senior undertakes accrual-based earnings management (see Equation (19)). She shifts earnings from period one into period two where the true underlying earnings remain unaffected. Thus, y_1 and thereupon, the inheritance tax base is lowered.

Even though this biasing activity leads to personnel costs, and we know from the benchmark that the senior is not interested in accounting signals but only in economic earnings, she does so in favor for the junior. Thus, accrual-based earnings management is considerably influenced by SEW. More precisely, the senior attempts to increase her utility via the junior's utility, i.e., besides lowering her effort ($e_{1,s}^F < e_{1,s}^B$) as stated in Lemma 2, she uses accrual-based earnings management to increase the junior's utility and ultimately, the own utility. Intuitively, the bias increases in the inheritance tax rate, $\frac{\partial b_{1,s}^F}{\partial h} > 0$, to offset a higher tax payment.

From a real manipulation perspective, the question whether an over- or underinvestment occurs again critically depends on the senior's level of SEW, which is shown in the second part of Result 2. If she is strongly interested in the utility of the junior, an investment above the benchmark occurs. Since investment creates an immediate loss in period one, the senior is only willing to overinvest if her interest for the junior is high enough ($\Psi > \hat{\Psi}$). Here, the high investment has again two utility increasing effects: the growth and the tax effect.

A similar finding is documented by Achleitner et al. (2014), who suggest that, driven by SEW, family businesses are less likely to engage in value-decreasing underinvestment practices. However, we also find that there is a reversed case, where the senior invests less than optimal in order to cut costs in the first period, as current utility has a higher impact on her total utility ($\Psi < \widehat{\Psi}$). Note, that the critical value for an over- or underinvestment itself depends on the inheritance tax rate $\left(\frac{1}{h+1}\right)$. Therefore, it is more likely to observe underinvestment when the tax rate decreases. Thus, we predict that an overinvestment is less likely in countries with a low inheritance tax rate or where selling firm shares is not relevant for inheritance taxation.

3.3 Succession with an external manager

An essential advantage of family firms comes from low agency costs because of the consolidation of ownership and management. However, it is not always the case that a junior takes over the ownership and the operating business, e.g., when children are not interested in managing the firm. Operational tasks are then often delegated to external managers, which changes the situation into a classical principal-agent setting, where agency costs arise because of the possibility of opportunistic behavior (moral hazard). In this chapter, we take a closer look at the separation of ownership and control in family firms following a succession. Thus, we assume that an external manager is hired in period two and analyze how actions in both periods are affected.

Second-period compensation contract

Applying backward induction, we start again by analyzing the actions of the second period. In our model, agency costs occur for two reasons. Firstly, a lower than optimal effort level of the manager decreases the residual outcome of the junior, x_2 . Secondly, the manager might engage in accrual-based earnings management in order to increase his compensation w . Both, effort and manipulation activities, are not observable for the junior. For this reason, the linear contract w also contains the incentive rate v besides the fixed payment f . Since earnings after the succession x_2 are not observable and, therefore, not available for contracting purposes, the junior has to use the accounting signal y_2 as performance

measure for the contract: $w = f + v \cdot y_2$.²⁵ The manager in turn privately observes earnings x_2 and has discretion over the reported numbers, which is a leeway to manipulate the accounting earnings in his favor. However, recall that the manipulation cost is higher for the external manager than for the internal manager ($\lambda > 1$). The optimal contract solves the following problem of the junior:

$$\max_{f,v} E[x_2 - h y_1 - w] \quad (20)$$

subject to

$$E[U_m] \geq 0, \quad (21)$$

$$(e_{2,m}, b_{2,m}) \in \underset{e'_{2,m}, b'_{2,m}}{\operatorname{argmax}} E[U_m(e'_{2,m}, b'_{2,m})]. \quad (22)$$

The junior maximizes the expected firm value net of managerial compensation, subject to two constraints. The first constraint ensures the participation of the manager and the second is the incentive constraint for the manager's second-period actions. The solution to the problem is presented in Lemma 3.²⁶

Lemma 3 *The optimal incentive rate and the corresponding actions of the manager in the second period are given by:*

$$e_{2,m}^E = \frac{\lambda \sqrt{d_{1,s}^E}}{\lambda + 1}, \quad (23)$$

$$b_{2,m}^E = \frac{d_{1,s}^E}{\lambda + 1}, \quad (24)$$

$$v^E = \frac{\lambda}{\lambda + 1}. \quad (25)$$

Proof: See the Appendix. ■

Since we consider a risk-neutral setting, the incentive rate is not affected by risk sharing

²⁵From an agency viewpoint, it would be optimal for the junior to lease the firm to the agent in a risk-neutral setting. Then the manager would gain the second-period economic earnings and would give a fixed payment to the junior. However, since true economic earnings cannot be used for contractual purposes and the performance measure y_2 is not congruent to the true economic earnings, agency costs arise even when players are risk neutral.

²⁶Results in the *external* succession scenario are symbolized by the superscript E .

considerations and the size of the firm. Even though v^E motivates the manager to work, it also creates incentives to manipulate earnings. The extent to which the manipulation occurs depends on the monitoring intensity λ , as comparative statics show: $\frac{\partial v^E}{\partial \lambda} > 0$. The first-best effort level can only be reached if $\lim_{\lambda \rightarrow \infty} v^E = 1$. In this case, monitoring eliminates agency costs. However, in any other case, the contract cannot duplicate the benchmark solution.

First-period reporting

Anticipating the reaction of the external manager, the senior chooses her optimal actions in period one. These are stated in the next lemma.

Lemma 4 *If an external manager is hired in the second period, optimal actions of the senior in the first period are given by:*

$$d_{1,s}^E = \frac{(\lambda + 1)^2 \Psi^2}{(\Psi(\lambda + 2h(\lambda + 1)) - 2\lambda - 2)^2}, \quad (26)$$

$$e_{1,s}^E = k_0(1 - \Psi h), \quad (27)$$

$$b_{1,s}^E = -h \Psi k_0^2. \quad (28)$$

Proof: See the Appendix. ■

Even though agency costs arise, the senior still invests in future growth. By working on the capital stock and providing effort, which positively depends on the investment, the manager increases firm value. The internal monitoring technology makes it less attractive for the manager to manipulate earnings and, thus, limits the agency costs. In equilibrium, a stronger monitoring technology λ in period two leads to a higher first-period investment of the senior.²⁷ The question whether the investment exceeds the extent in the benchmark solution is answered in the next result.

²⁷See the Appendix: proof of Lemma 4.

Result 3 *Assume that the senior's succession plan requires that the junior has the chairmanship of the supervisory board and an external CEO must be hired. Then the following observations can be documented:*

1. *The senior's accrual-based earnings management equals the level of the internal scenario.*
2. *The senior's investment level is positively affected by monitoring technology λ .*
3. *Real earnings management: senior's investment level is always lower compared to the internal scenario. If $\Psi > \check{\Psi} = \frac{\lambda+1}{\lambda(h+1)+h+\frac{1}{2}}$ ($\Psi < \check{\Psi}$), the investment d_1^E exceeds (is below) the benchmark.*

Proof: See the Appendix. ■

Similar to the internal succession setting, the senior's actions are SEW-driven. She uses accrual-based earnings management to shift earnings into the second period in order to avoid a high taxation for her junior. Thus, manipulation incentives do not depend on whether an internal or external management runs the firm. The question remains if the senior's accrual-based earnings management, which increases the manager's contractual base y_2 , has an effect on the manager's payoff. The answer can be found by taking a look at the fixed payment. As the participation constraint is binding, it holds that $\frac{\partial f^E}{\partial b_{1,s}^E} < 0$. Thus, the junior takes the accrual management of the senior into account and lowers the fixed payment in order to balance out the higher variable payment.

Regarding the investment volume, the extent of deviation from the benchmark solution depends on the SEW of the senior and on the agency costs. Note that, as opposed to the internal succession scenario, there is accrual earnings management in the second period of the external succession scenario ($b_{2,m}^E > 0$), since the manager attempts to increase his incentive payment. Therefore, second-period accrual management is strictly higher if a non-family member is CEO, which is in line with empirical studies. For example, Yang (2010) shows that non-family CEOs exhibit a stronger tendency to manipulate accruals than family CEOs do. Similar to our findings, it is argued that it is more necessary for firms with external CEOs to monitor them and to motivate them using incentive compensation based on accounting earnings than it is for firms employing family CEOs, who reject costly

manipulation practices.²⁸

The last part of Result 3 shows that real earnings management of the senior again depends on her SEW: There is a critical value $\check{\Psi}$, which determines whether first-period over- or underinvestment occurs. Moreover, in comparison to the internal scenario, a higher degree of altruism of the senior is needed for an overinvestment in the first period. Since an external manager leads to agency costs, which in turn provide lower investment incentives to the senior, $\check{\Psi}$ exceeds $\hat{\Psi}$.²⁹

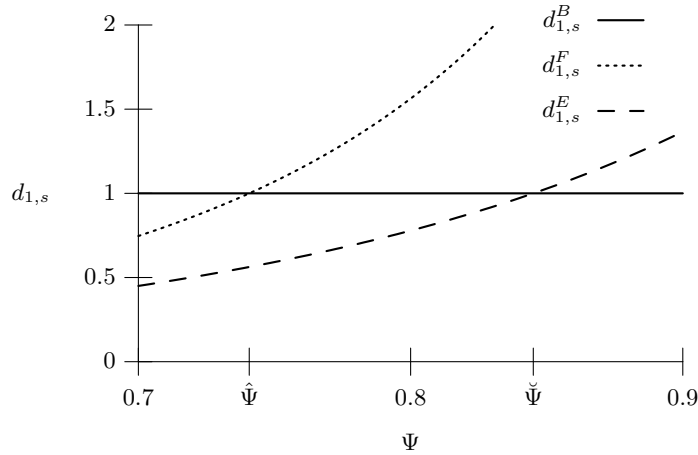


Figure 3: Investment levels of different scenarios (parameters: $h = 0.35$, $\lambda = 2$)

Figure 3 illustrates the investment levels of the different succession scenarios as functions of SEW Ψ . It demonstrates the effect of the critical values of SEW on the real earnings management behavior. If $\Psi < \hat{\Psi}$, the senior's investment is below the benchmark level in both scenarios. In contrast, independent of the succession scenario, the senior always overinvests if $\Psi > \check{\Psi}$. Although real activity manipulations differ from each other with respect to their absolute levels, the manipulation strategy is identical. Only in the area between $\hat{\Psi}$ and $\check{\Psi}$ the real earnings management strategies are different. While the senior will overinvest if her offspring leads the firm, the investment is strictly below the benchmark

²⁸In addition, Ferramosca and Allegrini (2018) show that the extent of accrual-based earnings management activities depends on the involvement of family members in executive positions.

²⁹Note that we define real earnings management activities as decisions, which are driven by SEW-considerations. Decisions, that are solely based on differences in the productivities of the second-period players (without any consideration of *behavioral* aspects), are investment decisions. Therefore, in order to determine real earning management practices of the senior, the productivities of all other players are set equal one. The influence of a lower productivity of the junior ($\delta_j < \delta_m$) on investment is investigated in Section 4.

in the case of an external manager. Consequently, if the firm's leadership remains within the family, an overinvestment is more likely.

4 Senior's succession decision: internal vs. external

In this section, we identify conditions under which the senior prefers a succession scenario, where an external manager is hired in period two even though an interested internal successor is available. The previous chapters show that the senior adjusts her actions dependent on the succession scenario. However, recall that the senior has authority over the succession, i.e., she can implement whatever succession scenario she prefers. As an example, she could establish in the firm's articles of association that only external managers can have the executive rights, whereas next-generation family members are solely permitted to assume duties/responsibilities in the firm's advisory board.

To study whether the senior prefers a family-member or an external agent as CEO of the second period, we compare the senior's equilibrium expected utility in both scenarios: $\Delta = E[U_s^F] - E[U_s^E]$.³⁰ We find that effects of most parameters are clear and intuitive. For example, improving monitoring (λ increases) makes it more complicated for external managers to engage in manipulation activities and, thus, reduces agency costs.³¹ Correspondingly, hiring an external manager becomes more advantageous, i.e., the senior's utility $E[U_s^E]$ increases. In contrast, a higher productivity of the junior makes an internal succession more beneficial.³² For $\delta_j = 1$, the senior chooses the internal succession since the junior does not cause any moral hazard problem and provides the same productivity. However, in case of a less productive junior (i.e., $\delta_j = \frac{1}{2}$), the question whether the junior becomes CEO depends on the agency costs caused by an external manager. If these costs are sufficiently high, it can be advantageous for the senior to choose a less productive junior to run the firm. Similarly, a low-productivity junior could also take over the job as CEO if the additional utility of keeping the management within the family (via dynastic utility from Ψ) is significantly high. It is straightforward that an increase of both (δ_j, Ψ)

³⁰Note that the difference is expressed in absolute values. Thus, it can take positive and negative values.

³¹See Section 3.3 for a closer analysis of the agency costs.

³²Recall that there are always capable managers available on the market. These external agents provide a productivity of $\delta_m = 1$, whereas the junior's productivity equals $\delta_j \in \{\frac{1}{2}, 1\}$.

reduces the advantage of hiring an external professional.

Regarding the inheritance tax rate h , we find that its impact on the senior's succession decision is less intuitive. Result 4 summarizes the effects.³³

Result 4 *Assume a sufficiently high degree of SEW of the senior ($\Psi = 1$) and a low productive junior ($\delta_j = \frac{1}{2}$), a higher inheritance tax rate influences the senior's succession decision in favor of the external manager, i.e., $\frac{\partial \Delta}{\partial h} < 0$.*

Proof: See the Appendix. ■

We are able to identify three effects coming from an increase in the taxation rate h . The first effect evokes a decrease of Δ , which results from the taxes' influence on the investment level: Initially, a higher tax rate leads to a higher investment of the senior in order to lower the junior's inheritance taxation base. This is driven by SEW, which means $d_{1,s}$ increases particularly strong for high values of Ψ . The increased capital stock then provides higher expected second-period earnings $K(d_{1,s})(\delta_i e_{2,i} + 1)$. Since the effort positively depends on the investment, the optimal second-period effort level increases, which additionally leads to higher earnings. This reaction takes place in both scenarios (internal and external). However, due to the lower productivity of the junior ($\delta_j = \frac{1}{2} < \delta_m$), the effort level in the external scenario is strictly higher. Consequently, an earnings difference between the scenarios increases in the investment $d_{1,s}$ and makes hiring an external agent more beneficial. For reasons of tractability, we call this process "earnings effect". Secondly, a higher tax rate h directly increases the future tax burden. Because of the high $d_{1,s}^E$ and the corresponding lower tax base y_1^E , Δ decreases in h , which we denote as the "tax burden effect". The third effect is that a higher tax rate leads to higher agency costs. This is again caused by the increased capital stock, which makes accrual-based manipulation by an external more attractive ($\frac{\partial b_{2,m}^E}{\partial d_{1,s}} > 0$) and, due to the larger size of the company, more difficult to prevent. As agency costs arise, the senior's expected utility $E[U_s^E]$ decreases, and an increase of Δ follows. This may be called "agency effect".

It becomes clear that the decision whether to implement an internal or an external suc-

³³Note that the condition $0 \leq h < \frac{1}{2}$ must be fulfilled. However, the condition $\Psi = 1$ is not necessary. The effect of Result 4, i.e., the influence of the tax rate on the senior's succession decision, holds also for lower values of Ψ (see the Appendix).

cession depends on the interplay between the tax rate with various other factors. For the assumptions named in Result 4, we find that, in equilibrium, the “earnings effect” and the “tax burden effect” dominate the “agency effect”, i.e., a higher tax rate makes hiring a non-family CEO more beneficial.

As a consequence, we would predict that internal successions are more preferred in countries where inheritance taxation is low and agency costs (e.g., because of low corporate governance standards) are high. A similar result is documented by Tsoutsoura (2015). She considers family firm sales and family-internal successions, and shows that a higher inheritance taxation makes the latter scenario less likely. Although, we do not consider the possibility of a liquidation of the firm in this model, her findings still do correspond to our result: if we assumed a sufficiently high level of h , the expected surplus of both succession scenarios ($E[U_s^F]$ and $E[U_s^E]$) would become negative, making the firm’s liquidation a more beneficial option.

5 Conclusion

We develop a two-period agency model to examine earnings management practices of a family firm at the time of change in ownership and control. By considering two succession scenarios, we are able to suggest explanations for differences in investment and earnings management behaviors of family firms.

We show that earnings management strongly depends on the succession scenario which is implemented by the person who is in charge prior to the succession. If the firm shares are transferred within the family, accrual-based earnings management of the preceding owner leads to an earnings shift from the first into the second period. This is driven by SEW considerations which aim to reduce the inheritance taxation of a successor from the family. Regarding real earnings management, incentives for manipulations arise again through SEW. We find that activities critically depend on the degree of altruism. A significantly high (low) SEW leads to a first-period investment in the capital stock which is above (below) the economic optimal level. If a successor from the family does not run the operational business of the firm and instead hires an external manager, earnings management activities are also affected by agency costs. A further insight from our model is that the inheritance tax rate can affect the founder’s decision regarding the succession

scenario. We show that an increase in the inheritance tax rate makes hiring an external manager in the second period more beneficial compared to the situation where the firm is led by a family member. Our results show that SEW facilitates inter-generational thinking and, thus, extends the time horizon of decision-makers. Consequently, we find a positive influence of SEW on long-term investments.

Our model is able to provide detailed explanations for some empirical patterns regarding earnings management in family firms during a succession. We suggest that succession decisions, earnings management activities, investment behaviors and performance differences of family firms are largely explained by simple contractual and socioemotional considerations of the families involved in the businesses. In particular, we identify inheritance taxation, agency costs, as well as altruistic and dynastic SEW as the main drivers of the results. Nevertheless, we believe that future analytical research can generate more precise results that allow predictions beyond the ones we propose. Moreover, as the emphasis of previous studies is mainly set on empirical methods, we are convinced that accounting behaviors and succession decisions of family firms should be examined in more controlled environments.

Appendix

Proof of Lemma 1

In the benchmark solution, the senior does not leave or assigns the firm and is only interested in the firm value. Since she stays for two periods, she chooses her actions in order to maximize the sum over both periods. The senior's ex ante utility is given by:

$$E[U_s] = -d_{1,s} + k_0(\delta_s e_{1,s} + 1) + K(d_{1,s})(\delta_s e_{2,s} + 1) - \frac{1}{2} \left(e_{1,s}^2 + \frac{b_{1,s}^2}{k_0^2} + e_{2,s}^2 + \frac{b_{2,s}^2}{K(d_{1,s})^2} \right).$$

Differentiating above with respect to $e_{1,s}$, $e_{2,s}$, $d_{1,s}$, $b_{1,s}$ and $b_{2,s}$ leads to the following first-order conditions:

$$\begin{aligned} \frac{\partial E[U_s]}{\partial e_{1,s}} = 0 &\iff -e_{1,s} + k_0 \delta_s = 0, \\ \frac{\partial E[U_s]}{\partial e_{2,s}} = 0 &\iff -e_{2,s} + \sqrt{d_{1,s}} \delta_s = 0, \\ \frac{\partial E[U_s]}{\partial d_{1,s}} = 0 &\iff -1 + \frac{\delta_s e_{2,s} + 1}{2\sqrt{d_{1,s}}} + \frac{b_{2,s}^2}{2d_{1,s}^2} = 0, \\ \frac{\partial E[U_s]}{\partial b_{1,s}} = 0 &\iff -\frac{b_{1,s}}{k_0^2} = 0, \\ \frac{\partial E[U_s]}{\partial b_{2,s}} = 0 &\iff -\frac{b_{2,s}}{d_{1,s}} = 0. \end{aligned}$$

Solving the equation system for $e_{1,s}$, $e_{2,s}$, $d_{1,s}$, $b_{1,s}$ and $b_{2,s}$, under the assumption of $\delta_s = 1$, the solutions are represented by equations (9), (10), (11), (12) and (13). Inserting these values in the Hessian matrix of the objective function H gives

$$H^B(e_{1,s}^B, e_{2,s}^B, b_{1,s}^B, b_{2,s}^B, d_{1,s}^B) = \begin{bmatrix} -1 & 0 & 0 & 0 & 1/2 \\ 0 & -1 & 0 & 0 & 0 \\ 0 & 0 & -k_0^{-2} & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 \\ 1/2 & 0 & 0 & 0 & -1/2 \end{bmatrix}.$$

Since $k_0 > 0$, $H^B(\cdot)$ is negative definite and, thus, the derived solution is a maximum.

Proof of Lemma 2

In contrast to the benchmark, in the internal scenario the senior is also interested in the junior's utility. We obtain the first-period actions by solving the junior's problem in the second period (backward induction): The junior's ex ante utility in period two is given by:

$$E[U_j] = \sqrt{d_{1,s}}(\delta_j e_{2,j} + 1) - h \cdot (-d_{1,s} + k_0(\delta_s e_{1,s} + 1) + b_{1,s}) - \frac{e_{2,j}^2}{2} - \frac{b_{2,j}^2}{2d_{1,s}}.$$

Differentiating the expected utility with respect to $e_{2,j}$ and $b_{2,j}$, and solving the first-order conditions yield:

$$\begin{aligned} \frac{\partial E[U_j]}{\partial e_{2,j}} = 0 &\iff e_{2,j}^F = \delta_j \sqrt{d_{1,s}}, \\ \frac{\partial E[U_j]}{\partial b_{2,j}} = 0 &\iff b_{2,j}^F = 0. \end{aligned}$$

The senior's expected utility is given by:

$$\begin{aligned} E[U_s^F] &= -d_{1,s} + k_0(\delta_s e_{1,s} + 1) - \frac{e_{1,s}^2}{2} - \frac{b_{1,s}^2}{2k_0^2} + \Psi \left(\sqrt{d_{1,s}}(\delta_j e_{2,j} + 1) \right) \\ &+ \Psi \left(-h \cdot (-d_{1,s} + k_0(\delta_s e_{1,s} + \tilde{\theta}_1) + b_{1,s}) - \frac{e_{2,j}^2}{2} - \frac{b_{2,j}^2}{2d_{1,s}} \right). \end{aligned} \quad (\text{A.1})$$

Inserting $e_{2,j}^F$ and $b_{2,j}^F$, and differentiating with respect to $e_{1,s}$, $d_{1,s}$ and $b_{1,s}$ lead to:

$$\begin{aligned} \frac{\partial E[U_s^F]}{\partial e_{1,s}} = 0 &\iff -\Psi k_0 \delta_s h + k_0 \delta_s - e_{1,s} = 0, \\ \frac{\partial E[U_s^F]}{\partial d_{1,s}} = 0 &\iff -1 + \Psi \left(\frac{\sqrt{d_{1,s}} \delta_j^2 + 1}{2\sqrt{d_{1,s}}} + h \right) = 0, \\ \frac{\partial E[U_s^F]}{\partial b_{1,s}} = 0 &\iff -\frac{b_{1,s}}{k_0^2} - \Psi h = 0. \end{aligned}$$

Solving the linear equation system for $e_{1,s}$, $b_{1,s}$ and $d_{1,s}$, and given $\delta_s = 1$, the solutions are represented by equations (17), (19) and (18).

Since $\delta_j \in \{\frac{1}{2}, 1\}$, $\Psi \in [0, 1]$, $h \in [0, \frac{1}{2})$ and $k_0 > 0$, the Hessian matrix $H^F(\cdot)$ of the objective function is negative definite and, thus, the derived solution is a maximum.

Proof of Result 1

To proof the influence of different parameters on the investment level, note that the conditions $\delta_j \in \{\frac{1}{2}, 1\}$, $\Psi \in [0, 1]$ and $h \in [0, \frac{1}{2})$ hold:

1. Differentiating (18) with respect to Ψ and simplifying yield:

$$\frac{\partial d_{1,s}^F}{\partial \Psi} = - \frac{4\Psi}{\left(\Psi \delta_j^2 + 2\Psi h - 2\right)^3} > 0.$$

The investment increases in Ψ .

2. Differentiating (18) with respect to h and simplifying yield:

$$\frac{\partial d_{1,s}^F}{\partial h} = - \frac{4\Psi^3}{\left(\Psi \delta_j^2 + 2\Psi h - 2\right)^3} > 0.$$

The investment increases in h .

3. Differentiating (18) with respect to δ_j and simplifying yield:

$$\frac{\partial d_{1,s}^F}{\partial \delta_j} = - \frac{4\Psi^3 \delta_j}{\left(\Psi \delta_j^2 + 2\Psi h - 2\right)^3} > 0.$$

In our model, we assume that $\delta_j \in \{\frac{1}{2}, 1\}$. Thus, the investment is strictly higher if $\delta_j = 1$.

Proof of Result 2

1. To investigate accrual-based management behavior, we consider the sign of $b_{1,s}^F$. Since $\Psi \in [0, 1]$ and $h \in [0, \frac{1}{2})$, equation (19) is always negative and, thus, the senior shifts earnings from the first to the second period in equilibrium.

2. To study real earnings management, we consider the difference between the investment levels in the benchmark and the internal succession scenario. Recall that, in order to determine real earnings management, the productivity of the player may not be considered (see footnote 30 on page 21). To eliminate productivity effects, we set δ_s and δ_j to one.

Using (13) and (18), we obtain:

$$d_{1,s}^B - d_{1,s}^F = \frac{4(\Psi h - 1)(\Psi h + \Psi - 1)}{(2\Psi h + \Psi - 2)^2}.$$

Solving $d_{1,s}^B - d_{1,s}^F = 0$ for Ψ yields:

$$\widehat{\Psi} = \frac{1}{h+1}.$$

Since $h \in [0, \frac{1}{2}]$, $\widehat{\Psi} \in (\frac{2}{3}, 1]$. Thus, an overinvestment takes place if $\Psi > \widehat{\Psi}$. Otherwise, if $\Psi < \widehat{\Psi}$, the senior's investment level is lower compared to the benchmark.

Proof of Lemma 3

To obtain the optimal incentive contract of period two, we must consider the optimal action levels of the external manager. Differentiating (7) with respect to $e_{2,m}$ and $b_{2,m}$, and solving the first-order conditions yield:

$$\begin{aligned} \frac{\partial E[U_m^E]}{\partial e_{2,m}} = 0 &\iff e_{2,m}^E = v^E \delta_m \sqrt{d_{1,s}^E}, \\ \frac{\partial E[U_m^E]}{\partial b_{2,m}} = 0 &\iff b_{2,m}^E = \frac{v^E d_{1,s}^E}{\lambda}. \end{aligned}$$

In program (20), the participation constraint is binding at the optimum: $E[U_m] = 0$. By substituting from that constraint into the objective function, the junior's utility can be written as:

$$E[U_j] = \sqrt{d_{1,s}}(\delta_m e_{2,m} + 1) - h \cdot (-d_{1,s} + k_0(\delta_s e_{1,s} + 1) + b_{1,s}) - \frac{e_{2,m}^2}{2} - \frac{\lambda b_{2,m}^2}{2 d_{1,s}}. \quad (\text{A.2})$$

Inserting the incentive constraint for $e_{2,m}$ and $b_{2,m}$ into the junior's objective function leads to:

$$\sqrt{d_{1,s}} + v \delta_m^2 d_{1,s} - h \cdot (-d_{1,s} + k_0(\delta_s e_{1,s} + 1) + b_{1,s}) - \frac{v^2 \delta_m^2 d_{1,s}}{2} - \frac{v^2 d_{1,s}}{2 \lambda}.$$

From the first-order condition for the optimal v , we obtain the equilibrium incentive rate:

$$v^E = \frac{\lambda}{\lambda + 1}.$$

The corresponding manipulation activity of the external manager is then given by:

$$b_{2,m}^E = \frac{\lambda \sqrt{d_{1,s}^E}}{\lambda + 1}.$$

Inserting v^E , $b_{2,m}^E$, and $e_{2,m}^E$ in the expected managers utility $E[U_m]$, which is given by Equation (7), and simplifying yield:

$$f^E = \frac{1}{2} \frac{\lambda \left(2\sqrt{d_{1,s}^E} - 2b_{1,s}^E + d_{1,s}^E \right)}{\lambda + 1}.$$

In equilibrium, an increase of the senior's bias $b_{1,s}^E$ reduces the fixed payment of the external manager: $\frac{\partial f^E}{\partial b_{1,s}^E} < 0$.

Proof of Lemma 4

The solutions of the optimal actions of the senior in a succession setting with an external manager correspond to the procedure explained in detail above for Lemma 2. Therefore, the proof is omitted.

Next, we study the effect of a stronger internal monitoring on senior's investment. Differentiation (26) in respect to λ gives:

$$\frac{\partial d_{1,s}^E}{\partial \lambda} = - \frac{(\lambda + 1) \Psi^3}{4 \left(\left(-1 + \left(h + \frac{1}{2} \right) \Psi \right) \lambda + \Psi h - 1 \right)^3} > 0.$$

Since $h \in [0, \frac{1}{2})$ and $\Psi \in [0, 1]$, $\frac{\partial d_{1,s}^E}{\partial \lambda}$ is strictly positive.

Proof of Result 3

1. Accounting earnings management: See Proof of Result 2.
2. To study real earnings management, we consider the difference between the investment levels of the benchmark and the external succession scenario. Again recall, that effects from the productivities of the players are not considered in order to determine earnings

management. Using (13) and (26), we obtain:

$$d_{1,s}^B - d_{1,s}^E = 1 - \frac{(\lambda + 1)^2 \Psi^2}{(2(\Psi)\lambda h + (\Psi)\lambda + 2(\Psi)h - 2\lambda - 2)^2}.$$

Solving $d_{1,s}^B - d_{1,s}^E = 0$ for Ψ yields:

$$\check{\Psi} = \frac{\lambda + 1}{\lambda(h + 1) + h + \frac{1}{2}},$$

$$\bar{\Psi} = \frac{\lambda + 1}{\lambda h + h - \frac{1}{2}}.$$

The critical value $\check{\Psi}$ is always between 0 and 1. Thus, an overinvestment takes place if $\Psi > \check{\Psi}$. Otherwise, if $\Psi < \check{\Psi}$, the senior's investment level is lower compared to the benchmark. In contrast, the second critical value $\bar{\Psi}$ takes no value which fulfills the condition $\Psi \in [0, 1]$.

Comparing the critical values of Ψ of the internal and external scenario gives:

$$\hat{\Psi} - \check{\Psi} = - \frac{0.5}{(1 + h)(\lambda(h + 1) + h + 0.5)} < 0.$$

This shows that the critical value of altruism in the external setting is strictly higher. Therefore, an underinvestment is more likely if an external manager runs the firm in period two.

Proof of Result 4

(1) Senior's succession decision if the junior's ability is low

For the optimal decision of the senior between an internal and external scenario with a low ability of the junior, we distinguish two cases of monitoring. For simplification, a high degree of SEW ($\Psi = 1$) is assumed. Inserting $e_{1,s}^F, b_{1,s}^F, e_{2,j}^F, b_{2,j}^F$ and $d_{1,s}^F$ in the senior's utility $E[U_s]$ which is given by (A.1), and we obtain the equilibrium surplus $E[U_s^F]$ of the internal succession scenario. To derive the equilibrium surplus of the external succession scenario, we must consider the modified objective function of the junior which is given by (A.2). Inserting $e_{1,s}^E, b_{1,s}^E, e_{2,m}^E, b_{2,m}^E, v^E, f^E$ and $d_{1,s}^E$ into the senior's utility $E[U_s]$, we obtain $E[U_s^E]$. The senior's utility between the internal and the external succession

scenario is given by

$$E[U_s^F] - E[U_s^E] = \Delta. \quad (\text{A.3})$$

- (i) Assume a scenario with a low productive junior ($\delta_j = 0.5$) and low monitoring ($\lambda = 1$). Then, the difference between the senior's utility between the internal and the external succession scenario is characterized by:

$$\begin{aligned} \Delta = & \frac{8h(h - \frac{1}{2})(h - \frac{7}{8})^2 k_0^2 - 4h(h - \frac{7}{8})}{(2h - 1.75)^2} - \sqrt{(4h - 3)^{-2}} \left(2\sqrt{(4h - 3)^{-2}} + 2 \right) \\ & - \frac{32 \left(\frac{1}{8} + (h - \frac{3}{4})^2 (h - \frac{1}{2}) k_0^2 - \frac{1}{2} (h - \frac{3}{4})^2 k_0 \right) h - 5}{(4h - 3)^2} \\ & + \sqrt{(2h - 1.75)^{-2}}. \end{aligned}$$

Differentiating the above with respect to h and simplifying yield:

$$\begin{aligned} \frac{\partial \Delta}{\partial h} = & \frac{\frac{32}{\sqrt{(2h-1.75)^2}} \left(- (h - \frac{3}{4}) \left(-\frac{13}{16} + h \right) (h - \frac{7}{8}) \sqrt{(4h - 3)^{-2}} + 2 (h - \frac{7}{8})^3 \right)}{\sqrt{(4h - 3)^{-2}} \sqrt{(2h - 1.75)^{-2}} (2h - 1.75)^3 (4h - 3)^3} \\ & + \frac{32 \left(-4 (h - \frac{3}{4})^3 \sqrt{(4h - 3)^{-2}} \right)}{\sqrt{(4h - 3)^{-2}} \sqrt{(2h - 1.75)^{-2}} (2h - 1.75)^3 (4h - 3)^3}. \end{aligned}$$

Since $h \in (0, 0.5]$, $\frac{\partial \Delta}{\partial h}$ is strictly negative. In this scenario, a higher inheritance tax rate makes hiring of an external manager more beneficial.

- (ii) Assume a scenario with a low productive junior ($\delta_j = 0.5$) and a high monitoring ($\lambda = 2$). Then, the difference between the senior's utility in the internal and the external succession scenario is characterized by:

$$\begin{aligned} \Delta = & \frac{\left(8h(h - \frac{1}{2})(h - \frac{7}{8})^2 k_0^2 - 4h(h - \frac{7}{8})^2 k_0 + h - \frac{7}{8} \right)}{(2h - 1.75)^2} + \sqrt{(2h - 1.75)^{-2}} \\ & + 3(3h - 2)^{-2} - 2 \left(3\sqrt{(6h - 4)^{-2}} + \frac{2}{3} \right) \sqrt{(6h - 4)^{-2}} \\ & - \frac{18h \left(\frac{1}{8} + (h - \frac{1}{2})(h - \frac{2}{3})^2 k_0^2 - \frac{1}{2} (h - \frac{2}{3})^2 k_0 \right)}{(3h - 2)^2}. \end{aligned}$$

Differentiating above with respect to h and simplifying yield:

$$\begin{aligned} \frac{\partial \Delta}{\partial h} = & - \frac{22.5 \left(h - \frac{3277057}{4915586} \right) \left(h - \frac{102295}{132707} \right) \left(h - \frac{1225405}{1400463} \right)}{\left(2h - \frac{7}{4} \right)^3 \left(3h - 2 \right)^3} \\ & + \frac{18 \left(h^2 - \frac{97205h}{55576} + \frac{1577}{2062} \right) \left(h - \frac{24341}{27788} \right)}{\sqrt{(6h - 4)^{-2} \left(2h - \frac{7}{4} \right)^3 \left(3h - 2 \right)^3}} \\ & + 6 \frac{-9h^3 + 18h^2 - 12h + 8/3}{\sqrt{\left(2h - \frac{7}{4} \right)^{-2} \left(2h - \frac{7}{4} \right)^3 \left(3h - 2 \right)^3}}. \end{aligned}$$

Since $h \in (0, 0.5]$, $\frac{\partial \Delta}{\partial h}$ is strictly negative. Therefore, a higher tax rate makes hiring an external manager more beneficial.

In Result 4, we study the influence of the inheritance tax rate on the senior's succession decision. Above, we consider the extreme case of $\Psi = 1$. However, the same influence of the tax rate can be obtained if we relax this condition. Therefore, we now assume $\Psi = \frac{1}{2}$:

- (iii) Assume a scenario with a low productive junior ($\delta_j = 0.5$), low monitoring ($\lambda = 1$) and a lower value for SEW ($\Psi = 0.5$). Inserting these values in (A.3) and differentiating the expression with respect to h yield:

$$\begin{aligned} \frac{\partial \Delta}{\partial h} = & - \frac{(h - 1.749987) (h - 1.81256) (h - 1.8749865)}{32 (h - 1.875)^3 (h - 1.75)^3} \\ & + \frac{(h - 1.8761) (h^2 - 3.7489h + 3.5136)}{4 \sqrt{(h - 1.75)^{-2} (h - 1.875)^3 (h - 1.75)^3}} \\ & - \frac{1}{4 \sqrt{(h - 1.875)^{-2} (h - 1.875)^3}}. \end{aligned}$$

As in (i), it holds that $\frac{\partial \Delta}{\partial h}$ is strictly negative since $h \in [0, \frac{1}{2})$.

- (iv) Assume a low productive junior ($\delta_j = 0.5$), low SEW ($\Psi = 0.5$) and a stronger monitoring ($\lambda = 2$), substitution and differentiation yield:

$$\begin{aligned} \frac{\partial \Delta}{\partial h} = & - \frac{45 (h - 1.6666) (h - 1.7708) (h - 1.874999)}{256 (h - 1.875)^3 (1.5h - 2.5)^3} \\ & - \frac{3 (9h - 14.9921) (h^2 - 3.3342h + 2.7792)}{32 \sqrt{(h - 1.875)^{-2} (h - 1.875)^3 (1.5h - 2.5)^3}} \\ & + \frac{18 (h - 1.87708) (h^2 - 3.7479h + 3.5117)}{32 \sqrt{(1.5h - 2.5)^{-2} (h - 1.875)^3 (1.5h - 2.5)^3}}. \end{aligned}$$

Similar to (ii), it also holds that $\frac{\partial \Delta}{\partial h}$ is strictly negative since $h \in [0, \frac{1}{2})$.

In all scenarios mentioned above and in presence of a low productive junior, comparative statics have the same effect. Therefore, a higher tax rate makes hiring an external manager more attractive. This finding also holds for lower values of Ψ (i.e., $\Psi = 1$).

(2) Senior's succession decision if the junior's ability is high

In case of a junior with a high ability, he is equally productive as an external manager. Since hiring an external is linked to agency costs, the senior will always decide that his junior should run the firm. To show this analytically we use (A.3) and assume $\delta_j = 1$ and $\lambda = 2$:

$$\Delta = -1296 \frac{\left(h - \frac{2}{3}\right)^3 (h - 0.5)^3 \left(\left(-h^2 + \frac{7}{6}h - \frac{1}{3}\right) \sqrt{(2h - 1)^{-2} + \frac{1}{24}}\right)}{(3h - 2)^4 (2h - 1)^4} - 1296 \frac{\left(h - \frac{2}{3}\right)^3 (h - 0.5)^3 \left(0.5 \sqrt{(6h - 4)^{-2} (6h^2 - 7h + 2)}\right)}{(3h - 2)^4 (2h - 1)^4}.$$

Since $h \in [0, \frac{1}{2})$, the equation above is strictly positive and, therefore, a family-member CEO is always preferred.

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Essay IV

Title

A model on subjective performance evaluations and reciprocal agents

A model on subjective performance evaluations and reciprocal agents

Abstract

A common phenomenon in subjective performance evaluations is the leniency bias. This work uses an agency model to examine the determinants of the bias and the economic consequences for the firm. It is shown that the anticipation of reciprocally acting employees leads superiors to intentionally manipulate the results of subjective evaluations. Dependent on other influences a positive bias (leniency) enables beneficial reciprocation, which can increase the firm's profit. The underlying cause of this is discretion over the performance measure. It constitutes an additional device of optimization that allows to provide incentives more precisely.

Keywords:

agency, contracts, subjective performance evaluation, reciprocity, behavioral accounting

JEL-Classification:

C72, D82, M40, M52

1 Introduction

In order to achieve corporate goals managers often try to align interests of their employees by means of performance-based compensation contracts. One major task in designing incentive contracts is the determination of appropriate performance measures. The usual theoretical approach of addressing this is the analysis and utilization of explicit performance measures. However, there are some factors which can complicate the matter in practice. Firstly, as it is often too costly or too difficult to determine the contribution of an employee to company performance, firms simply lack the ability to objectively evaluate performance (see Baker et al., 1994a, p. 1127). Given that objective performance evaluation is possible, a second problem arises from the fact that many jobs consist of various tasks. The use of an explicit contract could cause the employee to focus too much on aspects captured by the contract and leaving other aspects not included in the contract unconsidered (see Holmström and Milgrom, 1990, 1991; Baker, 1992). This list of problems is easily extended.

A common method to overcome these obstacles is to assess and reward individual performances by means of subjective measures. In this case the person in charge enjoys discretionary power over the performance measures and uses his or her very own impressions to determine evaluation results. Besides its availability for almost all kinds of jobs, the main advantage is that subjective assessment provides a more holistic picture of performance (Prendergast, 1999). There is a vast literature addressing prevalence and benefits of subjective performance evaluation.¹

However, there is also evidence that subjective assessments increase the chance of inaccuracies and biases. It is, for example, possible that workers waste resources fulfilling favors for their bosses (Prendergast, 1999, p. 9). Moreover, there are two phenomena observable in practice, which show that the quality of subjective evaluations is affected. These phenomena are called “leniency bias” and “centrality bias”. While the former indicates that supervisors are reluctant to give poor ratings to employees, the latter shows that ratings are also compressed around some norm rather than truly distinguishing good

¹ See, e.g., Baker et al. (1994a), Smith et al. (1996), Levin (2003), Murphy and Oyer (2003), Gibbs et al. (2004), and Rajan and Reichelstein (2009).

from bad performances (Prendergast, 1999, p. 9).²

The literature analyzing these phenomena is mostly empirical or experimental (see Bol, 2008, 2011; Bol and Smith, 2011; Breuer et al., 2013), however, there is also research that examines the topic analytically (e.g., MacLeod, 2003; Kamphorst and Swank, 2015; Marchegiani et al., 2016). Explanations for these biases are diverse. While some authors find the lack of rewards for accurate ratings for supervisors (Fox et al., 1983) or the avoidance of undesirable discussions (Varma et al., 1996) as the main causes for inaccuracies, others claim that cognitive limitations (Ittner et al., 2003) or collusion (Thiele, 2013) lead to the distortions. Also favoritism (Ferriy and Judge, 1991), inequality aversion (Grund and Przemeczek, 2012), altruism (Giebe and Gürtler, 2012; Golman and Bhatia, 2012), reciprocity (Sebald and Walzl, 2014, 2015), as well as loss aversion and reference dependent preferences (Marchegiani et al., 2016) are mentioned as possible causes.

The purpose of this paper is to add another explanation for leniency in subjective performance evaluations and to characterize determinants of the bias. I also address profit concerns and examine if and how the manipulation increases or decreases the firm's surplus as well as agency costs. I assume that leniency is the result of deliberate and economically motivated manipulations by superiors, who add a positive or a negative bias to the actual evaluation result in order to enhance the economic outcome. The major driver for this is that superiors have to deal with reciprocally acting employees. The concept of reciprocity argues that individuals are driven by motivations where direct utility is gathered through rewarding or punishing actions (Dohmen et al., 2009, p. 592). More precisely, individuals tend to consider social aspects, like someone else's well-being, his/her motivations and intentions, or the own sensation of fairness, and respond "in-kind" (Falk and Fischbacher, 2006). The literature on this concept is extensive.³

I apply contracting theory and use a principal-agent scenario on the basis of the LEN model, where a risk neutral employer / supervisor (principal) and a risk averse employee

² There are numerous papers indicating that evaluation results are biased: Medoff and Abraham (1980), Baker et al. (1994b), Gibbs (1995), Flabbi and Ichino (2001), Dohmen (2004), Gibbs and Hendricks (2004), Dohmen et al. (2004), Frederiksen and Takats (2011), Frederiksen (2013), and Frederiksen et al. (2017).

³ Others are, e.g., Akerlof (1982), Rabin (1993), Fehr et al. (1997), Fehr and Gächter (1998), Rabin (1998), Levine (1998), Bolton and Ockenfels (2000), Charness (2004), Dufwenberg and Kirchsteiger (2004), Irlenbusch and Sliwka (2005), Dohmen et al. (2008, 2009), and Battigalli and Dufwenberg (2009).

(agent) interact. My model works as follows. By anticipating differences between self-evaluations of the agent and the actual evaluation result, the principal foresees that the probability for adverse reactions, i.e., reactions that are able to harm the firm's outcome, is increased. Here, I follow one particular line of argumentation in the literature, which claims that people resist revisions of self-appraisals when confronted with deviating feedback and instead tend to engage in directing feelings outward.⁴ In order to prevent negative behaviors and to enhance the probability of positive and productive reactions, respectively, the principal distorts the evaluation. However, this intentional biasing of the evaluation may not solely lead to positive responses. In this regard, I follow discussions about consequences from biases in evaluations and fairness perceptions and assume that reactions are not straightforward.⁵ On the one hand, leniency increases the performance measure and thereby positively affects the agent's salary, which then may lead to increased satisfaction and performance. On the other hand, however, inaccurate evaluations can be perceived as unfair by the agent. Firstly, the evaluation result does not represent actual performance, which may lead to frustration. Secondly, the principal's intention to manipulate the evaluation is not based on benevolence but on the maximization of her payoff. Hence, biasing can also reduce motivation, lead to a negative attitude and at worst result in actions against the organization (Cohen-Charash and Spector, 2001; Bol, 2008; Kamphorst and Swank, 2015; Marchegiani et al., 2016).

I find that even though manipulations may result in demotivation and punishing behaviors, the principal still manipulates the subjective evaluation result positively under specific circumstances, as it increases her profits. This confirms the empirical finding of a general tendency of supervisors to give good ratings, however, the explanation I add now is a purely economic one. The reason for this result is that the discretion over the performance measure serves as an additional device to provide incentives. The opportunity to shift emphasis between several optimization variables allows the principal to optimize her surplus more precisely. In comparison with the classic LEN model I find that the overall profit can be increased whereas agency costs are always increased.

⁴ See Shrauger and Lund (1975), Baird (1977), Greenwald (1980), Swann Jr. (1987), Baumeister et al. (1996), and Bushman and Baumeister (1998).

⁵ Analyses, discussions and different perspectives are found in Akerlof and Yellen (1988), Blinder and Choi (1990), Greenberg (1990), Cohen-Charash and Spector (2001), Colquitt et al. (2001), Gibbs et al. (2004), Bol (2008, 2011), Kamphorst and Swank (2015), and Marchegiani et al. (2016).

My paper contributes to two streams of literature. Firstly, since it concerns particular patterns in evaluation results, it contributes to the accounting literature addressing characteristics and effects of subjective performance evaluations.⁶ Secondly, as I explain the observed pattern with a behavioral concept, I contribute to the analytical literature using insights from fields of psychology to explain phenomena in (economic) decision making and characteristics of contract designs.⁷

My explanation for biased evaluations should be understood to have a complementary character. Since the authors also use behavioral explanations, my approach is loosely related to the analyses of Grund and Przemeczek (2012), Giebe and Gürtler (2012), Golman and Bhatia (2012), and Marchegiani et al. (2016). My paper is particularly closely related to Sebald and Walzl (2014, 2015) because, similarly, I explain leniency effects by means of reciprocity. However, there are some major (analytical) differences. Firstly, I focus on effort instead of ability and, therefore, analyze a classic moral hazard problem. This allows me to also address how the bias is influenced by observability of effort, effort aversion, noise in the evaluation and risk aversion. Secondly, while Sebald and Walzl (2014, 2015) solely focus on punishing reciprocal behaviors, I also allow positive responses, i.e., reaction that are beneficial to the company.

The paper is structured as follows. Section 2 introduces the model. In the following two sections I analyze settings which differ regarding informational symmetry with respect to effort. The first-best solution (Section 3) establishes the benchmark, whereas the second-best solution (Section 4) describes a more realistic real business life scenario. Chapter 5 compares findings of the preceding sections with each other and with results from the classical LEN model. Section 6 concludes.

⁶ For example, Baker et al. (1994a), MacLeod (2003), Bol (2008), Rajan and Reichelstein (2009), Kampkötter and Sliwka (2011), Bol (2011), Bol and Smith (2011), Breuer et al. (2013), and Kamphorst and Swank (2015).

⁷ See Rabin (1993), Bénabou and Tirole (2002, 2004), Köszegi (2006), Köszegi and Rabin (2006), Falk and Fischbacher (2006), Giebe and Gürtler (2012), Golman and Bhatia (2012), Grund and Przemeczek (2012), Sebald and Walzl (2014, 2015), and Marchegiani et al. (2016).

2 Model

I consider a single period LEN principal-agent model. A risk-neutral principal (she) hires a risk-averse agent (he) to provide effort e in a newly created project. The project, however, is a complex good or service such that it is impossible for the principal to objectively evaluate the agent's contribution to it. The principal therefore applies subjective criteria to assess the performance of her employee. Using her personal impressions of the agent's work she creates an appraisal in written form. I assume that the report is published, i.e., at least the department of human resources (HR) is informed about the evaluation outcome, and that its content thereby becomes verifiable for third parties.⁸ Consequently, a contract can credibly be written on the appraisal report, which means it can serve as a performance measure for the agent. Formally, the report takes the form

$$y = e + \delta + \varepsilon. \quad (1)$$

The evaluation is based on the agent's true effort but also affected by some random noise $\varepsilon \sim N(\mu, \sigma_\varepsilon^2)$.⁹ With this it is taken into account that the principal's impression of the agent's work is not perfectly accurate. Furthermore, since the principal has discretion over the evaluation result, she is able to add a bias $\delta \in [-1, 1]$ to change the evaluation in her favor. More precisely, the principal can manipulate the evaluation in that she improves or worsens the outcome. A scenario with $\delta > 0$ would be an example for a leniency bias.

Since y serves as the performance measure of the agent, his compensation contract takes the form

$$s = f + vy, \quad (2)$$

with f symbolizing the agent's fixed wage and v being the incentive rate.

It is common knowledge that, parallel to the principal, the agent privately makes an alternative assessment of his own performance, i.e., he forms an expectation on how his official evaluation result should look like. The problem with this is that he is prone to

⁸ The scenario of subjective impressions leading to a verifiable report that serves as a performance measure may fit to the evaluation of a white-collar employee at the lower or middle management level (see Giebe and Gürtler, 2012, Golman and Bhatia, 2012 or Grund and Przemeczek, 2012 for similar approaches).

⁹ The agent's productivity is normalized to one.

thought patterns that deviate from the ones of the “homo oeconomicus”. This is where the concept of reciprocity comes into play. Technically, the agent compares his effort e with the official assessment of his work y and develops an own sensation of fairness. Whenever there appear differences between the official evaluation report and his own assessment of performance, which is the evaluation result the agent anticipates, his personal self-esteem is affected in that he perceives ego-threatening or ego-boosting feelings. Based on this psychological process (see, e.g., Shrauger and Lund, 1975; Baird, 1977; Baumeister et al., 1996) the agent subsequently engages in a reciprocal (re)action Ω . Possible are both rewarding and punishing actions. Examples for punishing responses could be diminished cooperation, the manipulation of information or communication, theft from the workplace, or the opening of a law suit, etc. Rewarding responses, in turn, can be the voluntary offer to help coworkers, extra dedication and commitment, and any other behavior positively influencing the working climate and/or productivity. The return from the project (e.g. net present value) x is consequently affected by the agent’s effort $e \geq 0$ and his reciprocal response $\Omega \gtrless 0$, as well as some noise $\epsilon \sim N(0, \sigma_\epsilon^2)$:

$$x = e + \Omega + \epsilon. \quad (3)$$

Once the agent has reciprocated in a positive or negative way, it is not possible for the principal to make the reaction subject to the agent’s performance evaluation. This is, firstly, because of the verifiable report already being written, and secondly, due to the nature of the reciprocation, which is not always (precisely) identifiable or directly assignable to a person.

The principal is aware of the agent’s character traits and having the maximization of profit in mind she is able to foresee how the agent’s reciprocal habits might interfere with the project outcome. In order to avoid harmful actions and to increase chances of positive reciprocal behaviors she uses her knowledge about the drivers of the reciprocal response when manipulating the evaluation report y with δ . The principal, thus, applies her power of discretion over the evaluation report to intentionally bias the result in order to maximize project outcome x . Thereby, δ serves as a second optimization variable besides incentive rate v and fixed pay f .

While the exact extent of δ remains unobservable for the agent, it is commonly known that reports can be distorted. This is why the agent also considers the principal’s motivation

to manipulate in his decision making. Following the discussion of effects from biased evaluations (see Bol, 2008, for an overview), I assume that the consequences of manipulation can be both positive and negative. In fact I consider leniency to have two distinct effects on the agent. On the one hand, it increases the performance measure, which is beneficial for the agent's payoff and therefore increases his utility. On the other hand, however, the anticipation of deliberate inaccuracy in the evaluation can be perceived as unfair by the agent. This perception of unfairness should be particularly high if the agent envisions that the principal's underlying intention for the manipulation is not altruism but profit maximization. Accordingly, any conjecture about deliberate inaccuracy may also be related to a lowered motivation to positively reciprocate or to negative reciprocation at worst. I try to capture the opposing effects with the following expression:

$$\Omega = \omega(y - e) - \psi(y - e)^2. \quad (4)$$

The agent's reciprocal reaction Ω consists of two parts. While $\omega \in [0, 1]$ causes reciprocal actions motivated by the sensation of good evaluations and changes in the salary, $\psi \in [0, 1]$ characterizes activities driven by the perception of receiving an imprecise (in other words, potentially manipulated) evaluation report. Correspondingly, Ω can also be an emotional reaction, at least the part affected by ψ . Both ω and ψ are given exogenously. It follows that the direction and the size of the reciprocal response are not straightforward. Whenever, for example, the evaluation falls short of the agent's own assessment of his work (i.e., his anticipated evaluation report), the reciprocal response would harm the principal's outcome. In this case a larger positive bias would be beneficial in that it would make the impact of the reciprocal reaction less negative. If, as a second example, the evaluation is better than the self-assessment of the agent (i.e., $y > e$), the reaction is dependent on the (relative) sizes of ω and ψ . Consequently, increasing the bias in this scenario could enhance chances for both a positive response as well as an adverse reaction.

Considering all economic and psychological factors the preferences of the agent can be summarized by the following exponential utility function:

$$U_A = -\exp[-r(s - c - \kappa)]. \quad (5)$$

In this $r > 0$ is the Arrow-Pratt measure for absolute risk aversion and $c = \frac{\epsilon^2}{2}$ denotes the

cost of effort and κ the cost of an involvement in a reciprocal reaction.¹⁰

Due to its exponential form, the linearity of wage s , and normally distributed random variables, the agent's expected utility can be expressed through its certainty equivalent

$$CE = E[s] - c - \kappa - \frac{r}{2} \cdot Var[s] \quad (6)$$

$$= f + v(e + \mu + \delta) - \frac{1}{2}e^2 - \kappa - \frac{1}{2}rv^2\sigma_\varepsilon^2. \quad (7)$$

To complete the setting I summarize the timeline of the agency. Figure 1 below illustrates the sequence. At the beginning the principal decides about the contract she offers to the agent. It is common knowledge that the agent's variable pay is dependent on the incentive rate and the result of the subjective evaluation, which is subject to the principal's discretion. Anticipating the agent's effort decision, the resulting evaluation report (including the bias), and possible reciprocal responses to the evaluation, the principal determines contract conditions (fixed and variable pay) and makes an offer to the agent ("take it or leave it"). Analyzing contract terms and anticipating both the result of the (biased) evaluation, as well as his own reciprocal response to it, the agent provides his effort in the project strategically. Simultaneously, the principal gathers impressions on the agent's performance, (e.g., through presentations on the project progress, etc.) and considering the agent's inclination to reciprocity she determines the extent to which she biases the report in order to minimize chances of adverse reactions. In the next stage, the principal writes the official evaluation report, which includes the bias, and publishes it (e.g., sends it to HR). The agent then compares the report with his own assessment of performance and, dependent on whether he perceives it as fair or unfair, engages in rewarding or punishing actions that affect the outcome of the principal. At stage five the agent receives his compensation contingent on the optimal incentive rate and the optimized evaluation report in place. In the last stage of the game the project outcome realizes.

¹⁰Rilling et al. (2002) find that subjects in experiments perceive it as rewarding when reciprocating cooperatively, which indicates there are no cost from positive reciprocation but increased utility. Nevertheless, the majority of literature assumes that there are cost (see e.g. Fehr et al., 1997). I follow this assumption, however, due to the different findings and for reasons of simplicity I do not endogenize it.

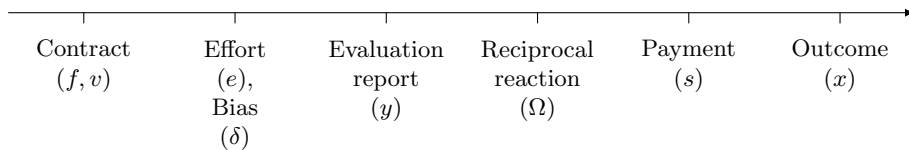


Figure 1: Timeline in the agency

3 First-best solution

Before analyzing a real business world scenario with information asymmetry regarding effort, I determine a benchmark solution in order to enable comparisons. In the first-best solution the agent's effort is observable and contractible, which reduces the principal's problem such that she only needs to motivate the agent to participate in the game (see Holmström, 1979, p. 76). As a consequence, evaluation report y becomes irrelevant in the first-best solution of the standard model. However, my model intends to address reciprocal responses conditional on evaluation reports that might be biased and also tries to compare different scenarios. For this reasons, I assume that in the first-best solution at hand y continues to exist as a performance measure.¹¹ However, since perfect observability of effort allows to write an accurate report, I assume that y does not contain noise ε any longer.

To ensure that the agent accepts a contract his certainty equivalent must exceed (or at least be equal to) his reservation wage CE_0 , which implies that there exists an ex ante binding participation constraint.¹² The risk-neutral principal acts as the residual claimant of project outcome x . Her ex ante optimization problem, thus, specifies as

$$\max_{e, f, v, \delta} E[\Pi] = E[x - s] \quad (8)$$

subject to

$$CE \geq CE_0. \quad (9)$$

The problem is solved by backward induction, which means identifying the optimal bias

¹¹One could think of y as a credential or certificate that triggers the reciprocal reaction.

¹²I assume that if the agent is indifferent between the firm's offer and an outside-option, he decides in the best interest of the employer.

is the starting point.¹³ The principal's objective function at this stage denotes

$$\max_{\delta} E[\Pi|f^*, v^*, e^*] = E[e^* + \Omega + \epsilon - s(f^*, v^*, e^*)] \quad (10)$$

$$= E[e^* + \omega(y - e^*) - \psi(y - e^*)^2 + \epsilon - f^* - v^*y] \quad (11)$$

$$= e^* + \omega\delta - \psi\delta^2 - f^* - v^*(e^* + \delta), \quad (12)$$

where the stars indicate (known) optimal realizations. As a preliminary result, one can already see that the reciprocal reaction Ω is independent of the agent's effort. Whether it is a positive or a negative response solely depends on the agent's reciprocal characteristics and the extent of the bias.

For $\omega, \psi > 0$ optimization of (12) with respect to δ yields

$$\delta^* = \frac{\omega - v^*}{2\psi}. \quad (13)$$

Assuming $CE_0 = 0$ and solving the agent's participation constraint for $E[s]$, one has to substitute the result into (8) to establish the principal's ex ante expected surplus. Considering the optimal bias it has the form

$$\max_{e, v, f} E[\Pi(\delta^*)] = E[e + \Omega + \epsilon] - c - \kappa - \underbrace{\frac{r}{2} \cdot \text{Var}[s]}_{= 0} \quad (14)$$

$$= e + \omega\delta^* - \psi(\delta^*)^2 - \frac{1}{2}e^2 - \kappa. \quad (15)$$

Given that there is no noise in y , the agent's compensation does not contain any risk, regardless of the incentive rate. Optimization over f ensures that the participation constraint is binding.

The results of the remaining optimizations are presented in Lemma 1.

¹³Normally, δ and e are determined simultaneously after conclusion of contract. However, as the first-best contract is written on effort, the optimal e is determined ex ante.

Lemma 1 *The benchmark levels for the incentive rate, effort, and the bias denote:*

$$v^{FB} = 0, \tag{16}$$

$$e^{FB} = 1, \tag{17}$$

$$\delta^{FB} = \frac{\omega}{2\psi}. \tag{18}$$

Proof: See the Appendix. ■

Similar to the standard LEN model the principal sets an optimal incentive rate of zero and an effort of one.¹⁴ However, in the standard model the incentive rate is zero in order to protect the agent from risk, whereas in the model at hand risk is not a factor as y does not contain noise in the first-best solution. The explanation for $v^{FB} = 0$ lies in the negative effect of the incentive rate on the reciprocal reaction. This can be seen when (13) is substituted into Ω , which yields $\frac{\omega^2 - v^2}{4\psi}$. The principal, thus, minimizes v^{FB} in order to benefit more from the reciprocal response. The evaluation bias is the principal's device to prevent (or at least mitigate) negative effects from negative reciprocation and to enhance chances for positive reciprocation, respectively. One property of δ^{FB} is, that it is positive, i.e., the principal always evaluates leniently. The optimal extent of the bias depends on the (relative) sizes of the reciprocal intentions ω and ψ .¹⁵ Regarding comparative statics, it reveals that δ^{FB} is positively dependent on ω and negatively dependent on ψ .

Incorporating the first-best results into the agent's reciprocal response function it becomes clear that Ω^{FB} is always positive.

Proposition 1 summarizes the findings from the first-best analysis.

Proposition 1 *If the agent shows reciprocal character traits and effort is observable and accurately assessable, then the principal always evaluates leniently, i.e., $\delta^{FB} > 0$. The agent's corresponding reciprocal reaction is always beneficial, i.e., $\Omega^{FB} > 0$.*

Proof: See the Appendix. ■

¹⁴If productivity is assumed to be one (as happened here), the first-best effort, which is the ratio of marginal productivity to marginal cost of effort, also becomes one (see e.g. Spremann, 1987, 1988, p. 58).

¹⁵Recall that ω symbolizes reciprocal motivation caused by high evaluations and salary changes, whereas ψ represents reciprocal intentions based on the perception of fairness concerning the accuracy of evaluations.

4 Second-best solution

In the second-best solution the agent's true effort is not observable and since the agent tends to behave opportunistically the principal needs to establish an incentive scheme which aligns interests. A solution to the problem is implementing a performance-based incentive contract with a positive incentive rate. However, due to the lack of precision in the principal's subjective assessment of performance the agent's compensation becomes risky. The principal needs to find a contract that, firstly, ensures the agent's participation and, secondly, optimizes the costs and benefits of effort. Accordingly, the participation constraint is complemented by an incentive compatibility constraint that captures the agent's optimal effort decision.

$$\max_{f, v, \delta} E[\Pi] = E[x - s] \quad (19)$$

subject to

$$CE \geq 0 \quad (20)$$

$$e \in \operatorname{argmax}_{e'} CE(e'). \quad (21)$$

Again, the model is solved by backward induction, which requires that the principal firstly selects bias δ . Given a second-best contract, with the optimal values v' and f' , the principal receives her impression about the agent's performance. The effort is not observable for the principal, however, she is able to anticipate it, which is denoted with \hat{e} . The objective function has the form

$$\max_{\delta} E[\Pi|f', v', \hat{e}] = E[\hat{e} + \omega(y - \hat{e}) - \psi(y - \hat{e})^2 + \epsilon - f' - v'y] \quad (22)$$

$$= \hat{e} + \omega(\mu + \delta) - \psi(\sigma_{\epsilon}^2 + (\mu + \delta)^2) - f' - v'(\hat{e} + \mu + \delta). \quad (23)$$

For $\omega, \psi > 0$ optimization via δ yields

$$\delta' = \frac{w - v'}{2\psi} - \mu. \quad (24)$$

One can see that the second-best bias is similar to the first-best bias conditional on the incentive rate. Obviously, expected noise in the performance measure $E[\epsilon] = \mu$ diminishes its size.

Parallel to the determination of the optimal bias the agent decides about his effort. Denoting the agent's conjecture about the principal's bias as $\widehat{\delta}$, the agent's certainty equivalent has the form

$$\max_e CE(\widehat{\delta}) = E[s] - c - \kappa - \frac{r}{2} \cdot Var[s] \quad (25)$$

$$= f + v(e + \mu + \widehat{\delta}) - \frac{1}{2}e^2 - \kappa - \frac{1}{2}rv^2\sigma_\varepsilon^2. \quad (26)$$

Optimization yields $e' = v$, i.e., the second-best effort is dependent on the incentive rate.

In order to determine the second-best incentive rate, the expressions for optimal bias and (anticipated) optimal effort are substituted into the principal's ex ante expected surplus, which leads to the following expression:

$$\max_v E[\Pi(e', \delta')] = E[x] - c - \kappa - \frac{r}{2} \cdot Var[s] \quad (27)$$

$$= e' + \omega(\mu + \delta') - \psi(\sigma_\varepsilon^2 + (\mu + \delta')^2) - \frac{1}{2}e'^2 - \kappa - \frac{1}{2}rv^2\sigma_\varepsilon^2 \quad (28)$$

$$= v + \frac{\omega(\omega - v)}{2\psi} - \psi\left(\sigma_\varepsilon^2 + \frac{(\omega - v)^2}{4\psi^2}\right) - \frac{1}{2}v^2 - \kappa - \frac{1}{2}rv^2\sigma_\varepsilon^2. \quad (29)$$

Optimization specifies the second-best solution, which is presented in Lemma 2:

Lemma 2 *The second-best levels for the incentive rate, effort, and the bias denote:*

$$v^{SB} = \frac{2\psi}{1 + 2\psi(1 + r\sigma_\varepsilon^2)}, \quad (30)$$

$$e^{SB} = v^{SB}, \quad (31)$$

$$\delta^{SB} = \frac{\omega - v^{SB}}{2\psi} - \mu. \quad (32)$$

Proof: See the Appendix. ■

In contrast to the first-best solution the second-best bias can be positive or negative, dependent on the exogenous variables ψ , ω , and μ . Comparative statics reveal that δ^{SB} increases in ω and decreases in ψ and μ . Regarding ω one can see from (23) that it does not depend on whether $(\mu + \delta) > 0$ or $(\mu + \delta) < 0$, an even larger positive bias always has a positive effect in that it results in a more positive or less negative reaction. Given that ω represents reciprocal motivation from a high evaluation and salary, respectively, the

explanation is straightforward. Consequently, the larger ω the more beneficial the effect of δ on the overall reciprocal reaction Ω and the stronger the incentive to increase the bias. Also the negative effect of ψ is intuitive. The stronger the perception of fairness, the more negative the effect of a bias that deteriorates the accuracy of the subjective evaluation. Assuming $\mu = 0$ the sign of the bias still depends on the size of ω compared to v^{SB} . As $v^{SB} > 0$ as long as $\psi > 0$, it is apparent that δ^{SB} also depends on the agent's risk aversion r and on the variance of the noise in the performance measures σ_ε^2 . Both factors increase the optimal bias. For σ_ε^2 the effect is not intuitive because the larger the variation in the noise of the performance measure, the more difficult it is for the principal to determine the optimal degree of manipulation, namely, a bias that induces a positive reaction. The explanation for this seems to be found in the parallel provision of incentives through v^{SB} and δ^{SB} . As (32) reveals, the optimal bias decreases in v^{SB} , which indicates that the two variables have a substitutive relationship. Regarding the optimal incentive rate in more detail, it turns out that it is not dependent on ω but only on ψ in terms of reciprocity. It holds that the higher ψ , the greater the incentive rate. Other comparative statics reveal that v^{SB} is negatively dependent on σ_ε^2 and r , which is similar to the standard LEN model.

Summarizing these results, one can conclude that discretion over the subjective performance measure serves as a second means of optimization for the principal, which allows her to provide incentives more precisely to agents prone to effort aversion, risk aversion, and reciprocal motivations. In other words, the principal shifts emphasis in the provision of incentives among v and δ . The bias is the principal's only device to encounter consequences from the agent's reciprocity. However, manipulating the performance measure is also relevant for costs and in order to remain at an efficient level of compensation emphasis in the incentive design can be shifted between f^{SB} , v^{SB} , and δ^{SB} . The driving factors behind this are the agent's fairness perception ψ , which is able to turn reciprocal reaction Ω negative, and the agent's risk aversion r . Whenever ψ is high the principal decreases the degree of manipulation, i.e., diminishes the provision of incentives through the bias, and puts more emphasis on the incentivisation via v in order to minimize chances of an adverse reciprocal reaction. Conversely, if r is high the incentive rate is diminished and more emphasis is put on incentives via δ to induce a stronger reciprocal reaction.

Applying δ^{SB} and v^{SB} yields reciprocal response Ω^{SB} and as opposed to the first-best solution the reaction can be beneficial or harmful.

Proposition 2 summarizes the main results.

Proposition 2 *In the second-best solution the principal biases evaluations positively (i.e., $\delta^{SB} > 0$) if $\omega > 2\mu\psi + v^{SB}$, with $v^{SB} = \frac{2\psi}{1+2\psi(1+r\sigma_\varepsilon^2)}$. The optimal bias δ^{SB} increases in the agent's risk aversion r and decreases in the agent's reciprocal perception ψ if $v^{SB} < \omega$. The optimal incentive rate v^{SB} increases in ψ and decreases in r . Biasing the subjective evaluation induces a beneficial reciprocal response, $\Omega^{SB} > 0$, if $2\psi(\varepsilon - \mu) - \omega < v^{SB} < 2\psi(\varepsilon - \mu) + \omega$.*

Proof: See the Appendix. ■

In the following I present two numerical examples in order to illustrate some of the results of the second-best solution. For scenario a) assume $\omega = 0.45$, $\mu = 0.1$, $\sigma_\varepsilon = 2$, and $r = 0.5$. In scenario b) let ω , μ , and σ_ε remain unchanged and set $\psi = 0.6$. Figure 2 shows the relation of the optimal bias and the optimal incentive rate dependent on ψ in scenario a) and dependent on r in scenario b). One can clearly see in scenario a) and b)

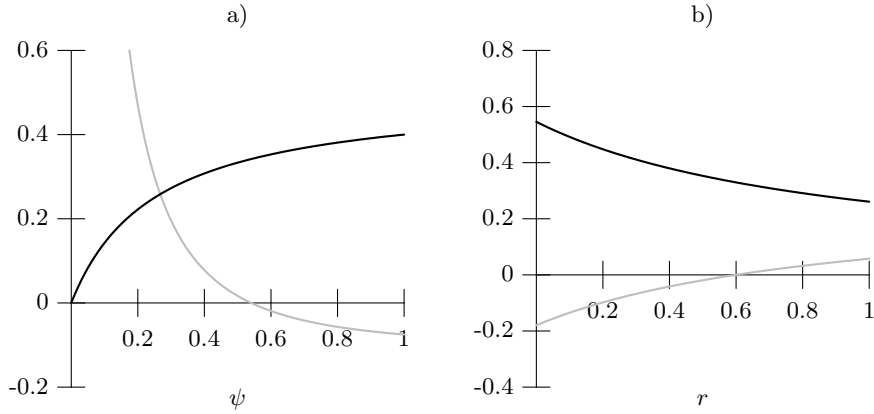


Figure 2: Relation of v^{SB} (black) and δ^{SB} (gray) dependent on ψ and r .

that the optimal bias and the optimal incentive rate work in the opposite direction, i.e., have a substitutive relationship. Whenever the agent shows a strong perception of fairness and corresponding reciprocal motivation, it is efficient for the principal to provide more incentives through v^{SB} , as it is less costly to put more risk onto the agent. Conversely, if the agent's risk aversion is high, it is better for the principal to hold the incentive rate low and to increase the bias, as it is more profitable to gain the outcome via positive reciprocation than through effort. One can also see that the optimal bias can be positive

and negative in both scenarios.

As a second example I present how the agent's reciprocal reaction is related to the principal's bias. Assume $\omega = 0.1$, $\psi = 0.6$, and $\varepsilon = -0.5$ for Ω_1 ; $\omega = 0.5$, $\psi = 0.5$, and $\varepsilon = 0$ for Ω_2 ; and $\omega = 0.6$, $\psi = 0.4$, and $\varepsilon = 0.5$ for Ω_3 . Figure 3 indicates that the potential size

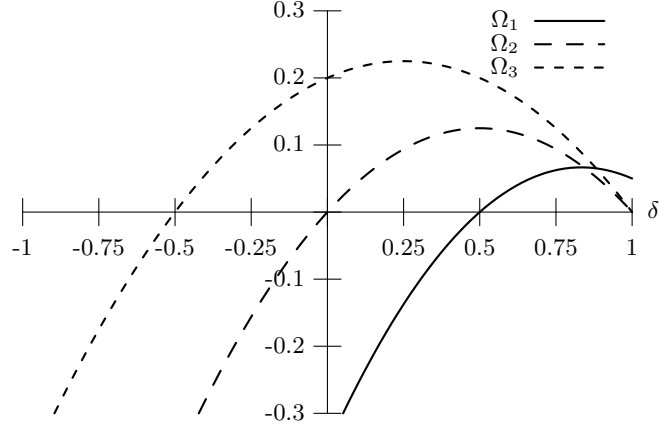


Figure 3: Sizes of Ω dependent on δ .

of a negative reaction can be much greater than the size of a possible positive reciprocal response. Furthermore, it shows that the bias decreases the better the conditions for an overevaluation of the agent's performance and increases the more likely an underevaluation of the performance of the agent. Correspondingly, the bias is the largest (i.e., the evaluation is the most lenient) if ε is negative and $\omega < \psi$, which is the case for Ω_1 . The strongest positive reaction is induced when chances of an overevaluation are high, i.e., $\varepsilon > 0$ and $\omega > \psi$. This is the case for Ω_3 .

5 Comparisons

In order to deepen the understanding on the characteristics of a bias and on how these manipulations affect the company I conduct a few comparisons.

I start with a comparison of the optimal biases and one can see from (18) and (32) that the extent of manipulation in the first-best solution can be above or below the bias in the second-best case. The difference seems to be explained by the principal's lack of ability to observe the agent's effort perfectly in the second-best solution. Information symmetry regarding effort is advantageous in that it increases evaluation accuracy, i.e., the principal can determine a greater bias without taking the risk of inducing an adverse reaction.

However, if the expected noise is small enough the second-best bias can also exceed the first-best bias.

Regarding the reciprocal responses, I find that Ω^{FB} is always greater than Ω^{SB} . Given that δ^{FB} is more precise it is only logical that the first-best bias also leads to a more beneficial reciprocal response.

Concerning the principal's surplus the question is whether it exceeds the surplus in the classical LEN model. For the first-best solution, it turns out that $E[\Pi^{FB}]$ can be smaller or greater than the principal's "classic" first-best expected surplus. The same holds for the second-best solution.¹⁶

Finally, I examine whether agency costs in my model are smaller or greater than in a situation where no manipulation or reciprocity is present. I find that agency costs in my model are always greater than in the standard LEN model, which means the principal is not able to adjust the bias in a way that she moves closer the first-best solution.

Proposition 3 summarizes the results.

Proposition 3 *The optimal bias in the first-best solution is greater than the bias in the second-best solution, i.e., $\delta^{FB} > \delta^{SB}$ if*

$$\mu > -\frac{1}{1 + 2\psi(1 + r\sigma_\varepsilon^2)}. \quad (33)$$

Regarding the reciprocal responses it holds that $\Omega^{SB} < \Omega^{FB}$. The principal's first-best expected surplus ($E[\Pi^{FB}]$) exceeds the first-best expected surplus in the classic LEN model ($E[\Pi_c^]$) if $\frac{\omega^2}{4\psi} > \kappa$. The principal's second-best expected surplus ($E[\Pi^{SB}]$) is greater than the second-best expected surplus in the classic LEN model ($E[\Pi_c']$) if*

$$\frac{4\psi^2(r\sigma_\varepsilon^4 + \sigma_\varepsilon^2) + 2\psi}{4\psi(1 + r\sigma_\varepsilon^2)} + \kappa < \frac{4\psi^2 + 2\psi\omega^2(1 + r\sigma_\varepsilon^2) + \omega^2}{4\psi(1 + 2\psi(1 + r\sigma_\varepsilon^2))}. \quad (34)$$

Agency costs ($E[\Pi^{FB}] - E[\Pi^{SB}]$) are always greater than agency costs in the classic LEN model ($E[\Pi_c^] - E[\Pi_c']$).*

Proof: See the Appendix. ■

¹⁶One must not forget that a direct comparison of the surpluses is not flawless because my model considers two kinds of "effort" (regular effort and the reciprocal reaction), whereas the classic model only considers regular effort without any chance of further benefits from reciprocation.

6 Conclusion

In this paper I develop a new agency model to analyze effects of reciprocity on subjective evaluations and the implementation of effort. Reciprocity is modeled as an involvement in kind or unkind actions in response to the result of a subjective performance evaluation. Based on real business-life observations I assume that principals attempt to cover effects from reciprocity by means of leniency in subjective evaluation. Leniency, however, has two distinct effects. On the one hand it increases the performance measure and compensation, on the other hand, deliberate manipulation of evaluation results reduces motivation and, thus, the willingness to positively reciprocate. Consequently, an optimal contract needs to consider both, effort and reciprocal motivations.

I find that principals bias subjective evaluations even if they are able to observe effort. By considering the agents' characteristics in terms of effort aversion, risk aversion, and reciprocity and by anticipating potential reactions to subjective evaluations, principals are able to provoke responses from the agents subsequent to the evaluations. These reciprocal actions can be beneficial and, thus, are able to increase the principal's surplus beyond the extent of the classical model. The reason for this is that biasing the evaluation serves as an additional means of optimization. However, biasing the performance measure does not decrease agency costs compared to the classical model. This reflects the fact that the agent's fairness perception presents an additional obstacles to the principal.

The analytical results support my hypothesis that the leniency bias might not only be caused by cognitive errors of superiors, favoritism or a simple reluctance to give bad news. My model suggests that it can be also the result of a conscious and rational decision making to motivate employees. I show that leniency does not always result in punishing behaviors but instead is able to affect profits positively. Future research should elaborate the bias, the reciprocal reaction, and their effects on company performance and profits in more depth. Since my results are determined by the characteristics of the analytical model and limited to its boundaries, laboratory experiments should be able point out in which particular contexts these conclusions can be drawn.

Appendix

Proof of Lemma 1

Differentiating the ex ante objective function of the principal with respect to e and v leads to the following first-order conditions:

$$\frac{\partial E[\Pi(\delta^*)]}{\partial e} = 0 \Leftrightarrow 1 - e = 0, \quad (35)$$

$$\frac{\partial E[\Pi(\delta^*)]}{\partial v} = 0 \Leftrightarrow -\frac{v}{2\psi} = 0. \quad (36)$$

The optimization of δ was already presented in (12) and (13). Solving the equation system leads to the results presented by (16), (17), and (18). The corresponding second-order derivatives are:

$$\frac{\partial^2 E[\Pi|f^*, v^*, e^*]}{\partial \delta^2} = -2\psi < 0, \quad (37)$$

$$\frac{\partial^2 E[\Pi(\delta^*)]}{\partial e^2} = -1 < 0, \quad (38)$$

$$\frac{\partial^2 E[\Pi(\delta^*)]}{\partial v^2} = -\frac{1}{2\psi} < 0. \quad (39)$$

Since all second-order derivatives appear to be smaller than zero, the solutions found are maxima. ■

Proof of Proposition 1

Assuming that the principal is able to observe effort and, thus, eliminates any noise from the performance measure, the optimal bias is given by (18). One can see that $\delta^{FB} > 0$ whenever $\omega, \psi > 0$.

Regarding the question if the first-best reciprocal response is positive or negative one has to substitute the optimal value δ^{FB} into Ω :

$$\Omega^{FB} = \omega(y - e) - \psi(y - e)^2 \quad (40)$$

$$= \omega\delta^{FB} - \psi(\delta^{FB})^2 \quad (41)$$

$$= \frac{\omega^2}{4\psi}. \quad (42)$$

It is easy to see that the optimal reciprocal reaction is positive whenever the agent has reciprocal character traits. ■

Proof of Lemma 2

Differentiation of the respective objective functions with respect to e and v leads to the following first-order conditions:

$$\frac{\partial CE(\hat{\delta})}{\partial e} = 0 \Leftrightarrow v - e = 0, \quad (43)$$

$$\frac{\partial E[\Pi(e', \delta')]}{\partial v} = 0 \Leftrightarrow 1 - \frac{v}{2\psi} - v - rv\sigma_\varepsilon^2 = 0. \quad (44)$$

The optimization of δ was already presented in (23) and (24). Solving the equation system leads to the results presented by (30), (31), and (32). The corresponding second-order derivatives are:

$$\frac{\partial^2 E[\Pi|f', v', \hat{e}]}{\partial \delta^2} = -2\psi < 0, \quad (45)$$

$$\frac{\partial^2 CE(\hat{\delta})}{\partial e^2} = -1 < 0, \quad (46)$$

$$\frac{\partial^2 E[\Pi(e', \delta')]}{\partial v^2} = -1 - \frac{1}{2\psi} - r\sigma_\varepsilon^2 < 0. \quad (47)$$

All second-order derivatives are smaller than zero, thus, the solutions are maxima. ■

Proof of Proposition 2

Solving (32) for ω leads to $\omega = 2\mu\psi - v^{SB}$, with $v^{SB} = \frac{2\psi}{1+2\psi(1+r\sigma_\varepsilon^2)}$. Since $\frac{\partial \delta^{SB}}{\partial \omega} = \frac{1}{2\psi} > 0$, $\delta^{SB} > 0$ if $\omega > 2\mu\psi - v^{SB}$.

The optimal bias is negatively dependent on ψ if $\omega > v^{SB}$ as

$$\frac{\partial \delta^{SB}}{\partial \psi} = -\frac{\omega - v^{SB}}{2\psi^2} \quad (48)$$

is a negative expression whenever $\omega > v^{SB}$.

The optimal bias is positively dependent on r because

$$\frac{\partial \delta^{SB}}{\partial r} = \frac{2\psi\sigma_\varepsilon^2}{(2\psi r\sigma_\varepsilon^2 + 2\psi + 1)^2} \quad (49)$$

is a positive expression.

The optimal incentive rate is negatively dependent on r because

$$\frac{\partial v^{SB}}{\partial r} = -\frac{4\psi^2\sigma_\varepsilon^2}{(2\psi r\sigma_\varepsilon^2 + 2\psi + 1)^2} \quad (50)$$

is a negative expression.

The optimal incentive rate is positively dependent on ψ because

$$\frac{\partial v^{SB}}{\partial \psi} = \frac{2}{(2\psi r\sigma_\varepsilon^2 + 2\psi + 1)^2} \quad (51)$$

is a positive expression.

Regarding the question if biasing the evaluation induces a positive second-best reciprocal response, one has to substitute the optimal bias δ^{SB} into Ω .

$$\Omega^{SB} = \omega(y(\delta^{SB}, v^{SB}) - e) - \psi(y(\delta^{SB}, v^{SB}) - e)^2 \quad (52)$$

$$= \omega(\varepsilon + \delta^{SB}(v^{SB})) - \psi(\varepsilon + \delta^{SB}(v^{SB}))^2 \quad (53)$$

$$= \omega\left(\varepsilon + \frac{\omega - v^{SB}}{2\psi} - \mu\right) - \psi\left(\varepsilon + \frac{\omega - v^{SB}}{2\psi} - \mu\right)^2 \quad (54)$$

$$= \frac{\omega^2 - (v^{SB})^2}{4\psi} + (\varepsilon - \mu)v^{SB} - (\varepsilon - \mu)^2\psi. \quad (55)$$

Solving (55) for v^{SB} yields $\{2\psi(\varepsilon - \mu) + \omega; 2\psi(\varepsilon - \mu) - \omega\}$. Therefore, $\Omega^{SB} > 0$, if $2\psi(\varepsilon - \mu) - \omega < v^{SB} < 2\psi(\varepsilon - \mu) + \omega$. ■

Proof of Proposition 3

The difference between the optimal biases is

$$\Delta_\delta = \delta^{FB} - \delta^{SB} = \frac{1}{1 + 2\psi(1 + r\sigma_\varepsilon^2)} + \mu. \quad (56)$$

Consequently, $\delta^{FB} > \delta^{SB}$ as long as

$$\mu > -\frac{1}{1 + 2\psi(1 + r\sigma_\varepsilon^2)}. \quad (57)$$

Considering the reciprocal responses it holds that

$$\Delta_\Omega = \Omega^{FB} - \Omega^{SB} \quad (58)$$

$$= \frac{4\psi((\mu - \varepsilon)(1 + r\sigma_\varepsilon^2)\psi + \frac{1}{2} + \frac{\mu}{2} - \frac{\varepsilon}{2})^2}{(1 + 2\psi(1 + r\sigma_\varepsilon^2))^2}. \quad (59)$$

Since terms in the numerator and the denominator are squared, the expression as a whole is also positive as long $\psi > 0$.

In the standard LEN model without behavioral aspects the principal's first-best expected surplus equals the agent's salary which consists of the fixed component, i.e., $E[\Pi_c^*] = f_c^* = \frac{1}{2}$. This expression has to be compared with $E[\Pi^{FB}]$, i.e.,

$$\Delta_{\Pi_{FB}} = E[\Pi_c^*] - E[\Pi^{FB}] \quad (60)$$

$$= \frac{1}{2} - \left(\frac{1}{2} + \frac{\omega^2}{4\psi} - \kappa \right). \quad (61)$$

It is easy to see that $\Delta_{\Pi_{FB}} < 0$ if $\frac{\omega^2}{4\psi} > \kappa$.

The second-best expected surplus of the standard LEN model denotes

$$E[\Pi'_c] = \frac{1}{2(1 + r\sigma_\varepsilon^2)}. \quad (62)$$

This expression has to be compared with

$$E[\Pi^{SB}] = \frac{4\psi^2 + 2\psi\omega^2(1 + r\sigma_\varepsilon^2) + \omega^2}{8\psi^2(1 + r\sigma_\varepsilon^2) + 4\psi} - \psi\sigma_\varepsilon^2 - \kappa. \quad (63)$$

Taking the difference and rearranging the solution leads to

$$\Delta_{\Pi_{SB}} = E[\Pi'_c] - E[\Pi^{SB}] \quad (64)$$

$$= \frac{4\psi^2(r\sigma_\varepsilon^4 + \sigma_\varepsilon^2) + 2\psi}{4\psi(1 + r\sigma_\varepsilon^2)} + \kappa - \frac{4\psi^2 + 2\psi\omega^2(1 + r\sigma_\varepsilon^2) + \omega^2}{4\psi(1 + 2\psi(1 + r\sigma_\varepsilon^2))}. \quad (65)$$

Since all variables and terms are positive, it is apparent that $\Delta_{\Pi_{SB}} < 0$ if

$$\frac{4\psi^2(r\sigma_\varepsilon^4 + \sigma_\varepsilon^2) + 2\psi}{4\psi(1 + r\sigma_\varepsilon^2)} + \kappa < \frac{4\psi^2 + 2\psi\omega^2(1 + r\sigma_\varepsilon^2) + \omega^2}{4\psi(1 + 2\psi(1 + r\sigma_\varepsilon^2))}. \quad (66)$$

In order to determine the extents of agency costs one has to compare differences between the respective first-best and second-best surpluses. In the classical model agency costs are given as

$$AC_c = E[\Pi_c^*] - E[\Pi'_c] = \frac{r\sigma_\varepsilon^2}{2(1 + r\sigma_\varepsilon^2)}, \quad (67)$$

whereas in my model the costs denote

$$AC = E[\Pi^{FB}] - E[\Pi^{SB}] \quad (68)$$

$$= \frac{1 + 2\psi\sigma_\varepsilon^2(1 + r + 2\psi(1 + r\sigma_\varepsilon^2))}{2 + 4\psi(1 + \sigma_\varepsilon^2)}. \quad (69)$$

Taking the difference yields

$$\Delta_{AC} = AC_c - AC \quad (70)$$

$$= \frac{-1 - 4\psi\sigma_\varepsilon^2(1 + r\sigma_\varepsilon^2)(\frac{1}{2} + \psi(1 + r\sigma_\varepsilon^2))}{4(1 + r\sigma_\varepsilon^2)(\frac{1}{2} + \psi(1 + r\sigma_\varepsilon^2))}. \quad (71)$$

As the numerator is negative while the denominator is positive, $\Delta_{AC} < 0$, i.e., agency costs in my model are always greater than agency costs in the classic LEN model. ■

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