Essays on Earnings Management Incentives

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Meiner Familie.

Abstract

Disclosed financial reports have an important influence on the behavior of the corporate management. Managers have different motivations to generate a desired view on their companies and this can lead to undesirable side effects in the form of managerial manipulation. Selected issues of earnings management incentives arising from the managerial compensation, career concerns and socioemotional intentions of family-members are investigated in this dissertation.

In particular, the papers analyze:

- how explicit (from the compensation contract) and implicit incentives (from career concerns) affect the earnings management following a CEO turnover and, moreover, how this manipulation behavior is influenced by the intensity of competition for CEOs and the firm's corporate governance system,
- how disclosed R&D expenditures of the firm's financial statement is affected by opportunistic real earnings management and classification shifting in the presence of a stock-based compensation,
- how earnings management during a family firm succession is affected by incentives from socioemotional concerns of the family members and the selected scenario of the succession in regard to the firm's future management structure.

Keywords

- Earnings management, implicit incentives, big bath accounting, contracting, career concerns, discretionary accruals, CEO turnover, long-term innovation incentives, real earnings management, classification shifting, socioemotional wealth, family firm succession, altruism, inheritance taxation

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Introduction

At the beginning of the 21st century, a series of financial scandals caused sustaining uncertainty among investors and a loss of confidence in companies as well as in the capital markets. In order to counteract this loss of confidence and to ensure the future functioning of the capital markets, a number of countries adopted specific corporate governance guidelines in the form of codes or laws. An important objective of these guidelines is to improve the quality of corporate financial reporting. One key aspect is to provide information for external users to evaluate the company's financial and operating performance in terms of decision making. Therefore, the financial reports are prepared in consideration of the framework of accounting standards which has to ensure that this information allows investors a true and fair view. However, the preparation of financial reports is in the discretion of the executives and, thus, opportunistic earnings management can arise.

This cumulative work examines selected issues of earnings management incentives. Beside explicit manipulation incentives (i.e., caused by an accounting-based compensation), this study also considers implicit incentives by the disclosed financial information (e.g., when the CEO labor market uses financial reports to evaluate the managerial ability). Theoretical models are developed in which arising explicit and implicit incentives are described and their effect on the earnings management behavior is analyzed. A comprehensive overview of the motivation and the results of the essays is given in the following:

Essay 1: A number of empirical studies document a special kind of earnings management following CEO turnovers. It is often observed that incoming CEOs increase discretionary expenses during their first year in charge.[1] At the first glance, this big bath strategy is counter-intuitive. Managers are usually compensated according to periodical accounting numbers and, hence, there are incentives to raise their remuneration. Moreover, the incoming CEO is under pressure to generate good corporate performance. The existing literature argues that an incoming CEO takes an earnings bath to reduce the performance targets and to save earnings for future accounting periods. The poor performance in the

[1] For instance, see Murphy, K. J. and Zimmerman, J. L. (1993). Financial performance surrounding CEO turnover. *Journal of Accounting and Economics 16*(1–3), 273–315.

first year is often blamed on the previous CEO and, thus, it is commonly not attributed to the ability of the incoming CEO and has no significant impact on his reputation.[2] In contrast, a good performance in the following years has a positive effect on the reputation of the manager. Here, implicit incentives arise through expected future wages and career opportunities.[3] Therefore, the current performance does not only have an impact on the present incentive payment, it also affects the manager's reputation and the future compensation. Furthermore, since there are these both sources of manipulation incentives, it is obvious that the conditions on the CEO's job market and the corporate governance environment can influence the earnings management behaviour.

The first essay examines the earnings management incentives following an executive turnover in a two-period agency relationship. The model shows that an incoming manager has strong incentives to take an earnings bath strategy. These manipulation incentives are driven by both career-related concerns and the compensation contract. The influence of career concerns on the earnings management strategy is determined by the informativeness of the accounting reports about the managerial ability. Since the second-year accounting report is more informative about the manager's ability, he has an incentive to shift earnings to the second year to improve his labor market assessment. The manipulation incentives from the compensation contract can arise from different incentive rates of both periods. Therefore, to increase his compensation, the manager has incentives to shift earnings to the period with the higher incentive rate. Since the influence of the manager on the first-year performance is limited, a lower first-year incentive rate is optimal and this encourages the big bath incentives. However, for a risk-averse agent, the incentives for a big bath strategy are influenced by the compensation risk. An earnings overstatement in the manager's first year in charge can only occur if the uncertainty of the accounting earnings in the second year is sufficiently high. Furthermore, in a setting where the manager is risk neutral, the analysis shows that the amount of income-decreasing discretionary accruals is affected by the CEO labor market and the firm's corporate governance design.

[2] See Bornemann, S., Kick, T., Pfingsten, A., and Schertler, A. (2015). Earnings baths by CEOs during turnovers: Empirical evidence from German savings banks. *Journal of Banking & Finance 53*.

[3] See Hermalin, B. E. and Weisbach, M. S. (1998). Endogenously chosen boards of directors and their monitoring of the CEO. *American Economic Review 88*(1), 96–118.

Stronger external governance mechanisms lower the extent of a big bath. However, the internal governance system is only adjusted to the external control environment. Thus, higher internal control mechanisms (given by the incentive contract) and external control mechanisms (determining the cost of earnings management) act as substitutes rather than complements. Since big bath behaviour is strongly influenced by career-related incentives, more competition for top managers between firms increases the value of career-related future compensation which enhances the level of the earnings understatement.

Essay 2: R&D expenditures are highly affected by earnings management motivations. Innovation activities mostly lead to income-decreasing investment and whereby the corresponding returns are generated in the long run. To enhance the current accounting income, managers have the possibility to reduce the investment in R&D. However, innovation projects lead to future competitive advantages which have a positive impact on the current market valuation of the firm.[4] To prevent a short-term orientation of the corporate management, their compensation should be based on the firm's market price. However, since investors use the financial statement information for their valuation, the disclosed short-term numbers still have an implicit impact on the firm's value and incentives to manipulate this information also arise in the presence of a stock-based compensation. In the literature, a cut in R&D expenses is well documented as a real manipulation activity. In contrast, the misclassification of R&D expenses to affect the corresponding disclosed amount has been only slightly considered.

The second essay investigates an analytical model where the manager can engage in real earnings management and classification shifting in order to increase the market price and, thus, his compensation. There are incentives to affect the firm's market price via reported financial information. The results show that there is a positive relationship between an increase of disclosed R&D investment as a signal for innovation activity and the market price. This leads to incentives to misclassify operating expenses as R&D expenses. Beside a stronger competitiveness because of the increased innovation in the long run, this classification shifting also implies a higher core income. Thus, the manager attempts to

[4] See Lerner, J. and Wulf, J. (2007). Innovation and incentives: Evidence from corporate R&D. *The Review of Economics and Statistics 89*(4), 634–644.

exaggerate the disclosed investment in innovation without a reduction of the accounting income. In contrast to this reclassification activity, the real earnings management strategy is determined by the duration of the R&D projects. Beside a cut in the R&D expenses, which is documented by prior research, an over-investment can also occur if investment returns are realized in the short run. These results hold if the innovation risk is not too high. In the extreme case of a significantly high level of innovation risk, higher reported R&D expenses have an negative influence on the market price. An under-investment is always implemented and the manager uses classification shifting to reduce the disclosed R&D expenses. Moreover, assuming that there are conditions where real earnings management and classification shifting act as substitutes rather than complements if the precision of the accounting system changes.

Essay 3: The literature argues that, in contrast to publicly listed companies, managers of family firms are less engaged in income-increasing earnings management since there is no separation between ownership and management.[5] However, manipulation incentives could arise based on the relationship between family members. Especially, this could take place when the family-managed firm is transferred from the current to the following generation. The recent literature states the motivation behind by socioemotional wealth of the family members.[6] An important part of this theory is the altruism of parents for their children and the continuation of the family dynasty which can explain the preference for a charge free transfer to the successors (e.g., by donation or inheritance) against the sale of the firm shares. Therefore, the founder renounces current possible financial benefits to a future advantage of the successor(s). Surrounding a succession, socioemotional concerns may influence the decisions of the founder and can also have an impact on earnings management before this event (e.g., to avoid inheritance tax payment).

The third essay analyzes earnings management incentives during a family firm succession in a two-period model. Here, a founder can engage in real manipulation and accrual management in the period before the succession. As a main result, earnings management

[5] See Jiraporn, P., DaDalt, P. J. (2009). Does founding family control affect earnings management? *Applied Economics Letters, 16*(2), 113–119.

[6] See Gómez-Mejía, L. R., Cruz, C., Berrone, P., and de Castro, J. (2011). The bind that ties. Socioemotional wealth preservation in family firms. *The Academy of Management Annals, 5*(1), 653–707.

is driven by the socioemotional concerns of the founder. When firm shares are transferred to the next generation, the results show that manipulation incentives arise by aiming a reduction of the inheritance taxation payment of the successor. To do so, the founder can shift earnings in the period following the succession to lower the accounting income and, thus, the tax base. This accrual management strategy remains independent of whether the successor manages the firm or hires an external manager. There are also incentives to over-invest in the future capital stock if the founder's altruism is sufficiently high. Beside the objective to lower the inheritance tax payment by current investment, the successor receives higher earnings due to the larger future capital stock. However, if the firm is lead by an external manager following the succession, a lower level of over-investment in the first period occurs. The results also show how the level of the inheritance tax rate influences the founder's choice between a family-member and an external manager as CEO. Therefore, if the tax rate is sufficiently low, it can be beneficial that a less-capable successor manages the company.

Taken together, the essays provide the following results:

1. Following a CEO turnover, an earnings bath is driven by compensation-based and career-related incentives. An earnings overstatement can only occur if the uncertainty of the second-period accounting income is sufficiently high. The amount of discretionary accruals increases in a higher demand for top managers in the labor market and weaker external control mechanisms. Moreover, internal and external control mechanisms act as substitutes rather than complements in restricting earnings management.

2. Disclosed R&D expenses are not only affected by real earnings management. If the corporate management is compensated by the firm's stock price, the disclosure of the investment in R&D can be also influenced by misclassification of expenses. The manipulation strategy by the management is critically determined by the duration of the R&D phase and the innovation uncertainty of investments.

3. Family firms have incentives to engage in earnings management before a firm succession. The motivation behind this is to reduce future inheritance tax payment of

the successors which is driven by the socioemotional concerns of the founder. If the founder's degree of socioemotional wealth is significantly high, the accounting income is reduced by real earnings management and accrual management. Moreover, how strong the founder engages in manipulation can differ depending on whether the successor runs the firm or hires an external manager.

Essay I

Title

Big bath accounting and CEO turnover: The interplay between optimal contracts and career concerns

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Comment

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Big bath accounting and CEO turnover: The interplay between optimal contracts and career concerns

ABSTRACT

Following executive turnovers, it is often observed that discretionary expenses are used to reduce the current accounting income and to move earnings to subsequent periods. To provide an analytical explanation for this big bath behavior, we study a two-period agency setting in the presence of career concerns in which a manager can add a bias to the reported signal. Earnings management incentives are driven by both career concerns and the optimal compensation contract. We analyze how the optimal incentive contract affects earnings management in the presence of career concerns and we present circumstances under which a manager takes an earnings bath following a CEO turnover. A first-period earnings overstatement can only occur if the uncertainty in the agent's second-period performance measure is sufficiently high. Furthermore, we investigate the impact of the demand for top managers and the firm's corporate governance system on the level of discretionary accruals. More competition for CEOs between firms leads to an increase in earnings management. Internal control mechanisms and external control mechanisms act as substitutes rather than complements in restricting earnings management.

1 Introduction

Executive compensation often relies on periodical accounting numbers which are based on financial reporting. Therefore, managers may have incentives to undertake earnings management to raise their remuneration. Surrounding a CEO turnover, a special kind of earnings management is observed. A number of empirical studies document big bath accounting during CEO turnovers, i.e., incoming CEOs increase discretionary expenses during their first year in charge.[1] The existing literature argues that an incoming CEO takes earnings baths to reduce the performance targets and to save earnings for future periods. The poor performance in the first year, which is commonly a partial year, is often blamed on the previous CEO and, therefore, has only little impact on the new CEO's reputation.[2] In contrast, the results of the following years are attributed to the new manager's performance and a good performance has a positive effect on his reputation. Thus, it appears that the motivation behind big bath behavior is less driven by short-term compensation incentives than by career concerns.[3] Career concerns create implicit incentives through expected future wages related to employment opportunities of a CEO. Labor market participants update their beliefs concerning the CEO's ability with the arrival of new information about his performance.[4] Thus, the current accounting income has an impact on future compensation and determines the manager's reputation.

Besides these implicit incentives, the incoming CEO receives a compensation contract that creates explicit incentives. The incentive contract needs to control effort incentives, risk sharing, and earnings management simultaneously. We examine the interplay between implicit and optimal explicit incentives in such a setting. In equilibrium, the firm (principal) is aware of the manager's earnings management/big bath incentives and it may counteract or enhance it by the compensation contract. In this paper, we aim at providing

[1] See, for instance, Murphy and Zimmerman (1993), Pourciau (1993), Reitenga and Tearney (2003), Geiger and North (2006), and Bornemann et al. (2015).

[2] See Ali and Zhang (2015) and Bornemann et al. (2015).

[3] In a survey of over 400 CFO's, Graham et al. (2005) document that more than 75% of the respondents agree that the primary incentive to hit performance targets was to improve their external reputation.

[4] Hermalin and Weisbach (1998) argue that the ability of new CEOs is usually unknown to the market. Therefore, their earnings management is very aggressive.

an explanation for big bath accounting even if the firm is able to control it by the optimal incentive contract. Having done this, we analyze how the intensity of competition for CEOs on the labor market and the firm's corporate governance system affect earnings management behavior.

To address these questions, we consider a two-period agency relationship in which the manager can engage in earnings management. The firm value is affected by the manager's effort in both periods and by his ability. A publicly observable and contractible accounting signal must be disclosed at the end of every period. The compensation contract and the future compensation from the labor market depend on these accounting signals. The manager can conduct earnings management in the first period. In our model, earnings management reflects a shift of earnings between two periods and, therefore, the bias of the first period must be reversed in the second period. To take the situation following CEO turnover into account, we assume that accounting earnings recognize the true earnings with a lag (lack of timeliness of financial reporting[5]) such that the influence of the new manager's ability on the accounting earnings in the first period is smaller than in the subsequent year.

At first, we examine the manager's earnings management strategy, which determines whether the manager over- or under-reports in the first period. We analyze how earnings management is driven by the interplay of career concerns and the optimal compensation contract. The influence of career concerns on the earnings management strategy is determined by the informativeness of the accounting signals about the manager's ability. Since the second-period accounting signal is more informative about the manager's ability, the manager has an incentive to shift earnings to the second period to improve his labor market assessment. The earnings management incentives from the compensation contract arise from the difference between the incentive rates of both periods. Hence, from a pure compensation perspective, the manager has incentives to shift earnings to the period with the higher incentive rate. In the absence of risk aversion, the optimal contract

[5] In our model, we use the theoretical concept introduced by Ball et al. (2000). They define timeliness as the degree to which the change in the market value of a firm is described by the current accounting profit. For an overview of the literature regarding the timeliness of financial reports, see Bushman and Smith (2003), and Armstrong et al. (2010).

encourages big bath behavior. However, assuming a risk-averse manager, we show that if the uncertainty in the second-period accounting earnings is sufficiently high, an earnings overstatement in the first period occurs. Interestingly, if the timeliness of the accounting system is low, a more risk-averse agent increases the firm's surplus. The reason is that a low timeliness of the accounting earnings makes effort motivation hard but earnings management incentives survive. In such a situation, hiring a highly risk-averse manager is a commitment of the firm to the market to similar incentive rates in both periods. Thus, equilibrium earnings management will be kept at bay.

We also study the influence of the firm's corporate governance system and the CEO labor market competition on the optimal level of discretionary expenses in the first year after a CEO turnover. We distinguish between internal and external governance. We find that a stronger external governance mechanism (e.g., the regulatory environment) reduces earnings management and increases the owner's surplus. The internal governance, represented by the incentive contract, acts as a substitute for external control mechanisms. The owner adjusts the incentive contract to counteract earnings management if the effectiveness of the external governance decreases. We also study how competition in the CEO labor market affects the level of an earnings bath and the owner's surplus. Higher competition for top managers between firms increases the value of career-related future compensation, and thus lowers the required current compensation. At the same time, higher future compensation increases earnings management incentives. We show that, in equilibrium, an increase in the competition intensity for CEOs between firms has only a positive effect for the owner if the manager's prior expected ability is high or the competition intensity is sufficiently low. Otherwise, more competition leads to a lower surplus.

Taken together, our results show that (i) the manager prefers a big bath strategy in the first year in charge unless the compensation risk in the second year is sufficiently high, (ii) a stronger external governance reduces the bias and (iii) higher competition for executives increases earnings management. In contrast to previous models of earnings management, we show that explicit incentives from an optimal contract in many cases encourage big bath accounting in the year following the executive turnover. Therefore, our study contributes to a better understanding of big bath incentives following turnover and how it is affected by the optimal incentive contract, by the firm's corporate governance mechanisms, and by the market for top managers.

Our paper is related to recent work on earnings management. Some authors examine earnings management in a single-period agency model, e.g., Feltham and Xie (1994). They consider a specific form of manipulation called window dressing where a costly activity affects the reported earnings, but has no effect on the underlying economic earnings.[6] In contrast to the single-period models, we study inter-period effects of earnings management such that under-reporting can become part of the manager's optimal manipulation strategy.

There are several papers that investigate earnings management problems where a manager can switch earnings across periods. Kirschenheiter and Melumad (2002) examine big bath accounting in a capital market model. They show that for sufficiently bad news, taking an earnings bath is optimal for the manager. As opposed to our paper, Kirschenheiter and Melumad (2002) do neither consider a turnover situation nor agency conflicts in their model. In their paper, there is no need (and no possibility) to control the manager's reporting behavior. The manager's reporting strategy is solely chosen to affect the capital market's inferences about the future cash flows. In our model, in contrast, the manager's incentive contract and the labor market's inferences about the manager's talent determine big bath accounting.

Similar to our model, Christensen et al. (2013) and Dutta and Fan (2014) analyze a LEN-model in which a self-interested manager can switch earnings across periods.[7] Christensen et al. (2013) identify settings in which the possibility of earnings management improves the agency's surplus. Dutta and Fan (2014) study how the possibility of earnings management affects the optimal contract for the manager.[8] They find that the incentives to manage earnings are driven by the difference between the incentive rates for the two periods, whereas their absolute levels have no effect. We observe a similar effect of the in-

[6] In contrast, real earnings management also affects economic earnings. For instance, see Ewert and Wagenhofer (2005).

[7] Liang (2004) also studies a two-period agency model of earnings management. Unlike our setting, he considers a binary effort model and assumes that the compensation schemes are exogenously given.

[8] As opposed to Christensen et al. (2013), they consider a full commitment setting.

centive contract on big bath accounting. However, as opposed to our model, both studies do not investigate the influence of career concerns on earnings management.

Our paper is also tied to the literature on career incentives. This area of research is strongly influenced by the work of Holmström (1982) who investigates career-related incentives in an agency relationship in the presence of a competitive labor market. He shows that, even in the absence of explicit contracts, managerial effort incentives are provided since the labor market uses firm performance to update expectations about the manager's talent. Furthermore, several studies examine career concerns to provide insights into, e.g., performance reporting (Wolitzky, 2012), investment incentives (Milbourn et al., 2001), aggregate performance measures (Arya and Mittendorf, 2011), and compensation contract design (Khoroshilov and Narayanan, 2008). Among these, the influence of career concerns on earnings management is investigated by Demers and Wang (2010) and Nieken and Sliwka (2015). In Demers and Wang (2010), a CEO can manage earnings to enhance his labor market assessment. They find that the incentives for earnings management increase in later stages of the manager's career. The work of Nieken and Sliwka (2015) is more closely related to our model and is concerned to explain big bath accounting.[9] They consider an overlapping generations model and study the influence of management turnover on reported income in the presence of career concerns. They find that an incoming manager has a career-related incentive for an earnings bath in the first period in office. However, in contrast to our approach, both papers do not consider the opportunity to control earnings management by an optimal incentive contract. Moreover, our paper is related to Dutta and Fan (2016) who examine how the possibility of earnings management influences the optimal renegotiation-proof incentive contract. Besides the contract, the manager is incentivized by implicit incentives from career concerns. They find that optimal explicit incentives may decrease over time.[10] Unlike our paper, Dutta

[9] Yu (2017) considers earnings management behavior surrounding CEO turnover in a two-period model. He examines how the manipulation is affected by the strategic interaction between an incoming and an outgoing CEO. The paper shows that an earnings bath can be induced by the reporting strategy of the outgoing CEO and the capital market reaction. Unlike our model, Yu (2017) does not explain the manipulation incentives arising from career concerns and an optimal contract.

[10] In a similar setting without earnings management possibilities Gibbons and Murphy (1992) found that explicit incentives increase over time.

and Fan (2016) do neither consider a CEO turnover setting nor do they investigate the influence of the timeliness of the accounting system on the equilibrium earnings management strategy. Moreover, none of the above cited papers considers how the firm's governance mechanisms and the competition for CEOs influence both the equilibrium compensation contract and big bath incentives.

Finally, our paper contributes to the literature that investigates the relation between internal and external governance mechanisms. The empirical evidence is mixed: while some studies suggest a complementary relation (Hay et al., 2008; Ward et al., 2009; Becher and Frye, 2011), others find that internal and external governance are substitutes (Li, 2014; Guo et al., 2015). Similar to our investigation, Cheng and Indjejikian (2009) explicitly consider the relation between the manager's compensation contract and the external governance. In their empirical analysis, they find that the compensation contract and the market for corporate control are complements.[11] We, in contrast, analytically demonstrate that the compensation contract and the external governance act as substitutes in an earnings management setting.

The rest of the paper is organized as follows. The next section introduces the model setup. In Section 3, we derive the optimal incentive contract and the corresponding earnings management strategy. In Section 4, we evaluate how corporate governance mechanisms and competition in the CEO labor market affect the equilibrium level of earnings management and the owner's surplus. In Section 5 we consider several robustness checks, and Section 6 concludes.

[11] Acharya et al. (2011) consider a two-period model where internal governance is related to the power of subordinates to limit the CEO's opportunistic behavior. They too find a positive influence of the external governance on the efficiency of the internal governance.

2 The model setup

We consider a two-period LEN-setting with a risk-neutral owner and a (weakly) risk-averse manager. At the beginning of the first period, the owner offers a renegotiation-proof two-period contract to the manager. The manager exerts an effort e_t in both periods $t = 1,2$. The agent's contribution to the firm value V is defined as:

$$V = 2a + e_1 + e_2.$$

We assume that the agent's contribution to the firm value cannot be isolated from the firm's other assets (Budde, 2007; Mauch and Schöndube, 2018) such that V is not observable and thus not available for contracting purposes. Let a be a measure of the manager's ability which is incompletely known to all parties. The ability a affects the firm value in each period $t = 1,2$. As V is not contractible, the owner has to choose an alternative performance measure for the manager. We assume that in each period the firm's accounting system produces a measure that is reported in the financial statements and, therefore, it becomes contractible.

To capture a setting with a new manager following a CEO turnover, we assume that the manager works for the first time for the firm, i.e., we do not have to consider the history of the management and contracting decisions. Furthermore, the manager's influence on the reported accounting numbers is limited in his first year in office, e.g., as it is a partial year. To take this situation into account, we make use of the concept of the timeliness of the accounting system.

Accounting timeliness and CEO turnover

The accounting system is not capable to capture all changes in the firm value, which are caused in one period, in the same period's accounting measure. This imperfection is the result of two effects. First, the recognition of changes in value is limited by existing accounting standards. Examples are the percentage-of-completion method of construction contracts (IAS 11), the forbidden recognition of internally generated goodwill (IAS 38.48) and the domination of historical cost measurement.

Second, a part of the economic consequences of the manager's decisions in a period shows up some time in the future and, thus, is not included in the current period's accounting signal. The decisions of the current period then also affect the signal(s) of the following periods. Examples are the implementation of a new corporate strategy or a new R&D project. The realization of the manager's decisions in the accounting earnings is also significantly influenced by the industry and the business model of a firm. In case of a dot-com or a highly innovative company, the connection between the current accounting earnings and the firm value is low compared to a firm which belongs to the mature industry.

Therefore, we assume that the accounting earnings x_t reflect only a fraction $q \in (0,1)$ of the value creation in period t.[12] The remaining share is captured in the next period's accounting earnings x_{t+1}. Thus, q essentially depends on the accounting standards and the industry in which the firm operates. The true accounting earnings in period t are defined by:

$$x_t = q(a+e_t) + (1-q)(a+e_{t-1}) + \theta_t.$$

The ability a and the accounting noise terms θ_t are jointly normally distributed random variables:

$$a \sim N(\bar{a}, \gamma\sigma^2),$$

$$\theta_t \sim N(0, (1-\gamma)\sigma^2).$$

$\gamma = \frac{Var(a)}{Var(a)+Var(\theta_t)} \in (0,1)$ is the fraction of the variance of total noise $(a+\theta_t)$ attributable to the ability.[13] We assume that all noise terms are pairwisely uncorrelated.

[12] The modeling of the timeliness of the accounting system is similar to the work of Nieken and Sliwka (2015). However, while in their model the parameter q only affects the influence of the managerial ability on earnings recognition, we also consider the effect on the effort. In a static setting, Kuhner and Pelger (2015) interpret the parameter q as the degree of the value relevance of an accounting system. In contrast, Christensen et al. (2013) model the timeliness of an accounting system as an exogenous and independent accrual noise.

[13] The modeling of the noise terms is similar to Autrey et al. (2007).

Following executive turnover, a new external CEO is in charge. Ignoring the effect of the new manager's predecessor, the accounting earnings in the two periods following the CEO turnover are given by:[14]

$$x_1 = q(a + e_1) + \theta_1,$$

$$x_2 = q(a + e_2) + (1 - q)(a + e_1) + \theta_2.$$

As the accounting earnings capture the economic consequences of decisions with a lag, the influence of the incoming manager's ability a on the accounting earnings in his first year in office is limited to the portion $q < 1$.

Earnings management

At the end of each period, the manager privately observes the accounting earnings x_t. Based on this information, he has to disclose an accounting report y_t at the end of the period t. He has discretion over the reported numbers and can use this opportunity to manipulate the accounting earnings, e.g., by using judgments in a principle-based accounting system. In particular, we assume that he can add a bias b to the earnings in the first period. The reported accounting signals are defined as follows:

$$y_1 = x_1 + b = q(a + e_1) + \theta_1 + b,$$

$$y_2 = x_2 - b = q(a + e_2) + (1 - q)(a + e_1) + \theta_2 - b.$$

The earnings management activity can be viewed as a window dressing task and the sign of the bias can be either positive or negative. We assume that the bias, which is added or subtracted in the first period, is reversed in the second period.

[14] Note that, due to the lag in the accounting earnings, first-period accounting earnings x_1 are also influenced by the outgoing manager p's ability and effort, $(1 - q)(a^p + e_0^p)$. However, a consideration of a predecessor does not qualitatively change our primary results. Hence, to simplify the model, we focus solely on the effect of the incoming manager.

In our analysis, we aim at providing an explanation for big bath accounting as the optimal manipulation strategy following a management change. In the literature, the term big bath is used to describe a setting where current reported earnings are biased downwards at the benefit of future earnings (e.g., Nikolai et al. (2010), p. 513). The reasons for taking a big bath are diverse. For example, Elliott and Shaw (1988) suggest that a big bath can be interpreted as an appropriate reaction to existing problems. Another cause to take a big bath is that the occurrence of bad news can lead firms to make the news even worse causing only little damage (Walsh et al., 1991). DeAngelo (1988) finds big bath behavior from newly elected managers after a successful proxy contest. Similarly, we consider big bath incentives following a CEO change. From a model perspective, similar to Nieken and Sliwka (2015), a reduce in current earnings (big bath) goes along with $b < 0$.

As our focus is set on earnings management incentives directly after a management turnover, for the reason of tractability, we do not explicitly consider a second-period manipulation activity in the main model. However, we investigate the effect of a second-period earnings management activity in the robustness checks in Section 5.

Career concerns

The manager is concerned about his reputation on the labor market.[15] At the end of the second period, the manager leaves the firm and obtains a new contract from the labor market. Labor market participants cannot observe the manager's actions and the design of the contract,[16] but they build rational conjectures about these values. Similar to Autrey et al. (2007), we assume that the market sets the manager's wage proportional to his expected ability, conditional on the reported signals y_1 and y_2, and conditional on rational conjectures with respect to the unobservable compensation contract $\widehat{w}$, efforts $\widehat{e_1}, \widehat{e_2}$, and earnings management $\widehat{b}$. More specifically, career-related compensation is defined by ϕLM_2, where $LM_2 = E[a \mid y_1, y_2, \widehat{w}, \widehat{e_1}, \widehat{e_2}, \widehat{b}]$. The parameter $\phi > 0$ is exogenously given

[15] The labor market is modeled similar to the capital market in Fischer and Verrecchia (2000) who consider earnings management in a single-period setting and examine the effect of a bias on the market assessment.

[16] According to IFRS, the total amount of the CEO compensation has to be disclosed and, therefore, it is observable. In contrast, the underlying structure of the contract is non-observable.

and can be interpreted as a measure of the degree of competition in the market for CEOs (see Section 4.2 for details).

As (a, y_1, y_2) are jointly normally distributed, LM_2 is normally distributed, too. Applying the rules for updating the probability distribution of a normally distributed random variable, conditional on the observation of a set of normally distributed variables,[17] we obtain:

$$LM_2 = \beta_0 + \beta_1 y_1 + \beta_2 y_2,$$

where $\beta_0 = \overline{a} - \beta_1(q(\overline{a} + \widehat{e_1}) + \widehat{b}) - \beta_2(\overline{a} + q\widehat{e_2} + (1-q)\widehat{e_1} - \widehat{b})$, $\beta_1 = q\frac{\gamma}{1+q^2\gamma}$ and $\beta_2 = \frac{\gamma}{1+q^2\gamma}$. Thus, the expected ability conditional on the observation of the reported accounting signals is a linear function of the two signals. Notice that $\beta_1 < \beta_2$. Due to our assumptions on turnover and timeliness, the first-period accounting measure is affected by the fraction q of manager's ability while the second-period signal is affected by the full ability, thus, $\beta_1 = q\beta_2$. The second-period signal has a higher information content about the manager's ability than the first-period signal and, therefore, gains more weight in revising expectations.

The manager's utility

At the beginning of the first period, the principal offers a two-period linear compensation contract w to the manager,

$$w = f + s_1 y_1 + s_2 y_2,$$

where f denotes the fixed salary and s_t the incentive rate in period t. The earnings management activity and the effort are costly for the manager. The disutility functions of the manager in period $t = 1, 2$ are given by:

$$c_1 = \frac{e_1^2 + \lambda b^2}{2},\ c_2 = \frac{e_2^2}{2}.$$

[17] See DeGroot (1970), p. 55, formula (19).

The parameter $\lambda > 0$ scales the costs of earnings management. We denote the manager's total disutility from working by $C = c_1 + c_2$.

The manager is weakly risk-averse with utility $U^M = -\exp[-r(w - C + \phi LM_2)]$ or $U^M = w - C + \phi LM_2$ in case of risk neutrality. $r > 0$ is the manager's degree of risk aversion. Given linearity and normally distributed random variables, the manager's certainty equivalent given the information at $t = 0$ is:

$$CE_0 = E[w - C + \phi LM_2] - \frac{r}{2} Var(w + \phi LM_2), \tag{1}$$

where risk neutrality can be captured by setting $r = 0$ in (1). The manager's reservation wage is set to zero without loss of generality. For a strictly risk-averse manager, equilibrium earnings management is affected by the posterior variance of y_2 given the realization of y_1, $Var(y_2|y_1)$. It is given by $\sigma^2_{2|1} \equiv Var(y_2|y_1) = \sigma^2 - \frac{\sigma^2 q^2 \gamma^2}{1-\gamma(1-q^2)}$.

Timeline of the model

At $t = 0$, the owner offers the manager a two-period renegotiation-proof compensation contract w. If the manager accepts the offer, he performs a productive effort at the beginning of both periods. The earnings management activity only takes place in the first period. At the end of the first period, the manager reports $y_1 = x_1 + b$, by choosing bias b. As there is no earnings management in the second period, the signal reported at the end of the second period is $y_2 = x_2 - b$. At the end of period two, the manager leaves the firm and the labor market offers the manager a contract with a payment proportional to LM_2. For simplicity, the discount rate is normalized to be zero. Figure 1 summarizes the timeline of the model.

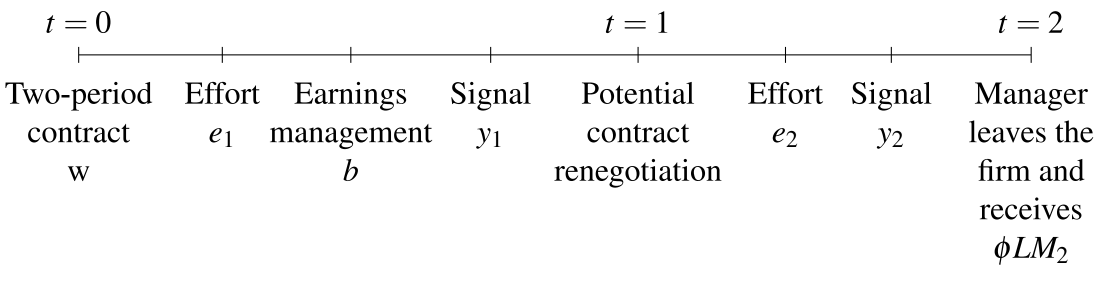

Figure 1: Timeline of events.

3 Optimal contracting during a CEO turnover

3.1 Benchmark solution

If the manager's actions were observable and contractible, it would be strictly optimal to pay only a fixed payment f to the risk-averse manager to avoid the risk premium $\frac{r}{2}Var(\cdot)$.[18] At the optimum, f makes the manager's participation binding, $f = C - \phi E(LM_2)$. If we would assume that the effort is also observable to the labor market, $E(LM_2) = \overline{a}$ results and the principal chooses e_1, e_2, b so as to maximize $E(V) - f = (2+\phi)\overline{a} + e_1 + e_2 - \frac{e_1^2+\lambda b^2}{2} - \frac{e_2^2}{2}$. The optimal solution is $e_1 = e_2 = 1$ and $b = 0$. In our model, neither the manager's actions nor the principal's contracting decisions are observable to the market. In line with this assumption, a benchmark solution in which (e_1, e_2, b) and f are unobservable to the market is appropriate for our analysis. In this case

$$\begin{aligned} E(V) - f &= 2\overline{a} + e_1 + e_2 - \frac{e_1^2 + \lambda b^2}{2} - \frac{e_2^2}{2} \\ &\quad + \phi\left[\beta_0 + \beta_1\left(q\left(\overline{a}+e_1\right)+b\right) + \beta_2\left(q\left(\overline{a}+e_2\right) + (1-q)\left(\overline{a}+e_1\right) - b\right)\right]. \end{aligned}$$

This function is maximized by $e_1^{FB} = 1 + \phi\left(\beta_1 q + \beta_2(1-q)\right)$, $e_2^{FB} = 1 + q\phi\beta_2$, $b^{FB} = \frac{\phi(\beta_1-\beta_2)}{\lambda}$. In contrast to the case that intra-firm decisions are observable to the market, both productive efforts are higher and a negative bias is also implemented. The reason is that the principal aims at reducing the fixed payment to the manager by increasing the manager's future compensation $\phi E(LM_2)$.[19] Higher productive effort and negative bias b are chosen to positively influence the market's posterior beliefs about the manager's ability. In equilibrium, the market is not fooled and it correctly anticipates efforts and bias. Even though high-powered efforts and bias are conjectured by the market, the best the principal can do is to fulfill these conjectures.

[18] If the manager is risk neutral, using a fixed payment is without loss of generality.

[19] A similar effect is documented by Wolitzky (2012). He investigates reporting policies and managerial reputation building in a two-period agency model in the presence of a labor market evaluation. He finds that the agent may accept a lower compensation payment at the benefit of a better performance report by the principal.

3.2 Second-best solution

We assume that the parties can commit to the two-period relationship. Therefore, if the manager accepts the initial contract, the owner does not replace the manager after the first period and the manager does not leave. However, the parties cannot exclude renegotiation of the contract at the end of the first period. Specifically, we assume that the principal can offer a new contract $w^R = f + s_1 y_1 + s_2^R y_2 + f^R$ at the end of the first period (after y_1 has been observed). w^R can change the incentive coefficient $\left(s_2^R\right)$ for y_2 and potentially pay an additional fixed payment f^R. In a setting with complete contracts, the anticipated change of the contract at the renegotiation stage can be included in the initial contract w, such that there is no loss of generality in considering renegotiation-proof contracts, i.e., initial contracts that are robust against renegotiation at the end of the first period. Christensen et al. (2003) have shown that any initial contract in which the second-period incentive coefficient is chosen sequentially optimal is renegotiation-proof. We consider this kind of renegotiation-proof contracts in our paper. As shown by Gibbons and Murphy (1992) and Christensen et al. (2003), a long-term renegotiation-proof contract induces the same incentives and payoffs as a sequence of single-period contracts, often employed in the career-concerns literature.

In the next subsection, we derive the sequentially optimal incentive weight for the second period that makes any initial contract w renegotiation proof.

3.2.1 Second-period effort and sequentially optimal second-period incentives

At the beginning of the second period, the manager has performed e_1 and b and he has reported y_1. If w^R is the final contract, he chooses second-period effort so as to maximize his certainty equivalent given his information set at $t = 1$ which is given by:

$$\begin{aligned} CE_1^R &= s_1 y_1 + f - c_1 + f^R + s_2^R E\left(y_2^R | y_1, e_1, b\right) - c_2\left(e_2^R\right) + E\left[\phi LM_2\left(y_2^R\right) | y_1, e_1, b\right] \\ &\quad - \frac{r}{2} Var[s_2^R y_2^R + \phi LM_2\left(y_2^R\right) | y_1, e_1, b]. \end{aligned}$$

e_2^R denotes the agent's second-period effort if w^R is the final contract and y_2^R is the corresponding value of the second-period accounting signal. If w is the final contract, the respective certainty equivalent is defined by CE_1 (with values s_2, e_2, and y_2 and without f^R). From the first-order condition $\frac{\partial CE_1^R}{\partial e_2^R} = 0$, we obtain $e_2^R = q(s_2^R + \phi\beta_2)$.

We now assume that the principal has selected contract w at the beginning of the game with incentive parameter s_2. The sequentially optimal second-period incentive rate at the renegotiation stage solves the following problem:

$$\max_{f^R, s_2^R} EU_1 = e_2^* - E[s_2^R y_2 + f^* \mid y_1, \widehat{e}_1, \widehat{b}] \tag{2}$$

subject to

$$CE_1^R \geq CE_1$$

$$e_2^R = q(s_2^R + \phi\beta_2).$$

EU_1 is the principal's expected return from second-period effort less the compensation cost from the new contract w^R, conditional on the observation of y_1 and conditional on conjectures about first-period actions $\left(\widehat{e_1}, \widehat{b}\right)$. All other elements of the principal's objective function can be regarded as constants at the renegotiation stage. The principal has to consider two constraints in his optimization problem. First, the incentive constraint for the effort of period two and second, the participation constraint $CE_1^R \geq CE_1$. The latter ensures that the manager will only accept the new contract offer at the renegotiation stage if he is not worse off with the new contract. Lemma 1 states the solution to the above problem.

Lemma 1 *The sequentially optimal incentive rate for the second period and the corresponding effort are given by:*

$$s_2^* = \frac{q - r\sigma_{2|1}^2 \phi\beta_2}{r\sigma_{2|1}^2 + q^2}, \tag{3}$$

$$e_2^* = q(s_2^* + \phi\beta_2). \tag{4}$$

Proof. See the Appendix.

Note that s_2^* trades-off incentivizing e_2 subject to the posterior risk premium, represented by $r\sigma_{2|1}^2$. Neither the long-term effect of e_1 on y_2 nor the ex ante risk premium are considered ex post. Comparative statics show that $\frac{\partial s_2^*}{\partial \sigma_{2|1}^2} < 0$ and $\frac{\partial s_2^*}{\partial \beta_2} < 0$. Furthermore, $\frac{\partial s_2^*}{\partial q} < 0$ if r is sufficiently low. High $\sigma_{2|1}^2$ makes motivating e_2 costly from a risk-charging perspective, such that low-powered incentives are optimal. The parameter β_2 has three effects on the principal's optimization problem. First, if we consider optimal second-period effort e_2^*, the incentives from the labor market $\phi\beta_2$ act as a substitute for explicit incentives s_2^*. Second, future market compensation is uncertain and the posterior risk premium increases in β_2. Third, higher future market compensation resulting from high β_2 increases the manager's wealth such that less compensation from the principal is necessary to fulfill the participation constraint. The first and the third effect vanish at the optimum: if the principal increases s_2 by one marginal unit, the additional compensation from the market due to higher effort is exactly offset by the additional disutility from effort. Thus, only the risk effect matters and, therefore, s_2^* decreases in β_2. Notice that the marginal contribution of second-period effort to firm value is 1 but its marginal contribution towards y_2 is q. If the manager were risk neutral $(r = 0)$, $s_2^* = 1/q$ would result, i.e., the lower the timeliness, the higher the incentive rate must be to induce the desired effort. However, if manager's risk aversion increases, high-powered incentives become more costly such that the effect eventually reverses.

As f^R's only task is to make the participation constraint binding, we omit its value in Lemma 1. Obviously, if the principal sets $s_2 = s_2^*$ in the initial contract, she has no incentive to renegotiate the initial contract such that the initial contract is also the final contract. In what follows, we consider the set of renegotiation-proof initial contracts characterized by $s_2 = s_2^*$.

3.2.2 First-period action choice and initial contract

Any initial contract w with $s_2 = s_2^*$ as given in (3) is renegotiation-proof. We now determine the (sequentially) optimal first-period incentive rate and the resulting values for first-period effort and bias. The corresponding optimization problem is given by:

$$\max_{f,s_1} EU_0 = E(V-w) = E[2a+e_1+e_2^*-w]$$

subject to

$$CE_0 \geq 0,$$

$$(e_1,b) \in \underset{e_1',b'}{argmax}\, CE_0(e_1',b'),$$

$$e_2 = e_2^* = q(s_2^*+\phi\beta_2),$$

$$s_2 = s_2^* = \frac{q-r\sigma_{2|1}^2\phi\beta_2}{r\sigma_{2|1}^2+q^2}.$$

The owner maximizes the expected firm value net of managerial compensation, subject to four constraints. The first constraint ensures participation of the manager, the second and the third constraint are the incentive constraints for the manager's actions, and the last constraint makes the initial contract renegotiation-proof. The solution to the problem is presented in Lemma 2.

Lemma 2 *The sequentially optimal first-period incentive rate and the first-period actions are given by:*

$$s_1^* = \frac{s_2^*\left(1+\lambda\, q\left(q-1-\gamma r\sigma^2\right)\right)+\lambda\,\left(q-\phi\,\beta_2\, r\sigma^2\gamma q - r\phi\,\sigma_1^2\,\beta_1\right)}{1+\left(q^2+r\sigma_1^2\right)\lambda}, \tag{5}$$

$$e_1^* = q\,(\phi\,\beta_1+s_1^*)+(1-q)\,(\phi\,\beta_2+s_2^*), \tag{6}$$

$$b^* = \underbrace{-\frac{(s_2^*-s_1^*)}{\lambda}}_{\text{Explicit incentive}}\ \underbrace{-\frac{\phi\,(\beta_2-\beta_1)}{\lambda}}_{\text{Implicit incentive}}, \tag{7}$$

with $\sigma_1^2 = Var\,(y_1) = \sigma^2\left(\gamma q^2-\gamma+1\right)$.

Proof. See the Appendix.

In contrast to s_2^*, the equilibrium first-period incentive rate s_1^* depends on the degree of managerial costs for earnings management (λ). This is because the principal uses s_1 not only to control first-period effort but also to control earnings management.[20]

Equation (7) shows that the equilibrium level of earnings management is a function of two components, $b^* = b^S + b^{LM}$:

$$b^S = -\frac{s_2^* - s_1^*}{\lambda}, \tag{8}$$

$$b^{LM} = -\frac{\phi(\beta_2 - \beta_1)}{\lambda}. \tag{9}$$

The first component b^S is the explicit incentive which is determined by the compensation contract, while the second component b^{LM} results from career-related incentives based on the labor market's assessment of managerial ability.

3.3 Equilibrium earnings management strategy

We now turn our attention to the question whether the manager selects over- or under-reporting in the first period in office. This depends on the sign of b^*. Only if the optimal bias is negative, the manager shifts earnings from the first to the second period and, thus, an earnings bath occurs.

Result 1 *The following observations regarding the optimal earnings management strategy can be derived:*

1. *The implicit incentive component b^{LM} is always strictly negative.*
2. *The sign of the explicit incentive component b^S is determined by the difference between the incentive rates s_1^* and s_2^*. b^S decreases in the posterior variance $\sigma^2_{2|1}$ and there is a critical value $\overline{\sigma}^2_{2|1}$, so that b^S is strictly negative (positive) if $\sigma^2_{2|1}$ is lower (higher) than $\overline{\sigma}^2_{2|1}$.*

[20] From Lemma 1 and 2 it follows that the implicit incentives, scaled by ϕ, have an effect on the sequentially optimal incentive rates and, thus, on the effort and the bias. In contrast, in Dutta and Fan (2016) the implicit incentives have no impact on equilibrium bias and effort.

3. *In equilibrium, the earnings management strategy of the manager exhibits:*

   (a) *an earnings bath if* $\begin{cases} \sigma^2_{2|1} \leq \overline{\sigma}^2_{2|1} \\ \sigma^2_{2|1} > \overline{\sigma}^2_{2|1} \text{ and } |b^S| < |b^{LM}|, \end{cases}$

   (b) *an earnings overstatement if* $\sigma^2_{2|1} > \overline{\sigma}^2_{2|1}$ *and* $|b^S| > |b^{LM}|$,

with $\overline{\sigma}^2_{2|1} = \frac{q\left(\gamma q r \sigma^2(\phi q \beta_2+1)+r\sigma_1^2(\phi q \beta_1+1)+q(1-q)\right)}{r\left(q+\beta_2\phi\left(q+r\sigma_1^2(1-q)\right)\right)}$.

Proof. See the Appendix.

The first part of Result 1 shows that b^{LM} has an unambiguous effect on the manager's earnings management strategy: the presence of career-related incentives always enhances first-period under-reporting. The reason is that second-period earnings are more informative about the manager's ability than first-period earnings, $\beta_2 > \beta_1$, and, therefore, the second-period signal is more important for the labor market assessment than the first-period signal.[21] Hence, the second-period signal has a higher impact on the manager's reputation than the first-period one such that the manager has an incentive to transfer some earnings to the second period. This seems to be intuitive in a turnover setting: The accounting earnings following a CEO turnover are often only marginally affected by the incoming manager's talent and work in his first year in office. For instance, the effects of the development and implementation of a new strategy only show up in the long run. Consequently, the manager tries to increase the labor market assessment LM_2 by shifting earnings from the first to the second period. This, ceteris paribus, leads to an earnings bath.

The recent literature often explains big bath behavior by career-related incentives (e.g., Kuang et al., 2014; Ali and Zhang, 2015). However, under-reporting in the first period can also be driven by the incentive contract. Equation (8) shows that the explicit component of the optimal bias, b^S, arises from the difference between incentive rates in period one

[21] Nieken and Sliwka (2015) find a similar relation in a model where the manager cares about his short-term and his long-term reputation.

and two. Therefore, the manager has an incentive to increase his compensation by moving earnings to the period with the higher incentive rate.

The difference between the incentive rates is affected by the trade-off between providing effort (including manipulation) incentives and risk sharing. s_2^* trades off the incentive for e_2 and the posterior risk premium. Given the sequentially optimal value for s_2^*, s_1^* will be chosen to motivate e_1 and to control b recognizing the prior risk premium, and recognizing that both e_1 and b will be affected by s_2^*. Even the pure incentive effect is involved, such that we disentangle it at the end of this section by considering a risk-neutral manager. Here, we concentrate on the impact of performance measure risk on big bath accounting from the explicit contract.

Part (ii) of Result 1 shows that the posterior variance $\sigma_{2|1}^2$ influences the sign of the explicit incentive component. If $\sigma_{2|1}^2$ becomes sufficiently high $\left(\sigma_{2|1}^2 > \overline{\sigma}_{2|1}^2\right)$, $s_2^* - s_1^* < 0$ results. In addition, the following marginal effect holds true:[22]

$$\frac{\partial (s_2^* - s_1^*)}{\partial \sigma_{2|1}^2} < 0.$$

The higher the posterior risk, the lower the second-period incentives. If s_1^* decreases in s_2^*, the total marginal effect $\frac{\partial (s_2^* - s_1^*)}{\partial \sigma_{2|1}^2}$ must be negative. But even if s_1^* increases in s_2^*, the direct effect of $\sigma_{2|1}^2$ on s_2^* is always stronger than the indirect effect on s_1^*. As a consequence, a sufficiently high level of the posterior uncertainty in the accounting earnings changes the sign of b^S. Assume the posterior variance of the second-period compensation is zero, $\sigma_{2|1}^2 = 0$. Then $s_2^* = \frac{1}{q}$ results and e_2^{FB} is induced. The first-period incentive rate s_1^* is then for two reasons lower than s_2^* and the incentive contract therefore encourages big bath behavior: First, s_1^* needs to hold the prior risk premium at bay, and second, s_1^* has to control both productive effort e_1 and the bias simultaneously. Only if the posterior variance of the second-period accounting earnings is sufficiently high, this effect can tip over into the direction of s_1^*. High posterior variance implies low second-period incentives such that the incentive system mitigates big bath behavior.

[22] See the Appendix (Proof of Result 1) for details.

An immediate implication of the last part of Result 1 is that if $\sigma^2_{2|1}$ is sufficiently low, a big bath strategy is optimal in the first period. In this case both the implicit and the explicit incentives are negative.[23] In contrast, if $\sigma^2_{2|1} > \overline{\sigma}^2_{2|1}$, the high posterior variance is costly for the owner and, hence, she sets a relatively low sequentially optimal second-period incentive rate. The high level of $\sigma^2_{2|1}$ leads to a comparatively high s_1^* relative to s_2^*. If this effect is so strong that it overcompensates the career effect b^{LM}, the manager over-reports in period one. The manager's advantage from reputation-based earnings shifting is lower than the direct income effect.

At the end of this section, we consider the case of a risk-neutral manager. Even if the manager is risk neutral, there are interesting frictions in the game as the principal's objective is not contractible and earnings management is possible. Thus, the principal cannot rent the firm to the manager, but she must control two productive efforts and a bias by two performance measures in the presence of career concerns. To focus on the pure incentive effects, we also assume a risk-neutral manager in the next two sections.

From Lemma 1 and 2 with $r = 0$, we obtain the sequentially optimal incentive rates for a risk-neutral agent:[24]

$$s_1^{**} = \frac{2q^2\lambda - q\lambda + 1}{q(q^2\lambda + 1)}, \tag{10}$$

$$s_2^{**} = \frac{1}{q}. \tag{11}$$

Regarding the relation of the incentive rates of both periods we obtain a clear result:

Result 2 *If the manager is risk-neutral, the sequentially optimal second-period incentive rate is strictly higher than the first-period one:*

$$s_2^{**} - s_1^{**} = \frac{\lambda(1-q)}{\lambda q^2 + 1} > 0.$$

[23] The under-reporting in the first period is similar to the observation of Christensen et al. (2013). However, in contrast to our paper, they note that under-reporting is determined by the assumption of identical periods; see Proposition 4 in Christensen et al. (2013).

[24] Action levels in a risk-neutral setting are denoted with the superscript $**$.

The sequentially optimal second-period incentive coefficient will be chosen to optimally control the second-period effort. $s_2^{**} = 1/q$ induces $e_2^{**} = e_2^{FB}$. In the first period, the firm faces a trade-off between higher (less negative) earnings management and an inefficient high effort level. Inducing b^{FB} would require $s_1 = 1/q$, too. However, $s_1 = 1/q$ induces too high first-period effort $\left(e_1^{**} = e_1^{FB} + \frac{1-q}{q}\right)$. Thus, first-best effort of period one (e_1^{FB}) requires lower incentives than $s_1 = 1/q$ but then the bias becomes too strong. As a consequence, s_1^{**} is between these two values leading unambiguously to distortions from first-best. Thus, in equilibrium, the owner reduces the incentives to shift earnings into the second period by setting a higher incentive rate in period one which in turn induces an inefficiently high level of the first-period effort. Consequently, the explicit bias component b^s is also strictly negative and, in equilibrium, big bath accounting turns out to be optimal, $b^{**} < 0$.

Nieken and Sliwka (2015) find a similar relationship between big bath accounting and career concerns under risk neutrality. If an incoming manager cares for his long-term reputation, he has a career-related incentive to shift earnings to the subsequent period.[25] In addition, they show that explicit incentives can reduce big bath accounting which is contrary to our findings. The difference between the observations arises from two facts. First, the two papers consider a different kind of timeliness of the accounting system. Second, in Nieken and Sliwka (2015) the incentive contract is exogenously given while we consider optimal contracts.

3.4 Positive impact of the agent's risk aversion on the firm's surplus

We now consider the impact of the manager's risk aversion and of the timeliness of the accounting system on the owner's surplus. The previous analysis shows that an increase in the agent's risk aversion makes it more costly to encourage managerial effort. Intuitively, the higher risk premium to be paid to the manager should reduce the surplus of the

[25] Nieken and Sliwka (2015) assume that the signal in the period following CEO turnover is affected by the outgoing manager's ability. If the ability of an outgoing manager had an influence on the first-period accounting signal, we would have to consider the additional noise related to the predecessor p's ability, $(1-q)a^p$. Intuitively, as the first-period signal becomes less informative about the current manager's ability, big bath accounting would increase.

owner. However, if the timeliness of the accounting system is sufficiently low a higher risk aversion of the agent can improve the surplus.

Result 3 *Assume a sufficiently low timeliness of the accounting earnings q. Then a higher managerial risk aversion r increases the owner's surplus.*

Proof. See the Appendix.

To clarify the impact of a low timeliness of the accounting system, we consider the special case where q is zero, which implies $\beta_1 = 0$ and $\beta_2 = \gamma$. At this extreme, the first-period signal is not affected by the manager at all. The signal is pure noise. The second-period true earnings become $x_2 = a + e_1 + \theta_2$. As a consequence, no second-period effort can be induced in equilibrium, $e_2^* = 0$. The sequentially optimal second-period incentive weight will now be used to relieve the agent from any compensation risk by setting $s_2^* = -\phi\,\gamma$. With this second-period incentive coefficient, the agent is perfectly insured against risk from future compensation $\phi\,LM_2$. Now, the manager selects his first-period effort as to $e_1^* = \phi\,\gamma + s_2^* = 0$. Thus, no productive effort at all can be induced in equilibrium. However, an earnings bath is induced: $b^* = \frac{s_1^*}{\lambda}$. s_1^* trades-off earnings management incentives and the ex ante risk premium to be paid. It is given by $s_1^* = \frac{-\phi\gamma}{1+r\sigma^2\lambda(1-\gamma)}$. Thus, the higher the agent's risk aversion r, the lower the (absolute value of) equilibrium bias induced by the principal. If providing effort incentives is not possible or if effort incentives are only very difficult to provide, but manipulation incentives remain, high agent risk aversion is beneficial for the principal in terms of avoiding manipulation incentives. Hiring a highly risk-averse manager is an implicit commitment towards the market to a low first-period incentive rate. This reduces the bias and, therefore, the disutility of bias for which the agent has to be compensated in equilibrium. Notice that this commitment is valuable even though the market cannot observe the agent's incentive contract. With a highly risk-averse agent the market conjectures similarly low incentive weights, implying a low bias in equilibrium. However, besides reducing manipulation, an increase in r leads to a higher prior risk premium to be paid. In our model, if q is sufficiently low the manipulation effect strictly dominates the risk-premium effect at the optimum. As an example, we consider the parameter setting $q = 0.01, \lambda = 0.5, \gamma = 0.5, \sigma = 2, a = 6, \phi = 2$ with a) $r = 1/9$

and b) $r = 1/3$. While induced productive effort is low in both settings, in a), we obtain $b^* = -1.76$ with corresponding surplus of $EU_0^* = 23.15$, while with the higher risk aversion coefficient, we get bias $b^* = -1.47$ with surplus $EU_0^* = 23.28$.

The general insight here is that if providing effort incentives in both periods is limited, higher managerial risk aversion may become beneficial as it makes it less attractive for the principal to set (strongly) divergent incentive rates in the two periods and, thus, less manipulation is expected by the market. This reduces equilibrium bias and may increase the owner's surplus.

4 Effect of corporate governance and the CEO labor market on equilibrium big bath accounting

In the following section, we examine how corporate governance and the CEO labor market affect the optimal level of earnings management. To disentangle the involved incentive effects, we consider a risk-neutral agent. In this case, as we know from the previous section, an earnings bath is the optimal earnings management strategy for the manager.

4.1 How do internal and external governance mechanisms affect big bath behavior?

The reported financial numbers of the firm provide relevant information about the performance and the value of the firm to its stakeholders. The main objective of a corporate governance system is to reduce the agency costs that arise from the separation of ownership and control and, with regard to financial reporting, to ensure the credibility of the financial information by application of local GAAP. Hence, an effective corporate governance should reduce the possibility of earnings management and should make it more difficult for the manager to manage an earnings bath.

Corporate control mechanisms can be classified in two categories: external and internal governance.[26] External governance includes control mechanisms which are determined by the environment outside of the firm, e.g., the legal and regulatory environment or the capital market (e.g., see Bushman and Smith, 2001). Therefore, external controls are exogenously given and cannot be influenced by the owner. In addition, a higher level of external control mechanisms makes it more difficult for the agent to manage earnings and, hence, the level of external governance directly affects his personal costs of earnings management. For example, a stronger external control mechanism may increase the time that is needed to manage earnings or it may increase the litigation risk faced by the agent. In our setting, the strength of the external control mechanism is represented by the value of λ. In contrast to the external governance, internal control mechanisms (e.g., managerial incentive systems or the structure of the board of directors) can be influenced by the owner. In our model, the internal governance is represented by the incentive contract.

To provide an understanding of how these two governance categories interact in reducing earnings management, we first consider the influence of the internal governance, represented by the incentive contract, on the optimal bias level. Equation (7) shows that manipulation incentives arise if incentive rates deviate from each other. As an indicator of how intensively the compensation contract is used as an instrument for reducing manipulation activities, we use the following expression:

$$\Delta s = s_2^{**} - s_1^{**}.$$

With a risk-neutral manager, $\Delta s > 0$ holds true. As described earlier, the incentive contract which is designed by the owner has two tasks. On the one hand, the manager must be motivated to perform an effort in each period and, on the other hand, it has to control the manipulation incentives. The weighting between these two objectives can be represented by Δs. If Δs is relatively high, the contract primarily focuses on providing effort incentives and neglects the internal control function. In contrast, to counteract earnings management, Δs must be close to zero.

[26] See Gillan (2006) for an overview of the separation between external and internal governance.

In our model, the parameter λ can be interpreted as the degree of effectiveness of the external corporate governance. A higher level of λ implies a stronger external governance system, e.g., from an enhanced external auditing or tighter accounting standards, and therefore increases the manager's personal manipulation costs. Thus, increased external controls lead to a lower optimal bias level (see the proof of Result 4 for details):

$$\frac{\partial |b^{**}|}{\partial \lambda} < 0.$$

The influence of λ on b^{**} is twofold: First, there is a direct effect as can be seen by (7). The direct effect mitigates both the explicit and the implicit incentive for big bath accounting. Second, there is an indirect effect via the incentive rates. While s_2^{**} does not depend on λ, the first-period incentive rate s_1^{**} decreases in λ. Given that the incentives for big bath accounting are small due to strong external corporate governance, the principal does not need to counteract earnings management via high first-period incentives. Since the direct effect of λ is stronger than the indirect effect, the overall effect of higher λ reduces earnings management in equilibrium.

Due to the described indirect effect, the relationship between the contractual incentives and the external governance environment can be summarized by the following result:

Result 4 *Stronger external governance mechanisms act as a substitute for internal control mechanisms in terms of preventing managerial earnings management incentives from the contract.*

Higher external control leads to a lower first-period incentive rate, $\frac{\partial s_1^{**}}{\partial \lambda} < 0$, and reduces the internal control function of the incentive contract, $\frac{\partial \Delta s}{\partial \lambda} > 0$. If λ becomes extremely low (e.g., by loose examination by the auditor), the incentive rates of both periods are set nearly identical by the owner to reduce the manipulation incentives from the contract. In contrast, in an environment of strong external control mechanisms, the owner can focus on providing effort incentives. Consequently, the strength of an internal control system decreases in the restrictions which are imposed by an external framework.

Since internal control acts as a substitute for the external governance, weaker external governance leads to an increase in internal control. However, the influence of the internal

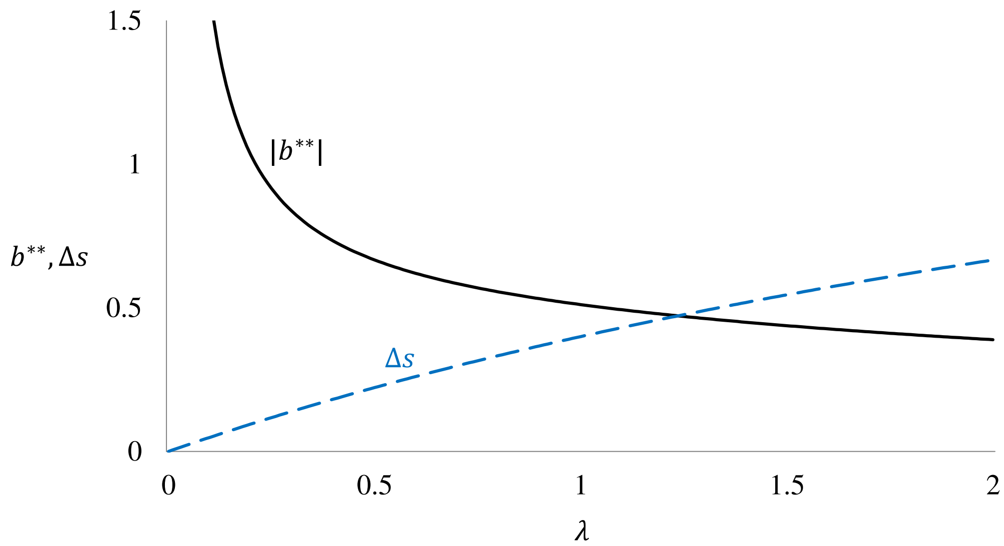

Figure 2: Influence of the external control environment λ on discretionary accruals and on internal control intensity (parameters: $q = 0.5$, $\phi = 0.5$, $\gamma = 0.5$).

governance is always limited to the explicit manipulation incentive b^S stemming from the incentive contract. Total earnings management can only be efficiently reduced by a stronger external governance. These findings are graphically presented in Figure 2, which plots the level of the bias and the internal governance as a function of the external governance level. Notice that a strong external control is always in the interest of the owner ($\frac{\partial EU_0}{\partial \lambda} > 0$, see again the Proof of Result 4). If she could determine the degree of external governance, she would set $\lambda = \infty$ under the assumption of costless controls to prevent any manipulation activities.

4.2 Big bath accounting and the CEO labor market

The manager leaves the firm at the end of the second period and obtains a new compensation contract from another firm. His future reward ϕLM_2 is affected by two factors. First, the value of the new contract is influenced by the labor market assessment LM_2 which measures the expected ability of the manager and, thus, his natural productivity. Second, the parameter ϕ scales the labor market assessment of the ability. A higher level of this parameter corresponds to higher future managerial compensation. We interpret the parameter ϕ as a measure of competition between firms for top managers. Finding the right CEO is an essential organizational task and critically influences the success of a company.[27] However, the pool for managers with suitable ability is small and corresponding persons are in demand.[28] A higher demand for capable managers increases the bargaining power of an incoming CEO and his compensation level. In our model, an increased demand for capable managers is characterized by a higher value of ϕ. Accordingly, if ϕ increases the manager is more interested in the improvement of the labor market assessment.

The following result states the impact of ϕ on the earnings management behavior:

Result 5 *Higher competition on the CEO labor market reinforces big bath accounting in the first period:*

$$\frac{\partial |b^{**}|}{\partial \phi} > 0. \tag{12}$$

Proof. See the Appendix.

Since the sign of the optimal bias is strictly negative, a higher demand for CEOs leads to more big bath accounting. This finding is intuitive: The manager will leave after the second period and he anticipates that accounting signals will determine his future compensation. His certainty equivalent is enhanced by a higher value of the expected future compensation and, therefore, stronger earnings management activities occur. To improve governance mechanisms, future empirical research should test this hypothesis on the relation between higher competition for CEOs and the amount of discretionary accruals following managerial turnover.

Next, we consider how career-related incentives from the labor market affect the owner's surplus.

[27] In an empirical study Berry et al. (2006) examine the relation between the choice of a CEO and the firm's success. They emphasize the importance of a CEO for the economic performance of the firm.

[28] Murphy (2013) documents an increase in the competition on the CEO labor market in the last two decades. He argues that rising executive pay results from a higher prevalence of hiring outside CEOs (p. 140).

Result 6 *The following observations regarding the relation between the labor market competition and the owner's surplus can be derived:*

1. *The owner's surplus increases in the intensity of competition* (ϕ) *if and only if:*

$$\overline{a} > \widehat{a} = \frac{\phi\beta_2^2 q(1+\lambda q^2)\left[(1+\lambda)(1-q)^2 + \lambda q^2(3-2q+q^2)\right] + \beta_2\lambda(1-q)}{\lambda q(1+\lambda q^2)} > 0.$$

2. *For* $\overline{a} \leq \widehat{a}$ *the owner's surplus is (weakly) decreasing in the intensity of competition* (ϕ) *on the labor market.*

Proof. See the Appendix.

Result 6 shows that the influence of competition on the owner's surplus depends on the value of the manager's ex ante expected ability $\overline{a}$. For a given value of ϕ, if the prior ability is sufficiently high, the owner of the firm benefits from higher competition on the labor market. In contrast, if prior ability is rather low, increasing competition reduces the owner's surplus. Note that the critical expected ability $\widehat{a}$ is increasing in ϕ. Thus, even for a high value of $\overline{a}$, if the competition between firms for top managers becomes extremely strong, the owner's surplus is decreasing in ϕ.

Figure 3 plots the manager's earnings bath in the first period and the surplus of the owner as functions of the intensity of competition ϕ for a given value of $\overline{a}$. The effort of both periods and the amount of earnings management increase in ϕ. If competition for CEOs between firms is relatively weak (i.e., ϕ is sufficiently low), then more competition leads to a higher surplus for the owner. In contrast, when the supply of capable managers is relatively low (i.e., ϕ sufficiently high), higher competition intensity reduces the surplus.

Result 6 can be explained as follows: In equilibrium, $E(\phi LM_2) = \phi\overline{a}$ holds. Hence, the higher the manager's prior ability, the higher the expected future compensation from the labor market. Ceteris paribus, the higher the future compensation, the lower the expected compensation to be paid by the principal to endow the agent with a certain overall utility level. However, ϕ has also an endogenous effect: the amount of earnings management of the manager rises in ϕ. Thus, if ϕ is sufficiently high, the disutility from induced earnings

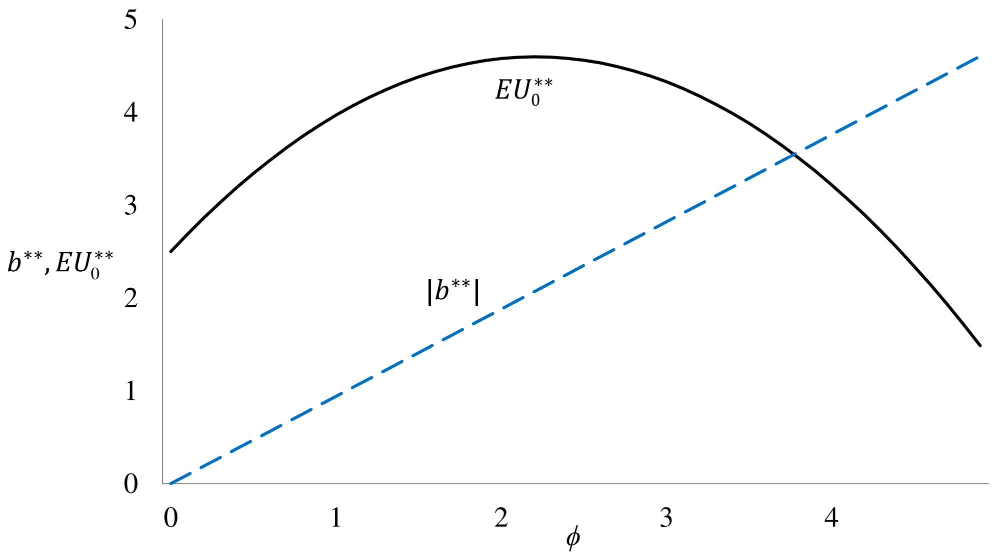

Figure 3: Influence of competition intensity ϕ on the owner's surplus (parameters: $\overline{a} = 1$, $q = 0.5$, $\lambda = 0.3$, $\gamma = 0.6$, $\sigma^2 = 1$).

management exceeds the value of future rewards outside the agency and the owner has to offer a contract with a higher expected payment to the agent. With regard to empirical studies of the subject, we therefore conjecture that firms in industries where there is a very strong competition for top managers are likely to perform worse than firms with an intermediate level of competition.

5 Robustness checks on big bath incentives

In this section, we briefly demonstrate how three variations in our standard assumptions influence big bath behavior. First, we investigate whether big bath accounting will still exist if we assume a long-term full commitment contract instead of a renegotiation-proof contract. Second, we consider big bath incentives if the agent can also manipulate the second-period signal. Third, we analyze a change of the accounting system's timeliness over time. To focus on the incentive effects, we exclude risk sharing considerations from our analysis and assume again a risk-neutral agent. The details of the formal analysis are relegated to the last section of the Appendix.

Long-term full commitment contract

If both parties can commit to a long-term full commitment contract (FC), no renegotiation option exists and both incentive rates s_1 and s_2 will be chosen ex ante optimal. The optimal incentive rates follow as

$$\begin{aligned} s_1^{FC} &= \frac{2\lambda q^3 - \lambda q^2 + q + 1}{\lambda q^4 + q^2 + 1}, \\ s_2^{FC} &= \frac{\lambda q^3 + q + 1}{\lambda q^4 + q^2 + 1}, \end{aligned}$$

and the difference of the incentive rates $s_1^{FC} - s_2^{FC} = \frac{q^2\lambda(q-1)}{\lambda q^4 + q^2 + 1} < 0$ shows that first-period big bath incentives from the optimal contract result. Thus, our results on big bath accounting are robust against the players' ability to commit to a long-term contract.

Second-period earnings manipulation

If the agent can manipulate second-period earnings by a bias b_2 at the cost of $\lambda \frac{b_2^2}{2}$ the second-period reported earnings change to $y_2 = x_2 - b + b_2$. Everything else is equal to the main setting. The optimal second-period bias from the agent's perspective is given by $b_2 = \frac{s_2 + \phi \beta_2}{\lambda}$. As a consequence of second-period earnings management, the principal reduces the sequentially optimal second-period rate which is now given by $s_2^{**} = \frac{\lambda q}{1 + \lambda q^2} < \frac{1}{q}$. The optimal first-period incentive rate becomes $s_1^{**} = \frac{\lambda q \left(2\lambda q^2 - \lambda q + 2\right)}{\left(1 + \lambda q^2\right)^2}$. While without b_2 the relation $s_1^{**} - s_2^{**} < 0$ induces big bath incentives from the contract, this is not always the case if a manipulation in the second-period signal is possible. For the difference of the incentive rates, we now obtain $s_1^{**} - s_2^{**} = \frac{\lambda q \left(\lambda q^2 - \lambda q + 1\right)}{\left(1 + \lambda q^2\right)^2}$ which may become positive. Thus, if earnings management in both periods in possible, big bath incentives in the first period from the contract will be mitigated (see Dutta and Fan (2016) for a similar result). However, first-period big bath incentives from the contract will still arise as long as $\lambda q^2 - \lambda q + 1 < 0$ or, equivalently, if $1 < \lambda q (1 - q)$. Thus, for sufficiently high λ $(\lambda > 4)$, there exists a range $\left[\underline{q}(\lambda), \overline{q}(\lambda)\right] \in (0, 1)$ such that the incentive contract induces big bath accounting in the first period if $q \in \left[\underline{q}(\lambda), \overline{q}(\lambda)\right]$.[29] The reason that q must be sufficiently high but not too high can be explained as follows: If the accounting signals reflect the true earnings immediately (q close to 1), the two periods are independent with the exception of the effect of first-period manipulation that reverses in the second period. In contrast, the second-period manipulation does not reverse during the contracting horizon. Thus, as there is no countervailing effect, the second-period incentive rate will be lower than the first-period one. On the other hand, if almost the entire true earnings are reported with a lag of one period (q close to zero), both optimal incentive rates will be close to zero such that no big bath incentives occur.

Variation of timeliness over time

We argued that, in a turnover setting, the influence of the new manager's work on current earnings is particularly low. To account for this, we now additionally assume that the fraction of true economic earnings reflected by the accounting signals is higher in the second period. Denoting the first- and second-period timeliness parameters by q_1 and q_2, respectively, the firm's earnings are given by

$$x_1 = q_1(a + e_1) + \theta_1,$$

$$x_2 = q_2(a + e_2) + (1 - q_1)(a + e_1) + \theta_2.$$

We assume $q_1 < q_2$. Solving the principal's optimization problem as in Lemma 1 and Lemma 2 with q_1 and q_2 leads to a difference between the incentive rates of $s_1^{**} - s_2^{**} = \frac{q_1 \lambda (q_2 - 1)}{q_2 \left(1 + \lambda q_1^2\right)} < 0$. First-period big bath accounting will be induced. For $q_1 = q_2 = q$, we obtain the result from our main analysis $s_1^{**} - s_2^{**} = \frac{\lambda (q-1)}{\left(1 + \lambda q^2\right)}$. Comparing the differences, big bath incentives need not necessarily be stronger with a higher timeliness parameter in the second period. The reason is that there are two countervailing effects at work. On the one hand, a lower timeliness in the first-period should lead to less sensitive contractual incentives from first-period earnings. On the other hand, a higher timeliness of second-period

[29] $\underline{q}(\lambda)$ and $\overline{q}(\lambda)$ are the two solutions of $\lambda q \left(\lambda q^2 - \lambda q + 1\right) = 0$.

earnings leads to a stronger contribution of second-period effort such that the sequentially optimal second-period incentive rate declines. Which effect dominates, depends also on the cost of earnings management λ.

6 Concluding remarks

We examine earnings management behavior following a CEO turnover in a two-period agency problem in the presence of career concerns. In our model, a manager aims at affecting his compensation and his labor market assessment by productive effort and by shifting earnings across the two periods. If the agent is risk neutral, both sources of incentives, the compensation scheme and career concerns, lead to a big bath accounting. If the agent is risk averse, this result continues to hold as long as the uncertainty in the second-period accounting earnings is not too high. If the uncertainty is high, the compensation scheme works against big bath accounting and an overstatement of earnings may occur in the period following the CEO turnover.

We analyze the interplay between career concerns and the optimal incentive contract in controlling the manager's productive effort and his earnings management action. Incentives from career concerns result because the labor market uses earnings to update beliefs about the manager's ability. Both productive effort choices and the earnings management action are influenced by the information content of the earnings about the CEO's ability. Earnings management is costly for the firm. However, as earnings management is rationally expected by the market, in equilibrium, the principal motivates the conjectured level of earnings management. If the timeliness of the accounting system is low and, therefore, the motivation of productive effort is difficult, employing a highly risk-averse manager is optimal for the firm. The reason is that hiring a highly risk-averse manager is a commitment of the firm to similar incentive rates in both periods. This reduces the conjectured earnings bias by the market and, thus, the equilibrium bias. Hence, we predict that for firms with a low timeliness of the accounting system, the amount of earnings management is likely to be lower the more risk averse their CEO is.

We study the influence of the firm's corporate governance system and of the intensity of competition for CEOs on equilibrium earnings management. We show that internal control mechanisms (the incentive contract) and external control mechanisms (determining the cost of manipulation) act as substitutes rather than complements. Improving the external governance system corresponds to a lower level of internal control, to a lower earnings management activity and to a higher welfare.

We also find that higher competition for top managers leads to higher discretionary expenses in the first year after an executive turnover. Moreover, the owner's expected surplus is also affected by the degree of competition. Besides increasing earnings management, higher competition intensity for CEOs between firms reduces the firm's payment to the manager as his future compensation increases. The latter effect dominates and increases the owner's surplus if the manager's prior expected ability is sufficiently high.

Several empirical studies document that the level of an earnings bath depends on the previous career of the manager. Thus, it is of crucial importance whether the new CEO comes from inside or outside the firm. Future research may examine the incentives for earnings management by considering two different types of new CEOs, insiders and outsiders.

The results of our study rely on the assumption that it is only the CEO who affects the earnings of the firm. In reality, however, several managers are sitting on the board, influencing the firm's earnings. If the firm's earnings would be also affected by the abilities of the other managers, the information content of earnings with regard to the new CEO's ability decreases. However, the career-related earnings management incentive for the CEO only depends on the difference of the weights the market attaches to the earnings of both periods when revising expectations over the CEO's ability. Thus, if the information content of both signals (β_1 and β_2) would be reduced by the same amount, career-related manipulation incentives would remain unchanged.

Our study shows that the expected future compensation of a new CEO significantly affects his earnings management incentives. If the CEO's market value diminishes (low value of ϕ), his earnings management activities decline, too. Thus, we would expect that the age pattern of CEOs influences their earnings management behavior, in particular, CEOs near to retirement should manipulate less.

Appendix

Labor market expectation

To derive the regression parameters (β_1, β_2), we consider the market's updated beliefs of the managerial ability having observed the accounting signals:

Let

$$LM_2 = E[a \mid y_1, y_2, \widehat{w}, \widehat{e_1}, \widehat{e_2}, \widehat{b}].$$

Given that (a, y_1, y_2) have a joint normal distribution, LM_2 is given by:[30]

$$LM_2 = E[a] + \mathbf{\Sigma_{21}} \mathbf{\Sigma_{11}}^{-1} (\mathbf{y} - E[\mathbf{y}]),$$

with $\mathbf{\Sigma_{21}} = \begin{bmatrix} Cov(a, y_1) & Cov(a, y_2) \end{bmatrix} = \begin{bmatrix} q\gamma\sigma^2 & \gamma\sigma^2 \end{bmatrix}$, $\mathbf{y} = \begin{bmatrix} y_1 & y_2 \end{bmatrix}^T$ and covariance matrix of $\mathbf{y}$

$$\mathbf{\Sigma_{11}} = \begin{bmatrix} \sigma^2\left(1 - \gamma(1 - q^2)\right) & q\gamma\sigma^2 \\ q\gamma\sigma^2 & \sigma^2 \end{bmatrix}.$$

Doing the matrix multiplication, we obtain $(\beta_1, \beta_2) = \mathbf{\Sigma_{21}} \mathbf{\Sigma_{11}}^{-1} = \begin{bmatrix} \frac{q\gamma}{q^2\gamma+1} & \frac{\gamma}{q^2\gamma+1} \end{bmatrix}$. Now LM_2 can be written as $LM_2 = \beta_0 + \beta_1 y_1 + \beta_2 y_2$ with

$$\begin{aligned} \beta_0 &= E[a] - (\beta_1, \beta_2) E[\mathbf{y}] \\ &= \overline{a} - \beta_1 (q(\overline{a} + \widehat{e_1}) + \widehat{b}) - \beta_2 (\overline{a} + q(\widehat{e_2}) + (1 - q)\widehat{e_1} - \widehat{b}). \end{aligned}$$

[30] See, e.g., DeGroot (1970), p. 55.

Variances

Let $\Gamma = w + \phi LM_2$. Prior and posterior variances of Γ are defined by:

$$\begin{aligned} Var(\Gamma) &= Var((\phi\,\beta_1 + s_1)\,y_1 + (\phi\,\beta_2 + s_2)\,y_2) \\ &= \sigma^2\left((\phi\,\beta_1 + s_1)^2(1-\gamma(1-q^2)) + (\phi\,\beta_2 + s_2)^2 + 2\gamma q\,(\phi\,\beta_1 + s_1)\,(\phi\,\beta_2 + s_2)\right), \end{aligned}$$

$$\begin{aligned} Var(\Gamma|y_1) &= Var((\phi\beta_2 + s_2)y_2|y_1) \\ &= (\phi\beta_2 + s_2)^2\, Var(y_2|y_1) \\ &= (\phi\beta_2 + s_2)^2\left(Var(y_2) - \frac{Cov(y_2,y_1)^2}{Var(y_1)}\right) \\ &= (\phi\beta_2 + s_2)^2\left(\sigma^2 - \frac{\sigma^2 q^2\gamma^2}{1-\gamma(1-q^2)}\right) \\ &= (\phi\beta_2 + s_2)^2\,\sigma^2_{2|1}. \end{aligned}$$

Proof of Lemma 1

In program (2), the participation constraint is binding at the optimum: $CE_1^R = CE_1$. By substituting from that constraint into the objective function, the principal's problem can be written as

$$\begin{aligned} &\max_{s_2^R} e_2^R - c_2\left(e_2^R\right) - \frac{r}{2}Var\left(s_2^R y_2^R + \phi LM_2\left(y_2^R\right)|y_1\right) + E\left\{\phi LM_2\left(y_2^R\right)|y_1,\widehat{e}_1,\widehat{b}\right\} \\ &+ f + s_2 E\left(y_2|y_1,\widehat{e}_1,\widehat{b}\right) - c_2\left(e_2\right) - \frac{r}{2}Var\left(s_2 y_2 + \phi LM_2\left(y_2\right)|y_1\right) \\ &+ E\left\{\phi LM_2\left(y_2\right)|y_1,\widehat{e}_1,\widehat{b}\right\} \\ &\text{s.t.} \\ &e_2^R = q(s_2^R + \phi\beta_2). \end{aligned}$$

Notice that if the agent's certainty equivalents are considered by the principal, we have to replace (e_1,b) by $\left(\widehat{e}_1,\widehat{b}\right)$ as the principal does not observe first-period actions. As the variances are not influenced by the agent's actions, we can remove (e_1,b) or $\left(\widehat{e}_1,\widehat{b}\right)$, respectively, from them. Note that $E\left(y_2|y_1,\widehat{e}_1,\widehat{b}\right) = E\left(y_2\right) + \frac{q\gamma}{q^2\gamma+(1-\gamma)}\left(y_1 - E\left(y_1|\widehat{e}_1,\widehat{b}\right)\right)$

with $E\left(y_1|\widehat{e}_1,\widehat{b}\right)=q(\overline{a}+\widehat{e}_1)+\widehat{b}$, $Var\left(s_2^R y_2^R+\phi LM_2\left(y_2^R\right)|y_1\right)=Var\left(\left(s_2^R+\phi\beta_2\right)y_2|y_1\right)$ $=\left(s_2^R+\phi\beta_2\right)^2\sigma_{2|1}^2$ and $E\left\{LM_2\left(y_2^R\right)|y_1,\widehat{e}_1,\widehat{b}\right\}=\beta_0+\beta_1 y_1+\beta_2\left((1-q)\widehat{e}_1-\widehat{b}+qe_2^R\right)$ $+\beta_2\left(E\left(a|y_1\right)\right)$. β_0, β_1 and β_2 are defined in Section 2. Neglecting terms that do not influence the optimization, the principal's problem becomes

$$\max_{s_2^R} e_2^R-\frac{\left(e_2^R\right)^2}{2}-\frac{r}{2}\left(s_2^R+\phi\beta_2\right)^2\sigma_{2|1}^2+\beta_2\phi qe_2^R$$
s.t.
$$e_2^R=q(s_2^R+\phi\beta_2).$$

Inserting the incentive constraint for e_2^R into the principal's objective function leads to

$$\max_{s_2^R}\ q(s_2^R+\phi\beta_2)(1+\beta_2\phi q)-\frac{\left(q\left(s_2^R+\phi\beta_2\right)\right)^2}{2}-\frac{r}{2}\left(s_2^R+\phi\beta_2\right)^2\sigma_{2|1}^2.$$

From the first-order condition for the optimal s_2^R, we obtain the renegotiation-proof second-period incentive rate:

$$s_2^*=\frac{q-\phi\beta_2 r\sigma_{2|1}^2}{q^2+r\sigma_{2|1}^2}.$$

The corresponding second-period effort is then given by: $e_2^*=q\left(s_2^*+\phi\beta_2\right)$.

Proof of Lemma 2

The agent's ex ante certainty equivalent is given by:

$$\begin{aligned}CE_0&=E\left(\Gamma\right)-C-\frac{r}{2}Var\left(\Gamma\right)\\&=f+s_1(q(\overline{a}+e_1)+b)+s_2(\overline{a}+qe_2+(1-q)e_1-b)\\&\quad-\frac{e_1^2+e_2^2+\lambda b^2}{2}+\phi(\beta_0+\beta_1(q(\overline{a}+e_1)+b)+\beta_2(\overline{a}+qe_2+(1-q)e_1-b))\\&\quad-\frac{r}{2}\sigma^2((\phi\,\beta_1+s_1)^2\left(1-\gamma(1-q^2)\right)+(\phi\,\beta_2+s_2)^2+2\gamma q\left(\phi\,\beta_1+s_1\right)\left(\phi\,\beta_2+s_2\right)).\end{aligned}$$

Note that $\Gamma=w+\phi LM_2$. The agent's optimal choice of second-period effort is known from the proof of Lemma 1, $e_2=q\left(s_2+\phi\beta_2\right)$. Differentiating CE_0 with respect to e_1 and

b, and solving the first-order conditions for these variables yield:

$$\frac{\partial CE_0}{\partial e_1} = 0 \Longleftrightarrow e_1 = q\,(\phi\,\beta_1 + s_1) + (1-q)\,(\phi\,\beta_2 + s_2),$$
$$\frac{\partial CE_0}{\partial b} = 0 \Longleftrightarrow b = -\frac{(s_2 - s_1)}{\lambda} - \frac{\phi(\beta_2 - \beta_1)}{\lambda}.$$

The owner's surplus is given by: $EU_0 = E(V) - E(w)$. At the optimum, the agent's participation constraint is binding $E(\Gamma) - C - \frac{r}{2}Var(\Gamma) = 0 \Leftrightarrow E(w) = C + \frac{r}{2}Var(\Gamma) - \phi E(LM_2)$. Thus, the owner's objective function can be written as

$$\begin{aligned} EU_0 =& E(V) - C - \frac{r}{2}Var(\Gamma) + \phi E(LM_2) \\ =& 2\bar{a} + e_1 + e_2 - \frac{e_1^2 + e_2^2 + \lambda b^2}{2} \\ &+ \phi(\beta_0 + \beta_1(q(\bar{a} + e_1) + b) + \beta_2(\bar{a} + qe_2 + (1-q)e_1 - b)) - \frac{r}{2}Var(\Gamma). \end{aligned} \tag{A.1}$$

We know from Lemma 1 that renegotiation-proofness requires $s_2 = s_2^*$ such that $e_2 = q\,(s_2^* + \phi\beta_2)$. Substituting these values and the incentives constraints for e_1 and b into EU_0, and applying the first-order condition with respect to s_1 give:

$$\frac{\partial EU_0}{\partial s_1} = 0$$
$$\Longleftrightarrow s_1^* = \frac{s_2^*\left(1 + \lambda\,q\left(q - 1 - \gamma r\sigma^2\right)\right) + \lambda\left(q - \phi\,\beta_2\, r\sigma^2\gamma q - \phi r\sigma_1^2\beta_1\right)}{1 + \left(q^2 + r\sigma_1^2\right)\lambda}.$$

Here, we already included the fact that $\beta_1 = q\beta_2$.

Proof of Result 1

(i) Recall that $b^{LM} = -\frac{\phi(\beta_2 - \beta_1)}{\lambda}$. It thus follows that

$$sgn(b^{LM}) = sgn(\beta_1 - \beta_2).$$

Since $\beta_1 < \beta_2$, b^{LM} is strictly negative.

(ii) Recall that $b^S = -\frac{s_2^*-s_1^*}{\lambda}$. Obviously, the sign of b^S depends on the sign of $s_2^*-s_1^*$. With $\beta_1 = q\beta_2$, we obtain

$$s_2^* - s_1^* = \frac{\beta_2 \lambda r \phi \left[q^3\left(\gamma\sigma^2+\sigma_1^2\right)+r\sigma_1^2\sigma_{2|1}^2(q-1)-q\sigma_{2|1}^2\right]}{\left(q^2+\sigma_{2|1}^2 r\right)\left(\lambda q^2+\lambda r\sigma_1^2+1\right)} + \frac{\lambda\left[rq\left(\gamma q\sigma^2+\sigma_1^2-\sigma_{2|1}^2\right)+q^2(1-q)\right]}{\left(q^2+\sigma_{2|1}^2 r\right)\left(\lambda q^2+\lambda r\sigma_1^2+1\right)}.$$

Differentiating with respect to $\sigma_{2|1}^2$ yields:

$$\frac{\partial(s_2^*-s_1^*)}{\partial\sigma_{2|1}^2} = -\frac{rq\lambda\left(\gamma qr\sigma^2+r\sigma_1^2+q\right)(\phi q\beta_2+1)}{\left(q^2+r\sigma_{2|1}^2\right)^2\left(1+\lambda\left(q^2+r\sigma_1^2\right)\right)} < 0.$$

Solving $s_2^*-s_1^*=0$ for $\sigma_{2|1}^2$ gives:

$$\overline{\sigma}_{2|1}^2 = \frac{q\left(\gamma qr\sigma^2(\phi q\beta_2+1)+r\sigma_1^2(\phi q\beta_1+1)+q(1-q)\right)}{r\left(q+\beta_2\phi\left(q+r\sigma_1^2(1-q)\right)\right)} > 0.$$

Thus, there exists a critical value $\overline{\sigma}_{2|1}^2 > 0$, so that $b^S < (>)\, 0$ if $\sigma_{2|1}^2 < (>)\, \overline{\sigma}_{2|1}^2$.

(iii) The optimal bias is determined by:

$$b^* = b^S + b^{LM}.$$

Since $b^{LM} < 0$, the sign of b^* is only positive if $\sigma_{2|1}^2 > \overline{\sigma}_{2|1}^2$ $\left(\text{i.e., } b^S > 0\right)$ and $b^S > |b^{LM}|$.

Proof of Result 3

Let us consider the case when $q \to 0$. Under this condition, the corresponding incentive rates are given by:

$$\lim_{q\to 0} s_1^* = -\frac{\phi\gamma}{1+\lambda r\sigma^2(1-\gamma)},$$
$$\lim_{q\to 0} s_2^* = -\phi\gamma.$$

Note that if $q=0$, then $\beta_1 = 0$ and $\beta_2 = \gamma$. Substituting the above values of the incentive rates in the ex ante certainty equivalent of the agent, we obtain the following effort and bias levels:

$$\lim_{q\to 0} \frac{\partial CE_0}{\partial e_1} = 0 \Longleftrightarrow e_1 = \phi\,\beta_2 + s_2^* = 0,$$
$$\lim_{q\to 0} \frac{\partial CE_0}{\partial e_2} = 0 \Longleftrightarrow e_2 = 0,$$
$$\lim_{q\to 0} \frac{\partial CE_0}{\partial b} = 0 \Longleftrightarrow b = -\frac{\phi\gamma}{\lambda(1+\lambda r\sigma^2(1-\gamma))}.$$

With these values, the owner's equilibrium surplus (A.1) is:

$$\lim_{q\to 0} EU_0^* = 2\overline{a} - \frac{\phi^2\gamma^2}{2\lambda(1+\lambda r\sigma^2(1-\gamma))^2} + \phi\overline{a} - \frac{r}{2}\frac{\phi^2\gamma^2\sigma^2(1-\gamma)}{(1+\lambda r\sigma^2(1-\gamma))^2}.$$

For the first derivative with regard to r, we obtain:

$$\lim_{q\to 0} \frac{\partial EU_0^*}{\partial r} = \frac{1}{2}\frac{\phi^2\gamma^2\sigma^2(1-\gamma)}{(-1+\lambda r\sigma^2(\gamma-1))^2} > 0.$$

Proof of Result 4

(i) Differentiating (7) with respect to λ and simplifying yield:

$$\frac{\partial b^{**}}{\partial \lambda} = \frac{(1-q)\left(\gamma\lambda^2(\phi+1)\,q^4 + \left(2\gamma\lambda\,\phi+\lambda^2\right)q^2+\gamma\phi\right)}{(\gamma q^2+1)\,(\lambda\,q^2+1)^2\,\lambda^2} > 0.$$

Note that in a risk-neutral setting, the optimal bias is negative and, thus, the amount of earnings management decreases in λ:

$$\frac{\partial |b^{**}|}{\partial \lambda} < 0.$$

(ii) Differentiating (10) with respect to λ and simplifying yield:

$$\frac{\partial s_1^{**}}{\partial \lambda} = -\frac{1-q}{(\lambda q^2+1)^2} < 0.$$

The second-period incentive rate does not depend on λ. Therefore, differentiating Δs with respect to λ leads to:

$$\frac{\partial \left(s_2^{**} - s_1^{**}\right)}{\partial \lambda} = \frac{1-q}{(\lambda q^2+1)^2} > 0.$$

(iii) Differentiating EU_0 with respect to λ and simplifying yield:

$$\begin{aligned}\frac{\partial EU_0}{\partial \lambda} = \frac{1}{2}\, & \frac{(1-q)\left(\gamma^2\lambda^2\left(\phi^2+1\right)\left(-q^5+q^4\right)+\left(\gamma^2\phi^2+\lambda^2\right)(1-q)\right)}{\left(\lambda\, q^2+1\right)^2\left(\gamma q^2+1\right)^2\lambda^2} \\ & + \frac{(1-q)\left(\phi\,\lambda^2\left(\gamma^2 q^3+\gamma q\right)+\left(\gamma^2\lambda\,\phi^2+\gamma\lambda^2\right)\left(-q^3+q^2\right)\right)}{\left(\lambda\, q^2+1\right)^2\left(\gamma q^2+1\right)^2\lambda^2}.\end{aligned}$$

Since $q \in (0,1)$, the above expression is strictly positive.

Proof of Result 5

Differentiating (7) with respect to ϕ and simplifying yield:

$$\frac{\partial b^{**}}{\partial \phi} = -\frac{\gamma(1-q)}{\lambda(\gamma q^2+1)} < 0.$$

In a risk-neutral setting, the optimal bias is always negative. Therefore, the amount of earnings management increases in ϕ:

$$\frac{\partial |b^{**}|}{\partial \phi} > 0.$$

Proof of Result 6

Under risk neutrality, the owner's equilibrium surplus is

$$\begin{aligned}
EU_0^{**} &= 2\overline{a}+e_1^{**}+e_2^{**}-C\left(e_1^{**},e_2^{**},b^{**}\right)+\phi\overline{a} \\
&= \frac{1}{2}\frac{1}{\lambda q^2\left(1+\lambda q^2\right)}(q^6\lambda^2\phi^2\left(2\beta_1\beta_2-\beta_1^2-2\beta_2^2\right)-2q^5\phi^2\lambda^2\Delta+ \\
&\quad q^4\left[-\phi^2\lambda\left(2\Delta^2+\beta_2^2\left(1+\lambda\right)\right)+2\overline{a}\lambda^2\left(2+\phi\right)+2\lambda^2\right]-2q^3\phi^2\lambda\beta_2\Delta \\
&\quad +q^2\left(-\phi^2\Delta^2-\phi\lambda\beta_2\left(2-\phi\beta_2\right)+2\overline{a}\lambda\left(2+\phi\right)+\lambda\right)-\lambda+2q\lambda\left(1-\phi\beta_2\right)),
\end{aligned}$$

with $\Delta=\beta_1-\beta_2$. For the first derivative with regard to ϕ, we obtain:

$$\begin{aligned}
\frac{\partial EU_0^{**}}{\partial\phi} &= \frac{1}{\lambda q^2\left(1+\lambda q^2\right)}(q^5\lambda^2\phi^2\left(2\beta_1\beta_2-\beta_1^2-2\beta_2^2\right)-2q^4\phi^2\lambda^2\beta_2\Delta+ \\
&\quad q^3\phi\lambda\left[-\left(2\Delta^2+\beta_2^2\left(1+\lambda\right)\right)\right]+\overline{a}(q^3\lambda^2+q\lambda) \\
&\quad -2q^2\phi\lambda\beta_2\Delta-\phi q(\Delta^2+\lambda\beta_2^2)+\beta_2\lambda\left(q-1\right).
\end{aligned}$$

Solving $\frac{\partial EU_0^{**}}{\partial\phi}=0$ for $\overline{a}$ yields:

$$\begin{aligned}
\widehat{a} &= \frac{\phi}{\lambda q\left(1+\lambda q^2\right)}\left\{\begin{array}{c}\lambda^2q^4\left[q(\beta_1^2-2\beta_1\beta_2+2\beta_2^2)+2\beta_2\Delta\right]+ \\ q^2\lambda\left(q(\beta_2^2(1+\lambda)+2\Delta^2)+2\beta_22\beta_2\Delta\right)+q\left(\lambda\beta_2^2+\Delta^2\right)\end{array}\right\} \\
&\quad +\frac{\beta_2\lambda\left(1-q\right)}{\lambda q\left(1+\lambda q^2\right)}.
\end{aligned}$$

With $\beta_1=q\beta_2$, $\widehat{a}$ becomes:

$$\widehat{a}=\frac{\beta_2\lambda(1-q)+\beta_2^2\phi q(1+\lambda q^2)\left[(1-q)^2+\lambda\left(q^2(3-2q+q^2)+(1-q)^2\right)\right]}{\lambda q\left(1+\lambda q^2\right)}>0.$$

Thus, as $\frac{\partial EU_0^{**}}{\partial\phi}$ is increasing in $\overline{a}$, $\frac{\partial EU_0^{**}}{\partial\phi}>0$, whenever $\overline{a}>\widehat{a}$.

Robustness checks on big bath incentives

Full commitment

If both contracting parties can commit to a long-term (two-period) contract, the principal's problem is given by:

$$\max_{f,s_1,s_2} EU_0 = E(V-w) = E[2a+e_1+e_2-w]$$

subject to

$$CE_0 \geq 0,$$

$$(e_1,e_2,b) \in \underset{e'_1,e'_2,b'}{argmax}\, CE_0(e'_1,e'_2,b').$$

With a binding participation constraint ($CE_0 = 0$), the principal's surplus is given by (A.1). Substituting the incentive constraints for e_1, e_2 and b (which turn out to be the same as in the renegotiation setting) into (A.1), and applying the first-order conditions with respect to s_1 and s_2 gives:

$$(s_2-s_1)\,q^2+\left(1-\gamma r\sigma^2\,(s_2+\beta_2\,\phi\,)-s_2\right)q-r\sigma_1^2\,(\phi\,\beta_1+s_1)+\frac{s_2-s_1}{\lambda}=0, \tag{A.2}$$

$$(s_1-2\,s_2)\left(q^2-q\right)-q\,(\phi\,\beta_1+s_1)\,\gamma r\sigma^2-s_2-r\sigma^2\,(s_2+\beta_2\,\phi)+1+\frac{s_1-s_2}{\lambda}=0. \tag{A.3}$$

For $r = 0$, we obtain the following solution:

$$s_1^{FC} = \frac{2\,\lambda\,q^3-q^2\lambda+q+1}{\lambda\,q^4+q^2+1}, \tag{A.4}$$

$$s_2^{FC} = \frac{\lambda\,q^3+q+1}{\lambda\,q^4+q^2+1}. \tag{A.5}$$

Using (A.4) and (A.5), we obtain:

$$s_2^{FC}-s_1^{FC} = -\frac{q^2\lambda\,(1-q)}{\lambda\,q^4+q^2+1} > 0.$$

Second-period earnings manipulation

We proceed similar to Section 3.2.1 with $y_2 = x_2 - b + b_2$ and second-period manipulation cost $\frac{\lambda b_2^2}{2}$. Then, from the conditions $\left\{\frac{\partial CE_1^R}{\partial e_2^R} = 0, \frac{\partial CE_1^R}{\partial b_2^R} = 0\right\}$, we obtain the incentive conditions $e_2^R = q(s_2^R + \phi\beta_2)$ and $b_2^R = \frac{s_2^R + \phi\beta_2}{\lambda}$. Assume a risk-neutral agent $(r = 0)$ in what follows. Similar to the proof of Lemma 1, the principal's second-period optimization problem with earnings management activity b_2 is given by

$$\begin{aligned}
&\max_{s_2^R} e_2^R - \frac{\left(e_2^R\right)^2}{2} - \frac{\lambda\left(b_2^R\right)^2}{2} + \beta_2\phi\left(qe_2^R + b_2^R\right) \\
&\text{s.t.} \\
&e_2^R = q(s_2^R + \phi\beta_2),\, b_2^R = \frac{s_2^R + \phi\beta_2}{\lambda}.
\end{aligned}$$

Inserting the two incentive constraints into the principal's objective function leads to

$$\max_{s_2^R}\; q(s_2^R + \phi\beta_2) - \frac{1}{2}q^2\left(s_2^R + \phi\beta_2\right)^2 - \frac{\left(s_2^R + \phi\beta_2\right)^2}{2\lambda} + \beta_2\phi\left[q^2(s_2^R + \phi\beta_2) + \frac{s_2^R + \phi\beta_2}{\lambda}\right].$$

Differentiating this expression for s_2^R and equalizing to zero, we obtain the renegotiation-proof second-period incentive rate:

$$s_2^{**} = \frac{\lambda q}{1 + \lambda q^2}.$$

Having derived the sequentially optimal incentive rate s_2^{**}, we consider the principal's ex ante problem similar to the proof of Lemma 2. With the second-period manipulation activity b_2, (A.1) becomes (with $r = 0$)

$$\begin{aligned}
EU_0 = 2\overline{a} + e_1 + e_2 - \frac{e_1^2 + e_2^2 + \lambda b^2 + \lambda b_2^2}{2} \\
+ \phi(\beta_0 + \beta_1(q(\overline{a} + e_1) + b) + \beta_2(\overline{a} + qe_2 + (1-q)e_1 - b + b_2)).
\end{aligned}$$

The renegotiation-proofness condition is given by $s_2 = s_2^{**}$ and the incentive constraints are $e_1 = q(\phi\,\beta_1 + s_1) + (1-q)(\phi\,\beta_2 + s_2)$, $e_2 = q(s_2 + \phi\beta_2)$, $b = -\frac{(s_2 - s_1)}{\lambda} - \frac{\phi(\beta_2 - \beta_1)}{\lambda}$, and $b_2 = \frac{s_2 + \phi\beta_2}{\lambda}$.

Substituting these values into EU_0, and applying the first-order condition with respect to s_1 gives:

$$s_1^{**} = \frac{\lambda q \left(2\lambda q^2 - \lambda q + 2\right)}{\left(1+\lambda q^2\right)^2}\,.$$

For the difference of the incentive rates, we obtain $s_1^{**} - s_2^{**} = \frac{\lambda q\left(\lambda q^2 - \lambda q + 1\right)}{\left(1+\lambda q^2\right)^2}$. Solving $s_1^{**} - s_2^{**} = 0$ for $q \in (0,1)$ yields the two solutions

$$\underline{q}(\lambda) = \frac{1}{2}\frac{\lambda - \sqrt{\lambda^2 - 4\lambda}}{\lambda},\;\; \overline{q}(\lambda) = \frac{1}{2}\frac{\lambda + \sqrt{\lambda^2 - 4\lambda}}{\lambda}.$$

For $\lambda > 4$ $0 < \underline{q}(\lambda) < \overline{q}(\lambda) < 1$ holds true.

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Essay II

Title

Earnings management, disclosure of R&D expenses and long-term innovation incentives: A game-theoretic analysis of real earnings management and classification shifting

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Earnings management, disclosure of R&D expenses and long-term innovation incentives: A game-theoretic analysis of real earnings management and classification shifting

ABSTRACT

This paper examines how a separately disclosed signal for R&D expenses affects earnings management. We investigate a single-period model in which the manager can engage in real earnings management and classification shifting. Here, the capital market holds rational expectations about the firm value and uses two reported signals, accounting income and R&D expenses, to update its beliefs. In order to increase the managerial compensation, incentives arise to misclassify operating as R&D expenses and to reduce investment in R&D. Real earnings management leads to a deviation from the optimal economic investment level. We show that if innovation investment returns can be realized in the short run, a clear over-investment occurs. In contrast, if the innovation risk is significantly high, classification shifting leads to a lower disclosed R&D investment signal and an under-investment strategy is always implemented by the manager. We also study the effect of the precision of the accounting system. Our results show that more precise signals can avoid classification shifting and lead to less biased accounting signals. In contrast, stronger real earnings management incentives are provided. Thus, if the precision of the accounting system is improved, both manipulation tools act as substitutes in equilibrium.

1 Introduction

Motivating innovation is the new stigma of the twenty-first century. Long interdisciplinary debates have been held to find answers how to make innovations happen. Main findings and main problems have been seen in the fact that innovation activities are chiefly unobservable and contain a high degree of uncertainty: On the one hand, firms face the risk of spending enormous amounts even though the idea does not lead to the desired result, or has already been brought out on the market by competitors. On the other hand, there is the internal risk that responsible managers do not spend the money in the best interests of the shareholders.

Competitive pressure has always been seen to be a catalyst for innovation activities,[1] therefore it is especially the second problem that companies have to solve to remain competitive in the future. Within the company, conflicts of interest might occur because investment decisions are often made out of short-term considerations. Managers are intended to make myopic decisions because investment decisions cut off today's accounting income in favor of uncertain future growth. One way to handle this problem is to link the managers' compensation to the market price. By tying their compensation to the long-term firm performance, an alignment between the interests of shareholders and the manager shall be achieved.[2]

However, whether a stock-based compensation explicitly strengthens the innovation behavior of a firm, largely depends on the capital market's absorption of the signals about the firm's innovativeness. According to Kleinknecht et al. (2002), there are mainly four relevant signals: R&D expenditures, current patent applications, expenditures of innovation as a whole[3], and the share on sales by incremental and drastic products. A long list of empirical studies confirms that the capital market prices the statement about R&D expenditures into the firm valuation as a positive signal for future growth (Junge et al., 2003).[4]

[1] See, for instance, Baily et al. (1995) and Blundell et al. (1995) for early empirical evidence.

[2] Several empirical studies, e.g., Lerner and Wulf (2007) as well as Murphy (2003), see a shift towards stock-based compensation during the last decades for responsibles in R&D divisions.

[3] These include also non-R&D expenditures which are linked to innovation activities.

[4] See, e.g., Chauvin and Hirschey (1993) who find a positive impact of R&D investment on the firm value

Besides, due to the fact that they are stated in the financial statements, R&D expenditures are observable and verified by auditors which make them advantageous compared to other signals. However, the management anticipates the use of R&D expenditures for firm valuation and has the discretion over the signals, such that incentives to manage earnings arise. Here, we differentiate between real and accounting earnings management. Real earnings management affects the timing or structuring of the investment or financing decision, and describes the deviation of the economically optimal investment level. Hence, accounting income can be intentionally altered which often entails real costs to the firm in form of a decreased long-term firm value (e.g. Ewert and Wagenhofer, 2005; Hunton et al., 2008). Empirical studies show that particularly an under-investment behavior occurs as it means to let reported income increase (Baber et al., 1991; Cohen and Zarowin, 2010; Gunny, 2010; Roychowdhury, 2006). However, these studies take data where a capital market is not considered to use R&D expenditures for formulating expectations about the firm value. And, more important, compensation schemes are solely based on short-term signals. Even in the presence of a long-term compensation, He et al. (2003) show that R&D investment can be cut by managers if the bonus is based on the stock price.

In contrast to real earnings management, accounting earnings management contains the interpretation of accounting standards and aims at affecting the recognition, measurement and disclosure of transactions which have already taken place. This manipulation is also called window dressing, because the activity changes the reported signals but has no real effect on underlying economic earnings as in the case of real manipulation. There are many studies about accounting earnings management in the presence of stock-based compensation where the findings are ambiguous.[5] However, most of these studies have in common that they only consider accounting earnings management in the form of accrual

of COMPUSTAT firms for U.S. firms of the industrial sector in the late 80's. Hall et al. (1993) find great evidence for the 80's and even before, Griliches (1981) for the early 70's. Patents, e.g., are the result of past innovation activity and are only a weak signal for future innovation activity. Coherently, Cooper et al. (2015) figured out that the number of filed patents is a stringy biased signal because round about 50% of ideas are not patented and, therefore, they do not measure the right current innovation strength.

[5] See, e.g., Subramanyam (1996), Ke (2003), Johnson et al. (2009), Burns and Kedia (2006), Bergstresser and Philippon (2006), and Efendi et al. (2007) who provide evidence of a positive association between the use of stock-based compensation and fraudulent manipulation of the accounting statements while Erickson et al. (2006) see no consistent evidence of such a link. Only O'Connor et al. (2006) find a contrary effect, namely, that high stock-based portions in the salary lead to less earnings management.

management. In our paper, we focus on an another approach, namely classification shifting as a special case of accounting earnings management which describes the misclassification of expenses between items within the income statement. In contrast to accrual management, classification shifting does not change the level of the accounting income but only the separately disclosed items.[6] This part of earnings management is a relatively new research direction. Nevertheless, first empirical studies document that responsibles manage expenses and revenues more likely in this manner (McVay, 2006; Fan et al., 2010) Market participants are often more interested in *adjusted* operating income rather than in accounting income (Bradshaw and Sloan, 2002; Gu and Chen, 2004). The *adjusted* operating income, also called core operating income,[7] is excluded from extraordinary special items (e.g., reconstruction or acquisition), and is therefore more informative about the profitability and efficiency of a firm.[8] Returns of R&D investment are realized some time in the future and excluding these expenses can increase the informativeness about the current core operating income. However, the impact of classification shifting on the publication of R&D investment has only marginally been considered.[9]

To fill this gap, our paper examines the interplay between opportunistic earnings management and financial statements information in the presence of a capital market. More precisely, we investigate how real earnings management and misclassification of expenses are affected by specific economic conditions like innovation risk, accounting system precision and duration of R&D projects. We also analyze which consequences arise for the innovation activities of the firm.

To address these questions, we consider a single-period model with an induced moral hazard problem. The firm's terminal value is affected by the manager's effort in the oper-

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[6] Contrary to this intra-period earnings manipulation activity, accrual management is characterized by an earnings shift across reporting periods.

[7] For instance, see McVay (2006).

[8] Further examples for items which do not belong to the core earnings are earnings from goodwill impairments, employee stock options or pension gains and losses. In addition, revenues from non-core activities are also excluded.

[9] There are few empirical investigations in this research field. Skaife et al. (2013) study factors which lead managers to classify operating as R&D expenses. Koh and Reeb (2015) investigate the strategic decision with regard to the corporate R&D investment disclosure and also consider classification shifting as a used manipulation tool.

ating business and by the investment choice in R&D. The publicly observable accounting signals, accounting income and R&D expenditures, have to be disclosed at the end of the period and they determine the market price of the firm. The (exogenously given) compensation contract is based on the stock price and, in order to manipulate it, the manager can engage in real and accounting earnings management. Therefore, the manager can classify operating expenses as R&D expenses (or vice versa) which increases (decreases) the signal regarding the R&D investment, whereby the accounting income remains unaffected. In our model, real earnings management occurs if the R&D expenses deviate from the optimal economic investment level.

Our results show that the capital market takes the short-term signal (accounting income) more heavily into account compared to the forward-looking signal as an indicator for future growth (R&D investment). Higher reported investment in innovation leads to a positive market reaction and has the following effect on the two manipulation tools: First, the manager uses the misclassification of operating as R&D expenses to mislead shareholders (e.g., the manager can affect the partition of product engineering, employee's working hours and overhead costs between operating and R&D expenses which, in fact, does not change the accounting income). Thus, classification shifting causes too high disclosed R&D expenses because the firm signals a higher level of innovation activity, which should lead to higher returns in the future. In addition, the manipulation lowers the operating expenses which in turn implicitly increases the core operating income. Second, the real earnings management behavior is ambiguous and depends on the kind of innovation where the manager is responsible for investment. A clear under-investment behavior is undertaken if innovation generates returns with a time lag, which is mainly the case of drastic innovations. However, if there are projects which can be launched immediately, e.g., small incremental innovations, then an over-investment occurs. These results are based on the assumption that investors evaluate R&D expenses as a positive signal, which in turn is the case when innovation risk is moderate.

If the innovation risk is sufficiently high, an increase in disclosed investment amounts lead to a lower market price. In this special case, we show that classification shifting evokes lower disclosed R&D expenses and the investment in R&D is always below the benchmark level.

To study the effect of the accounting precision, we consider a firm which generates returns with a lag of time (e.g., the pharmaceutical industry) in a moderate innovation risk regime. We show that a higher precision of the accounting system leads to a lower level of classification shifting and, thus, a lower bias in the reported signals. This arises by a lower informativeness of the R&D investment signal for shareholders if the precision increases. Thus, the misclassification of expenses is less attractive. Moreover, we find a positive relation between a higher precision of the accounting system and real manipulation activities. Therefore, more precise signals lead to a reinforced reduction of the long-term investment. Consequently, there is a substitution effect of real earnings management and classification shifting due to the change in precision of the accounting signals.

Our paper is related to recent work on earnings management in the presence of a stock-based compensation. Regarding real manipulation activities, the work of Dutta and Reichelstein (2005) is worth mentioning. They use a multi-period model to examine the role of stock-based compensation on the managerial investment behavior.[10] In their model, the accounting system bears measurement errors which can be exploited by the manager in order to pursue opportunistic interests. These measurement errors occur due to a misclassification between intangible investments and operating expenses.[11] The authors show that an optimal capitalization rate of soft investments is able to reduce the manager's leeway to misreport. In an accounting earnings management context, Fischer and Verrecchia (2000) study earnings management in the presence of an exogenously given incentive rate which is based on the market price. They identify how accounting manipulation affects the informativeness of disclosed accounting income for the capital market.[12] Their study is extended by Ewert and Wagenhofer (2005) to a setting where the manager has the additional possibility to undertake real earnings management and examine whether tighter

[10] In contrast to Dutta and Reichelstein (2005), in our model, the manager undertakes an investment decision which is at no cost to him.

[11] In their model, misclassification is not endogenously chosen by the manager but is exogenously given by the accounting system.

[12] Unlike our model, Fischer and Verrecchia (2000) assume that the capital market is not perfectly able to anticipate the agent's equilibrium actions.

accounting standards might lower the extent of managerial manipulation.[13] However, all these studies have in common that they only consider accounting earnings management as accrual management. In contrast, we focus on classification shifting.

Our model is closely related to the work of Kanodia et al. (2004). They study how the capital market's perceptions can be influenced by different accounting signals, i.e., the current accounting income and the investment in intangibles.[14] Their work considers predominantly the accounting practice and investigates whether intangibles should be capitalized. The focus is set on the change in the market price due to a separating practice and does not depend on the behavior of the manager being responsible for the investment in R&D. Thus, the involved manager acts in the best interest of the owner. We consider instead a setting with an opportunistic manager who uses the possibilities of earnings management to improve his compensation.

After presenting the model setup in Section 2, we examine the capital market's reaction on the accounting information and the manager's equilibrium action levels in Section 3. Section 4 shows the manager's earnings management behavior in two different innovation risk scenarios. In Section 5, we examine the influence of the accounting system's precision on the relation between classification shifting and real earnings management. Section 6 concludes.

[13] Moreover, accounting earnings management resulting from a stock-based compensation is often examined in the recent literature, e.g., Feltham and Xie (1994) and Goldman and Slezak (2006).

[14] For the importance of the separation of investments from operating income for accounting issues, see Kanodia and Mukherji (1996).

2 Model setup

We consider a single-period LEN model with a risk-neutral principal and her risk-averse manager. The manager stays for one period in the firm and can affect the firm's terminal value by his effort e and the investment in R&D d.[15] The terminal value (i.e., economic earnings) is unobservable to all and given by:

$$X = \underbrace{\Omega - \Psi + \alpha\,\Pi}_{\text{Current period}} + \underbrace{(1-\alpha)\,\Pi}_{\text{Realized in future}}$$

where

$$\Omega = e + \tilde{\theta} \tag{1}$$

$$\Psi = d + \tilde{\varepsilon}, \tag{2}$$

$$\Pi = 2\sqrt{d}. \tag{3}$$

Due to his effort e, the manager enhances the current operating income Ω. The investment in innovation leads to current expenditures Ψ and total returns of Π. We assume that the manager has the possibility to invest in several innovation projects which differ in their profitability[16] and that he would always invest in those having the highest expected net present value: each additional unit of the invested capital reduces the total profitability of the investment. Therefore, the returns which can be generated by the investment are positive but to decreasing rates. However, only a part of the returns of the investment belongs to the current period, where the rest leads to future gains.

To which extent total returns are divided in current and future returns is determined by $\alpha \in (0,1)$. If α is significantly high (low), the investment is front-loaded (back-loaded). Thus, the terminal value consists of $\Omega - \Psi + \alpha\,\Pi$, indicating the income of the current period, and $(1-\alpha)\Pi$ which stands for future returns of the investment. Note that the manager does not stay until the firm earns the whole returns of the investment.

[15] In the following, investment in R&D and investment in innovation are used as synonyms. In addition, since we do not assume any temporal disparity, we also use expenses and expenditures as synonyms.

[16] It is assumed that the firm does not have any budget restriction and can borrow needed financial resources.

Furthermore, the investment in R&D is subject to risk. Expenses might be unproductive and/or wasted which means that only few projects lead to success. We capture this by a random variable $\tilde{\varepsilon}$ where a positive value determines unproductive expenditures.[17] Besides, the operating income is linked to risk $\tilde{\theta}$ which is beyond the control of the manager.[18] For instance, an unscheduled increase in wholesale prices, which can not be compensated by higher sales prices, leads to higher expenses and, hence, to a lower operating income. Both error terms are independently distributed random variables and the distributions are common knowledge:[19]

$$\tilde{\theta} \sim N(0, \sigma_\theta^2),$$
$$\tilde{\varepsilon} \sim N(0, \sigma_\varepsilon^2).$$

Accounting system and earnings management

At the end of the period, the manager has to disclose two accounting signals to the capital market. The first signal is the accounting income y and the second one contains the amount of R&D expenditures z. The accounting income contains operating income, total R&D expenditures and the current part α of the R&D investment returns. z is only one item out of this sum. Thus, an increase in R&D investment by one unit leads to a simultaneous reduction in the accounting income and an increase of the reported signal of the R&D expenditures by this unit.

The accounting reports are given by:

$$\begin{aligned} y &= (\Omega - b + \tilde{\eta}) - \overbrace{(\Psi + b + \tilde{\tau})}^{z} + \alpha\, \Pi, \qquad (4) \\ &= e + \tilde{\theta} + \tilde{\eta} - d - \tilde{\varepsilon} - \tilde{\tau} + \alpha\, 2\sqrt{d}, \\ z &= \Psi + b + \tilde{\tau}, \qquad (5) \\ &= d + b + \tilde{\varepsilon} + \tilde{\tau}. \end{aligned}$$

[17] See for a similar approach Kanodia et al. (2004).
[18] See Bushman and Indjejikian (1993).
[19] In the following, we denote unrealized random variables with a *tilde*.

For simplification, we assume that the capitalization of R&D expenditures is not allowed.[20]

Accounting signals contain estimation errors which arise due to problems regarding the record of business transactions in the firm's accounting system. The way how transactions and events are recorded is determined by accounting standards and because of restrictive specifications, the accounting system is not able to completely map the terminal value. Furthermore, another reason for the imprecision of the signals is the high number of business transactions and their complexity. In our model, these errors are represented by $\tilde{\eta}$ for the operating income and $\tilde{\tau}$ for the R&D expenses.[21] The noise terms are independently distributed normal random variables, following:

$$\tilde{\tau} \sim N(0, \sigma_\tau^2),$$
$$\tilde{\eta} \sim N(0, \sigma_\eta^2).$$

To influence the signals, the manager can engage in classification shifting and real earnings management. Since he is responsible for the publication of the accounting signals, he has the discretionary leeway b to undertake classification shifting. We consider a situation where the manager is able to manipulate the signals by changing expenditures between operating and R&D items. Therefore, the reported innovation investment z can be increased or reduced by this manipulation while the accounting income y remains unaffected.

The manager also has the discretion over the investment in R&D d. When he deviates from the optimal economic investment level, we interpret this as real earnings manage-

[20] In current accounting standards, the capitalization of selected R&D outlays may take place. For instance, development costs in accordance with IAS 38.57 are mandatory to recognize as an asset if enumerated conditions are fulfilled. However, since the main expenditures are excluded by that special case, we consider a generalized approach in which non of the expenditures are allowed to be capitalized. If we considered the possibility of capitalization of R&D, it would reduce z and would improve the accounting income.

[21] In this context, another important error is the misclassification of operating expenses and investments in R&D which are considered by Kanodia et al. (2004). Since boundaries between these two kinds of expenditures are fuzzy to identify, misclassifications are quite common in practice and hardly to avoid. For instance, marketing outlays support the revenue of current products, but also have a positive effect on future sales of new products or the brand building. Our primary results are not affected by this kind of accounting errors and, thus, the noise term is not considered in this model.

ment because he attempts to increase his own benefit.[22] Thus, the manager engage in real earnings management if he over- or under-invests in R&D.

Manager's utility

The utility function of the manager is determined by $U^M = -exp[-r(w-c)]$. Effort as well as accounting earnings management is costly for the manager and the disutility function is convex: $c = \frac{e^2}{2} + \frac{b^2}{2}$. In contrast, the investment decision of the manager is not linked to disutility since it is assumed that he only has to define the total budget for the R&D department. The budget decision is based on the evaluation of the possible projects by the R&D department and the manager's task to select these innovation projects having positive returns. Due to the fact that the terminal value is unobservable, a stock-based compensation scheme for contracting is used:

$$w = f + sP.$$

The compensation comes at the end of the period and takes the form of a linear contract, consisting of a fixed and a variable part: f denotes the fixed salary and $s > 0$ the incentive rate based on the market price P. In our model, the market price is normally distributed, as we will show in the next section. According to the work of Goldman and Slezak (2006), we do not consider any accounting signals for the manager's compensation. They show that accounting signals are short-term oriented and, thus, used for compensation this would strengthen an under-investment behavior. The level of the incentive rate is common knowledge, exogenously given and, therefore, not part of the principal's optimization problem.

The difference between wage and disutility is weighted by the risk aversion parameter $r > 0$. Given the assumption of linear wages and a normally distributed market price P

[22] For the optimal investment level, see Section 4.

(as shown in the next section), the manager's certainty equivalent can be represented by:

$$CE = E[w-c] - \frac{r}{2}Var(w), \tag{6}$$

whereby the manager's reservation utility equals zero.

3 Equilibrium analysis

To model the market price, we use a standard noisy rational expectation framework. Here, the capital market is information efficient and holds conjectures about the manager's actions in order to estimate the terminal value X. According to IFRS, the total amount of CEO compensation has to be disclosed and, therefore, it is commonly known that the manager's wage depends on the market price.[23] Using all available information, the market price takes the following form:

$$P = E[X \mid y, z, \widehat{e}, \widehat{d}, \widehat{b}].$$

The market price consists of the expectation about the terminal value which is conditional on the reported signals y and z, as well as on the rational conjectures about the unobservable effort $\widehat{e}$, investment decision $\widehat{d}$ and the biasing decision $\widehat{b}$. The terminal value X, and the accounting reports $\xi = \begin{bmatrix} y & z \end{bmatrix}^T$ are jointly normally distributed:

$$\begin{bmatrix} X \\ \xi \end{bmatrix} \sim N\left(\begin{bmatrix} \widehat{e} - \widehat{d} + 2\sqrt{\widehat{d}} \\ E[\xi] \end{bmatrix}, \begin{bmatrix} \Sigma_{11} & \Sigma_{12} \\ \Sigma_{21} & \Sigma_{22} \end{bmatrix} \right).$$

[23] Our model is in contrast to the approach of Fischer and Verrecchia (2000) who assume that the wage is not known to the market and the equilibrium bias by the manager can not be exactly anticipated.

The market price at the contract termination date is obtained by using standard results for conditional normally distributed first moments:[24]

$$P = E[X(\widehat{e},\widehat{d})] + \Sigma_{12}{\Sigma_{22}}^{-1}(\xi - E[\xi]),$$

where the covariances between the terminal value X and the signals ξ are mapped by the vector $\Sigma_{12} = {\Sigma_{21}}^{T} = \begin{bmatrix} \sigma_\varepsilon^2 + \sigma_\theta^2 & -\sigma_\varepsilon^2 \end{bmatrix}$ and the covariance matrix of the signals by:

$$\Sigma_{22} = \begin{bmatrix} \sigma_\varepsilon^2 + \sigma_\theta^2 + \sigma_\tau^2 + \sigma_\eta^2 & -\sigma_\varepsilon^2 - \sigma_\tau^2 \\ -\sigma_\varepsilon^2 - \sigma_\tau^2 & \sigma_\varepsilon^2 + \sigma_\tau^2 \end{bmatrix}.$$

Inserting the expressions and rewriting the price equation lead to the following form:

$$P = \beta_0 + \beta_1 y + \beta_2 z.$$

As y and z are normally distributed, P is normally distributed, too. The equation illustrates that the market price is determined by three coefficients: The first one, β_0, collects the initial expectations of the market where β_1 and β_2 describe the adjustment due to the signals y and z:

$$\beta_0 = E[X(\widehat{e},\widehat{d})] - \beta_1 E[y(\widehat{e},\widehat{d})] - \beta_2 E[z(\widehat{d},\widehat{b})], \tag{7}$$

$$\beta_1 = \frac{\sigma_\theta^2}{\sigma_\eta^2 + \sigma_\theta^2}, \tag{8}$$

$$\beta_2 = \frac{\sigma_\tau^2\,\sigma_\theta^2 - \sigma_\varepsilon^2\,\sigma_\eta^2}{\left(\sigma_\varepsilon^2 + \sigma_\tau^2\right)\left(\sigma_\eta^2 + \sigma_\theta^2\right)}. \tag{9}$$

Obviously, β_1 is strictly positive which is an intuitive result: market participants perceive a positive conjunction between the current accounting income and the economic earnings. An increase of the accounting income always leads to a higher market price.

[24] For a detailed derivation of the expression, see DeGroot (1970), p. 55, formula (19).

In contrast, the sign of β_2 is ambiguous. The sign of β_2 depends on the risk which is linked to the R&D investment. If the risk is moderate ($\sigma_\theta^2 > \frac{\sigma_\eta^2 \sigma_\varepsilon^2}{\sigma_\tau^2}$), β_2 is positive and investment increases the investors' assessment. A negative β_2 means that the market price decreases in the R&D investment. This is the case when the innovation investment risk is significantly high ($\sigma_\theta^2 < \frac{\sigma_\eta^2 \sigma_\varepsilon^2}{\sigma_\tau^2}$).

Compared to an accounting regime where the capital market can only observe the accounting income, the disclosure of an additional signal z would have two advantages for the investors: First, it contains information about the realized R&D expenses Ψ and, thus, the capital market can infer information about ε. Second, since the accounting income includes z, reported R&D expenditures can be used to provide a more accurate picture of the realization of θ.

Evaluation of the financial reports

In order to analyze the earnings management behavior of the manager, we first consider the capital market and its evaluation of the disclosed reports.

As mentioned above, the capital market makes use of the available accounting signals y and z whereby y stands for short-term profitability, and z, the expenses in R&D, reflect the ability to realize future gains and growth. By comparing the effect of these two signals on the market price, we obtain our first result.

Result 1 *In order to influence the market price positively, an increase of the accounting income has a stronger effect than a comparable increase of the R&D expenses:*

$$\beta_1 > \beta_2. \tag{10}$$

Proof. See the Appendix.

As β_1 is strictly positive and always exceeds β_2, we see that the market mainly uses short-term numbers for the firm valuation. This important fact comes from the correlation between the two signals and the firm's terminal value: If there is a high correlation between a signal and the unobservable terminal value, the informativeness of the signal about the firm value is also high. The result above shows that, for the capital market assessment, the accounting income is more informative about the terminal value compared to R&D expenses if the innovation risk is moderate. Recall that, in the case of a high innovation risk, β_2 is negative. Therefore, the R&D investments z could be have a higher impact on the market price: $|\beta_1| < |\beta_2|$. However, the condition (10) holds regarding the positive effect of the signals on the market price since the influence of y is still stronger.

The manager's optimal choice of effort and investment

In contrast to Kanodia et al. (2004), we consider a setting where the manager does not act in the best interest of the shareholders. Therefore, he makes all decisions to improve his own utility and the managerial decisions are determined by the underlying incentive contract. The manager chooses his operating effort, investment level and earnings management by maximizing his certainty equivalent which depends on the capital market pricing rule:

$$\max_{b,e,d} E[f + sP - c] - \frac{r}{2} Var(f + sP). \tag{11}$$

Solving the maximization problem brings us to the first Lemma.

Lemma 1 *In the presence of a stock-based compensation, the managerial levels of effort, investment and earnings management are given by:*

$$e^* = s\beta_1, \tag{12}$$

$$d^* = \frac{\beta_1^2 \, \alpha^2}{(\beta_1 - \beta_2)^2}, \tag{13}$$

$$b^* = s\beta_2. \tag{14}$$

Proof. See the Appendix.

The manager decides simultaneously on effort and investment to maximize his payment. Since the compensation depends on the market price, he will use both available actions in order to influence the market price in his favor.

In the next sections, we therefore study the earnings management activities under different investment risk environments.

4 Earnings management and innovation risk

In this section, we consider the manager's earnings management in the case of either moderate or high innovation risk. To increase his compensation, the manager can undertake classification shifting and real earnings management in order to affect the capital market assessment. Here, we focus mainly on the case of moderate risk where R&D investment is seen as a positive signal. Afterwards, a short analysis about high innovation risk follows.

Classification shifting and moderate innovation risk

In the case of moderate innovation risk, which means $\sigma_\theta^2 > \frac{\sigma_\varepsilon^2 \sigma_\eta^2}{\sigma_\tau^2}$ and leads to $\beta_2 > 0$, the classification shifting activity b is given by equation (14). The following result defines whether expenses are classified as operating or investment items.

Result 2 *The manager has an incentive to increase the disclosed signal for R&D expenses by a modified classification of operating expenses:*

$$b^* > 0. \tag{15}$$

Proof. See the Appendix.

This finding is primarily driven by two effects: First, expenses for R&D are used to give a tendency about future innovation potential and future growth. This is recognizable in accounting reports where many firms emphasize their investment amount in innovation.[25] Hence, the investors consider investment in R&D separately and interpret these expenses as a positive signal for future income. Since the capital market uses the disclosed financial statements to update its belief about the firm value, managers have incentives to exaggerate these costs. Notice, that this is solely a book-entry act and not a real shift of expenses so that the firm's terminal value is not affected. However, classification shifting leads to personal costs for the manager and, in equilibrium, the firm has to compensate for the disutility. This reduces the firm value net of compensation. Furthermore, in contrast to accrual management, classification shifting does not change the reported accounting income y.

Second, beside the role of the informativeness about the future innovation potential of the R&D expenses, investors use the core operating income as an important measure for the terminal value.[26] In our model, the accounting income y, without the R&D expenses z, can be interpreted as core operating income. The possibility to separately disclose the investment allows the investors to make a more precise assessment about the level of core operating income.[27] The manager can use this to increase the valuation by classification shifting from operative to R&D expenses. The accounting income remains unaffected by the expenses shift but a higher amount of R&D investment implies lower operating expenses and, hence, higher core operating income.[28]

Classification shifting as a manipulation tool has one additional advantage compared to accrual management. The personal costs of the manager being related to classification shifting might be relativity low. Accounting earnings management is limited by exoge-

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[25] Many rankings make use of these numbers. For instance, the Fortune Magazine has published a ranking for the most innovative firms based on the R&D expenditures in 2014.

[26] The interpretation of Result 2 is similar to the considerations of McVay (2006). Self-interested managers shift core operating expenses to income-decreasing special items in order to meet the earning targets of investors, since special items are often ignored by them. Thus, the manager can improve the capital market's assessment without a change in the disclosed accounting income.

[27] The accounting income is the sum of several items and is therefore influenced by several noise terms. Due to the separate publication of z, a more accurate calculation of $\Omega + \tilde{\eta} + \alpha\,\Pi$ is possible.

[28] An example of a classification shift is the case of the Borden, Inc. They classify marketing expenses in an amount of USD 194 million as part of the extraordinary special item *reconstruction*. The regular classification would have reduced the core operating income. Another example is IBM which has classified gains on asset sales as a part of the core income. For both examples, see McVay (2006).

nous factors like legal regulatory environment, corporate governance structures and external audits. In the case of classification shifting, McVay (2006) describes the advantage for the management in a lower audit incentive to verify the item classification if the amount of the reported income remains unchanged. Hence, the manager's disutility which results from the manager's time, the reputation costs and the litigation risk, is lower compared to accrual management. In addition, empirical studies find that the managerial use of a misclassification of expenditures in order to affect the investor's assessment increases if the possibility of accrual management is limited.[29]

Real earnings management and moderate innovation risk

In contrast to classification shifting, real earnings management directly changes the true underlying earnings and, thus, affects the firm's terminal value. To evaluate and quantify real earnings management, it is necessary to derive a benchmark investment level for a comparison. Recall that we consider a self-interested manager who chooses the R&D investment level to increase his compensation. To derive the benchmark, we assume that the manager makes all decisions in the interests of the shareholders, and solves the following decision problem:

$$\max_{d} E[X-c] - \frac{r}{2} Var(w).$$

The manager maximizes the netto surplus of the agency relationship and, thus, the optimal level of R&D expenses is given by:[30]

$$d^{FB} = 1. \tag{16}$$

The risk-neutral shareholders are not interested in the short-term market price development. Therefore, this first-best investment level is not affected by exogenous influences (e.g., the risk environment).

[29] See the empirical study of Fan et al. (2010). They examine classification shifting in the fourth quarter financial reports.

[30] Note that the participation constraint of the manager is already substituted into the optimization problem.

In the case of unobservable actions, the optimal investment level is defined by (13). Even if the investment decision is independent of the absolute level of the incentive rate, it depends on the capital market's reactions via β_1 and β_2.[31]

To analyze the extent of real earnings management, we compare the benchmark level with the equilibrium investment level of the manager by taking the difference:

$$\Delta = d^{FB} - d^*. \tag{17}$$

An under-investment (over-investment) occurs if Δ is positive (negative). The following result shows how the duration determines the real earnings management behavior.

Result 3 *Real earnings management of the manager leads to:*

1. *under-investment in innovation (*$\Delta > 0$*) if* $\alpha < \alpha^c$,
2. *over-investment in innovation (*$\Delta < 0$*) if* $\alpha > \alpha^c$,

where $\alpha^c = \dfrac{\sigma_\varepsilon^2(\sigma_\eta^2 + \sigma_\theta^2)}{\sigma_\theta^2(\sigma_\varepsilon^2 + \sigma_\tau^2)}$.

Proof. See the Appendix.

Result 3 shows that real earnings management critically depends on $\alpha \in (0,1)$. This parameter, describing the portion of the returns of the R&D investment affecting the current accounting income, can also be interpreted as development time: a high level indicates a quick development time. The degree of α is primarily driven by the business model and the industry in which the firm operates. For instance, it may take several years for pharmaceutical companies to offer medical solutions (low α) whereas food producers often have products with short life cycles. Here, the innovativeness shows up in product improvements which do not require a long research phase and are quickly launched onto

[31] Recall that investment does not lead to disutility. Since the incentive rate is positive, the manager is always better off to improve the capital market's assessment.

the market (high α). Only in case where α equals α^c, the manager chooses the first-best investment level. A significantly low α leads to an investment below the first-best level.

An interesting implication is that there is an opposite scenario under which a stock-based compensation leads to an over-investment. If α is relatively high ($\alpha > \alpha^c$), the management invests in projects even if their net present value is negative. The immediate realization of project outcomes incentivizes the manager to undertake too many projects. As mentioned above, this can be seen in industries where mainly product improvements are launched. Figure 2 illustrates the influence of α on real earnings management.

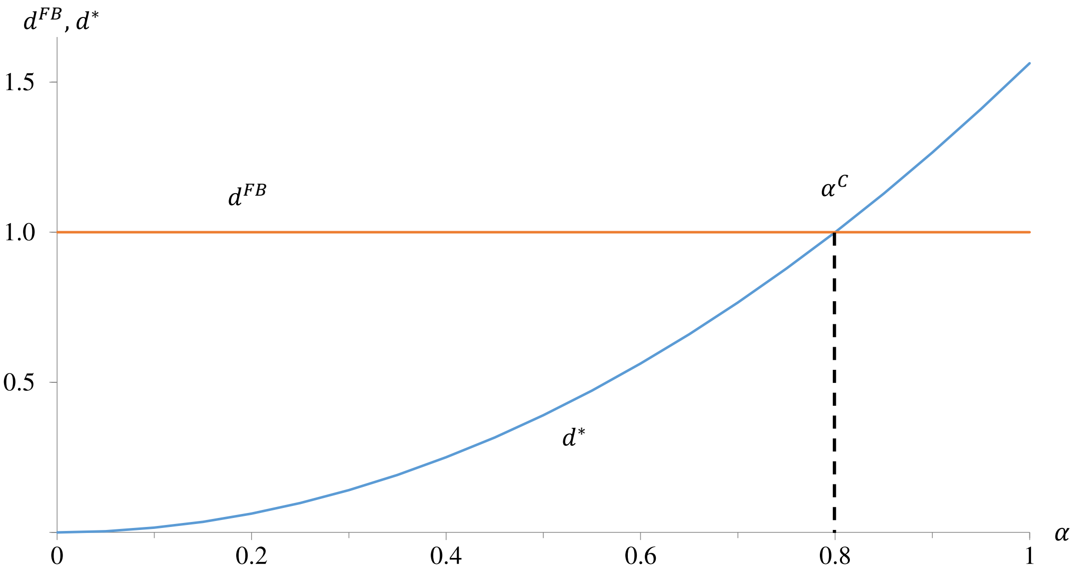

Figure 1: Comparison of first- and second-best investment levels (parameters: $\sigma_\theta^2 = 1$, $\sigma_\varepsilon^2 = 0.8$, $\sigma_\eta^2 = 0.2$, $\sigma_\tau^2 = 0.4$).

Comparative statics show explicitly which market components influence the investment decision in which manner. The next result summarizes the real manipulation behavior when returns of innovations investment can only generate in the long run ($\alpha < \alpha^c$) and, thus, the manager always under-invests (Δ is strictly positive).

Result 4 *Assume a significantly low α. The level of under-investment:*

(i) *decreases in a closer income realization:* $\frac{\partial \Delta}{\partial \alpha} < 0$,

(ii) *increases in the innovation uncertainty:* $\frac{\partial \Delta}{\partial \sigma_\varepsilon^2} > 0$,

(iii) *decreases in the operating uncertainty:* $\frac{\partial \Delta}{\partial \sigma_\theta^2} < 0$.

Proof. See the Appendix.

The first comparative statics result demonstrates how the effect of the return on innovation investment on the current income influences the level of R&D expenses. Projects that lead to an early realization of profits, increase the manager's willingness to invest. In the case of research projects which take many years to the launch stage, the investment is far below the benchmark level. In fact, this result gives a simple and intuitive explanation for the phenomenon that drastic innovations are rarely undertaken by firms.

The intuitive explanation for part (ii) of Result 4 is as follows: Higher uncertainty concerning the productivity of the investment leads to a lower investment level. As we have discussed earlier, R&D expenses do not always generate innovation and can therefore be unproductive. The higher the risk σ_ε^2, the lower the positive influence of signal z on the capital market's assessment. Consequently, the importance of the R&D expenses for the capital market decreases and higher real activity manipulation occurs.

An interesting finding is that the investment approaches the first-best level in a higher operating risk. Under the assumption of $\sigma_\theta^2 > \frac{\sigma_\varepsilon^2 \sigma_\eta^2}{\sigma_\tau^2}$, the capital market is strongly interested in the realized level of operating income because it explains more of the terminal value. Thus, if the uncertainty in the operating environment increases, the accounting income is more informative about the economic earnings of the firm X which leads to an increase in β_1. Since d^* is driven by β_1, the higher operating uncertainty leads to an increase in long-term investment.[32] As a consequence, real activity manipulations are reduced which is illustrated by part (iii) of Result 4.

[32] A similar relationship is documented by Atanassov et al. (2018). In an empirical study, they find that R&D investment increases in higher political uncertainty.

Bringing both earnings management practices together, we show that classification shifting reinforces the disclosed expenditures in R&D, whereas real earnings management leads to a real under- or over-investment behavior. Therefore, we have two effects which distort the results independently of one another. Moreover, it is obvious that the disclosed R&D expenditures must be handled with care: they do not reflect the entire growth potential of a firm since they contain a portion of distortion.

The effects of high innovation risk on earnings management

In this section, we consider the case where the firm operates in an industry with a high uncertainty of the R&D investment's productivity. Since $\sigma_\theta^2 < \frac{\sigma_\varepsilon^2 \sigma_\eta^2}{\sigma_\tau^2}$ is fulfilled, an increase in reported R&D expenditures leads to a lower valuation by the capital market, $\beta_2 < 0$. This influences the earnings management behavior which is summarized in the following result:

Result 5 *There is always an under-investment in innovation, and incentives to reduce the disclosed R&D expenses by a modified classification of operating expenses occur.*

Proof. See the Appendix.

Intuitively, if the capital market negatively weights the signal z, the manager attempts to reduce the disclosed R&D expenditures by the misclassification as operating expenses and by a lower real investment level. Due to the direct effect of real earnings management on the sent signal z, the manager would keep the investment level as low as possible. However, since the investment might lead to an immediate return in the current period ($\alpha \in (0,1)$), the R&D expenditures are still higher than zero in order to improve signal y. Nevertheless, the investment level is clearly lower compared to the benchmark investment as well as to the investment in a moderate innovation risk environment, $\sigma_\theta^2 > \frac{\sigma_\varepsilon^2 \sigma_\eta^2}{\sigma_\tau^2}$.

Result 5 illustrates that if the risk regarding innovation projects is sufficiently high, the shareholders of the firm can not provide the right incentives to obtain neither the benchmark nor the investment level of the moderate risk environment. Consequently, in a high innovative industry, a stock-based compensation leads to competitive disadvantages since little future investments are made. Nevertheless, it is worth mentioning that firms in the growth phase (start-ups), where the innovation risk is high, are mainly of a small size where it is doubtful if incentives via a stock-based compensation are needed because managers are often the owners themselves.

5 Earnings management and the precision of the accounting system

We now examine how a higher precision of both reported signals affects the relation between real earnings management and classification shifting. Our analysis is focused on the behavior of listed companies which generate investment returns in the long run (e.g., pharmaceutical companies). Therefore, we consider the case of a moderate innovation uncertainty $\left(\sigma_\theta^2 > \frac{\sigma_\varepsilon^2 \sigma_\eta^2}{\sigma_\tau^2}\right)$ and long-term returns of R&D investment ($\alpha < \alpha^c$). As we know from the previous section, under these conditions, incentives for an under-investment in innovation and a too high classification of R&D expenses are provided by a stock-based compensation. Note that both sources of manipulation incentives are determined by the capital market's reaction on the accounting signals. By changing the precision of the accounting system, the capital market's valuation of the firm is affected and, hence, the earnings management behaviour.

We assume that the informativeness of y and z regarding X can be refined by $k \geq 1$. This reduces the variances of $\tilde{\tau}$ and $\tilde{\eta}$, such that $Var(\tilde{\tau}) = \frac{\sigma_\tau^2}{k}$ and $Var(\tilde{\eta}) = \frac{\sigma_\eta^2}{k}$.[33] The parameter k is ad hoc exogenously given and observable to all parties. It can be thought of as a stronger corporate governance, e.g., tighter external controls or internal specifications by the owners for a more accurate publication. In which manner k affects the market assessment is stated in the next Lemma:

[33] In the literature, the precision is usually defined by the inverse of the variance of a signal (e.g., see Fishman and Hagerty, 1989; Christensen et al., 2013; Ewert and Wagenhofer, 2016). For a closer overview to referenced attributes of accounting precision, see Downen (2014).

Lemma 2 *Considering the precision of the accounting system, the regression parameters are given by:*

$$\beta_1 = \frac{k\,\sigma_\theta^2}{\sigma_\eta^2 + k\,\sigma_\theta^2}, \tag{18}$$

$$\beta_2 = \frac{k\left(\sigma_\tau^2\,\sigma_\theta^2 - \sigma_\varepsilon^2\,\sigma_\eta^2\right)}{\left(k\,\sigma_\varepsilon^2 + \sigma_\tau^2\right)\left(\sigma_\eta^2 + k\,\sigma_\theta^2\right)}. \tag{19}$$

Proof. See the Appendix.

Obviously, β_1 is strictly increasing in the precision of the accounting system $\left(\frac{\partial \beta_1}{\partial k} > 0\right)$ such that the reported accounting income y has a higher impact on the market price. In contrast, the influence on β_2 is not immediately apparent.

Recall that the disclosure of signal z has two advantages for the investors. First, the capital market can infer the information about ε (innovation risk) and, second, can implicitly use it to provide a more accurate picture of θ (operating risk) by the elimination of z from the accounting income. Here, the second effect is more important for the interplay of precision and valuation. The market can observe two signals which are correlated to each other and this correlation leads to a deviant impact of z on the capital market assessment: a higher precision of the accounting system reduces β_2 $\left(\frac{\partial \beta_2}{\partial k} < 0\right)$. A higher level of k increases the informativeness of y about the operating income Ω and, thus, z is less important to give an accurate picture of Ω.

Since the manager is compensated proportional on the market price, the change in the market valuation also affects the managerial earnings management which is stated in the following result.

Result 6 *An increase in the precision of the accounting system k leads to:*

(i) *less classification shifting,*

(ii) *more under-investment.*

Proof. See the Appendix

The first part of Result 6 describes the influence of the extent of accounting system precision on classification shifting. The optimal bias b^* critically depends on β_2, which is shown by equation (14). If the signals are more precise, z is less important for the investor's valuation and misclassification is less attractive for the manager ($\frac{\partial b^*}{\partial k} < 0$). Therefore, more precision mitigates the misclassification of expenses.

To understand part (ii) of the result, we need to consider the investment level in the second-best case which is shown by equation (13). Here, the investment is affected by a change in the precision of the accounting system in two ways. First, an increase of k leads to a higher β_1 and this has a positive impact on the investment level. Second, a higher k extends the spread $(\beta_1 - \beta_2)$ which lowers d^*.[34] Since the second effect exceeds the first one, a lower investment results if the accounting system is more precise. Note that, in the considered scenario, under-investment occurs in equilibrium. Consequently, the manager engage in more real earnings management ($\frac{\partial \Delta}{\partial k} < 0$).[35]

The relationship between both kinds of earnings management can be described by a substitution effect by a change in k which is described in the next result:

Result 7 *There is a substitution effect of real earnings management and classification shifting due to the change of precision in the accounting system.*

Under the condition of more precise accounting signals, on the one hand, there are less incentives to misclassify operating expenses. On the other hand, higher under-investment incentives arise. Note, there is no direct effect between these two managerial manipulation activities from the beginning of the game. Therefore, an endogenous substitution effect arises due to the market assessment.[36]

[34] See the Appendix (Proof of Lemma 2).

[35] Recall that if returns of innovation investment can only be generated in the long run ($\alpha < \alpha^c$) and the innovation risk is moderate, the manager always under-invests (Δ is strictly positive).

[36] A similar effect is observed by Ewert and Wagenhofer (2005). They find, regarding tighter accounting standards, a substitution of accrual management by real earnings management.

Empirical studies state that the use of classification shifting is more likely if real earnings management is constrained.[37] Our model demonstrates that a change in the relation of the use of these both manipulation tools can also result from the informativeness of the disclosed accounting information and, thus, an adjusted market reaction. Consequently, standard setters can increase the informativeness of accounting information by a higher precision which also lowers the biasing of the reports by managerial misclassification of expenses. However, there arise additional "costs" from implicit real activity incentives: as a side effect, lower long-term investment should occur by this adjustment. In fact, a higher precision of the accounting system does not necessarily have to be beneficial to the firm's shareholders.[38] From an innovation incentives perspective, a more precise accounting system has a negative impact on the realization of innovative projects.

6 Conclusion

In order to assess the innovative strength of a firm, R&D expenses as a source of information cannot be ignored from an investor's perspective. We study how financial information affect the capital market's assessment and the resulting earnings management incentives which in turn determines the innovation activity. We consider a single-period model where a manager publishes two accounting signals, accounting income and R&D expenses, which he can manipulate to increase the market price and his stock-based compensation.

The signals are in conflict to each other, as higher investment in innovation reduces the current accounting income. Comparing both signals with regard to their impact on the valuation, we find that accounting income has a stronger positive effect on the market

[37] Abernathy et al. (2014) find that if real manipulation is limited by difficult financial conditions and high levels of institutional ownership, managers are more likely to misclassify expenses. More general, Zang (2011) shows the substitution effect between these two manipulation tools in an empirical study. She finds that the adjustment of the level of accrual management according to the level of real activities manipulation depends on the their relative costs.

[38] This counter-intuitive finding is similar to Kanodia et al. (2005) who consider the investment choice under private information where the size of the investment return is not observable to the capital market. They show that a less precise accounting system can be value enhancing.

price. Due to this, incentives to undertake real earnings management occur: depending on the risk being connected with the innovation project as well as on the time the innovation needs to generate returns, there is only one case in which the manager undertakes an over-investment strategy. Only if the innovation risk is not too high and returns are realized immediately, the manager invests more than optimal in these projects. In all other cases, he is incentivized to cut expenditures. Thus, we show that incremental innovations are favored in comparison to drastic ones which need more time.

Beside these real earnings management considerations, there are also incentives to misclassify expenses. Managers can enhance the market price by a classification shift from operating to R&D expenses. This only affects the disclosed amount of R&D expenditures and has neither an effect on the accounting income nor on the firm's terminal value. The market puts a positive weight on the R&D signal and, thus, the manager classifies operating expenses as coming from innovation activities. In the extreme case of significantly high innovation risk, the market values R&D expenditures negatively. This induces the manager to lower disclosed R&D expenses.

We also examine the effect of a higher precision of the accounting system on earnings management in an industry where investment returns are realized in the long-run. More precise accounting signals lead to a lower level of misclassification of expenses and, in contrast, to higher real activity manipulation. Therefore, a higher precision of the accounting system leads to a lower bias in the reported signals and to a lower investment in innovation may occur.

Appendix

Variances and covariances

$$\begin{aligned}
Var(X) &= \sigma_\varepsilon^2 + \sigma_\theta^2, \\
Var(y) &= \sigma_\varepsilon^2 + \sigma_\theta^2 + \sigma_\tau^2 + \sigma_\eta^2, \\
Var(z) &= \sigma_\varepsilon^2 + \sigma_\tau^2, \\
Cov(X,y) &= \sigma_\varepsilon^2 + \sigma_\theta^2, \\
Cov(X,z) &= -\sigma_\varepsilon^2, \\
Cov(y,z) &= -\sigma_\varepsilon^2 - \sigma_\tau^2.
\end{aligned}$$

$$\begin{aligned}
&\Sigma_{11} = Var(X), \\
&\Sigma_{12} = \Sigma_{21}{}^T \begin{bmatrix} Cov(X,y) & Cov(X,z) \end{bmatrix}, \\
&\Sigma_{22} = \begin{bmatrix} Var(y) & Cov(y,z) \\ Cov(z,y) & Var(z) \end{bmatrix}.
\end{aligned}$$

Proof of Lemma 1

The managerial expected utility is given by:

$$CE = \left(\left(e - d + 2\,\alpha\,\sqrt{d}\right)\beta_1 + (d+b)\,\beta_2 + \beta_0\right)s + f - \frac{1}{2}e^2 - \frac{1}{2}b^2 - \frac{r}{2}s^2 Var\,(P)$$

where $\beta_0 = (\widehat{e} - \widehat{d} + 2\sqrt{\widehat{d}}) - \beta_1(\widehat{e} - \widehat{d} + 2\alpha\sqrt{\widehat{d}}) - \beta_2(\widehat{d} + \widehat{b})$. Differentiating managerial expected utility with respect to e, d and b and solving the first-order conditions for these variables yield:

$$\frac{\partial CE}{\partial e} = 0 \Longleftrightarrow e^* = s\beta_1,$$
$$\frac{\partial CE}{\partial d} = 0 \Longleftrightarrow d^* = \frac{\beta_1^2\, \alpha^2}{(\beta_1 - \beta_2)^2},$$
$$\frac{\partial CE}{\partial b} = 0 \Longleftrightarrow b^* = s\beta_2.$$

Proof of Result 1

Comparing the difference between the regression coefficients β_1 and β_2, and simplifying yield:

$$\beta_1 - \beta_2 = \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \sigma_\tau^2} > 0.$$

It therefore follows that the difference is strictly positive.

Proof of Result 2

Since $s > 0$ and $\beta_2 > 0$, the sign of the optimal bias, which is given by equation (14), is strictly positive.

Proof of Result 3

To obtain the difference between the first-best and the second-best investment level, we consider the difference between (16) and (13):

$$\Delta = 1 - \frac{\beta_1^2\, \alpha^2}{(\beta_1 - \beta_2)^2}.$$

Substituting (8) and (9) in the expression above and setting to zero, we obtain two solutions for α:

$$\alpha^C = \left[\frac{\sigma_\varepsilon^2\, \left(\sigma_\eta^2 + \sigma_\theta^2\right)}{\sigma_\theta^2\, \left(\sigma_\varepsilon^2 + \sigma_\tau^2\right)}, - \frac{\sigma_\varepsilon^2\, \left(\sigma_\eta^2 + \sigma_\theta^2\right)}{\sigma_\theta^2\, \left(\sigma_\varepsilon^2 + \sigma_\tau^2\right)} \right].$$

Variances have to be positive and additionally, $\alpha \in (0,1)$. Therefore, the second solution for α^C can be neglected. It follows that for $\alpha = \alpha^C$, Δ equals zero and, thus, the expenses level for R&D corresponds to the benchmark investment level of the first-best solution. Since we assume $\sigma_\theta^2 > \frac{\sigma_\varepsilon^2 \sigma_\eta^2}{\sigma_\tau^2}$, the expression $\frac{\sigma_\varepsilon^2 \left(\sigma_\eta^2 + \sigma_\theta^2\right)}{\sigma_\theta^2 \left(\sigma_\varepsilon^2 + \sigma_\tau^2\right)}$ is less than one. Hence, if α is lower (higher) than α^C, the $sgn(\Delta)$ is positive (negative) and the investment is lower (higher) than the benchmark level. This completes the proof.

Proof of Result 4

(i) Differentiating (17) with respect to α and simplifying yield:

$$\frac{\partial \Delta}{\partial \alpha} = -\frac{2\,\sigma_\theta^4 \alpha \left(\sigma_\varepsilon^2 + \sigma_\tau^2\right)^2}{\left(\sigma_\eta^2 + \sigma_\theta^2\right)^2 \sigma_\varepsilon^4} < 0.$$

Because $\alpha \in (0,1)$, the expression above is strictly negative.

(ii) Differentiating (17) with respect to σ_ε^2 and simplifying yield:

$$\frac{\partial \Delta}{\partial \sigma_\varepsilon^2} = \frac{2\,\sigma_\theta^4 \alpha^2 \left(\sigma_\varepsilon^2 + \sigma_\tau^2\right) \sigma_\tau^2}{\left(\sigma_\eta^2 + \sigma_\theta^2\right)^2 \sigma_\varepsilon^6} > 0.$$

This provides that the investment level increases in σ_ε^2.

(iii) Differentiating (17) with respect to σ_θ^2 and simplifying yield:

$$\frac{\partial \Delta}{\partial \sigma_\theta^2} = -\frac{2\,\sigma_\theta^2\, \alpha^2 \left(\sigma_\varepsilon^2 + \sigma_\tau^2\right)^2 \sigma_\eta^2}{\left(\sigma_\eta^2 + \sigma_\theta^2\right)^3 \sigma_\varepsilon^4} < 0.$$

This provides that the investment level decreases in σ_θ^2.

Proof of Result 5

To obtain the difference between the first-best and the second-best investment level, we consider the difference between (16) and (13), and simplify:

$$\Delta = \frac{\left(1-\alpha^2\right)\beta_1{}^2 - 2\beta_1\beta_2 + \beta_2{}^2}{\left(\beta_1-\beta_2\right)^2}.$$

Since we assume in this setting $\sigma_\theta^2 < \frac{\sigma_\varepsilon^2\sigma_\eta^2}{\sigma_\tau^2}$ which leads to $\beta_2 < 0$. Hence, $\Delta > 0$ and it always occurs an under-investment.

Proof of Lemma 2

In section 5, we expand our analysis by the precision of y and z. This affects the variance of these signals and the covariance between the signals which are now given by:

$$\begin{aligned} Var(z) &= \sigma_\varepsilon^2 + \frac{\sigma_\tau^2}{k}, \\ Var(y) &= \sigma_\varepsilon^2 + \sigma_\theta^2 + \frac{\sigma_\tau^2+\sigma_\eta^2}{k}, \\ Cov(y,z) &= -\sigma_\varepsilon^2 - \frac{\sigma_\tau^2}{k}. \end{aligned}$$

Consequently, the regression parameters (β_1, β_2) have to be adjusted in accordance to the modified signals. From the derivation of the regression parameters, which is described in section 3.1, we obtain $(\beta_1, \beta_2) = \mathbf{\Sigma_{12}\Sigma_{22}}^{-1} = \left[\begin{array}{cc} \frac{k\sigma_\theta^2}{\sigma_\eta^2+k\sigma_\theta^2} & \frac{k(\sigma_\tau^2\sigma_\theta^2-\sigma_\varepsilon^2\sigma_\eta^2)}{\left(k\sigma_\varepsilon^2+\sigma_\tau^2\right)\left(\sigma_\eta^2+k\sigma_\theta^2\right)} \end{array}\right].$

Differentiating (18) and (19) with respect to k and simplifying yield:

$$\frac{\partial\beta_1}{\partial k} = \frac{\sigma_\eta^2\sigma_\theta^2}{(\sigma_\eta^2+k\sigma_\theta^2)^2} > 0, \tag{A.1}$$

$$\frac{\partial\beta_2}{\partial k} = \frac{\left(-\sigma_\tau^2\sigma_\theta^2+\sigma_\varepsilon^2\sigma_\eta^2\right)\left(k^2\sigma_\varepsilon^2\sigma_\theta^2-\sigma_\tau^2\sigma_\eta^2\right)}{\left(k\sigma_\varepsilon^2+\sigma_\tau^2\right)^2\left(\sigma_\eta^2+k\sigma_\theta^2\right)^2} < 0. \tag{A.2}$$

Therefore, β_1 increases in k and, since we assume $k \geq 1$ and $\sigma_\theta^2 > \frac{\sigma_\varepsilon^2 \sigma_\eta^2}{\sigma_\tau^2}$, β_2 declines in k.

We now consider the effect of k on the difference between the regression parameters. Differentiating $(\beta_1 - \beta_2)$ with respect to k leads to:

$$\frac{\partial\left(\beta_1 - \beta_2\right))}{\partial k} = \frac{\sigma_\varepsilon^2 \sigma_\tau^2}{(k\sigma_\varepsilon^2 + \sigma_\tau^2)^2} > 0.$$

The difference between the regression parameters increases in k.

Proof of Result 6

We now consider the effect of k on earnings management. First, we examine the influence of k on classification shifting. Inserting (19) in (14), differentiating with respect to k and simplifying yield:

$$\frac{\partial b^*(k)}{\partial k} = \frac{s\left(-\sigma_\tau^2\,\sigma_\theta^2 + \sigma_\varepsilon^2\,\sigma_\eta^2\right)\left(k^2\,\sigma_\varepsilon^2\,\sigma_\theta^2 - \sigma_\tau^2\,\sigma_\eta^2\right)}{\left(k\,\sigma_\varepsilon^2 + \sigma_\tau^2\right)^2\left(\sigma_\eta^2 + k\,\sigma_\theta^2\right)^2} < 0. \tag{A.3}$$

Note that $\frac{\partial b^*(k)}{\partial k} = s\frac{\partial \beta_2}{\partial k}$ with $s > 0$. We know from (A.2) that the amount of misclassified expenses decrease in the accounting precision.

Second, we consider the effect of k on real earnings management. As in Proof of Result 3, to investigate the difference between the first-best and the second-best investment level. Inserting (8) and (9) in (13) and simplifying yield:

$$\Delta(k) = -\frac{\left(\sigma_\varepsilon^2\left(k\,\sigma_\theta^2\,(\alpha-1) - \sigma_\eta^2\right) + \alpha\,\sigma_\tau^2\,\sigma_\theta^2\right)\left(\sigma_\varepsilon^2\left(k\,\sigma_\theta^2\,(\alpha+1) + \sigma_\eta^2\right) + \alpha\,\sigma_\tau^2\,\sigma_\theta^2\right)}{\left(k\,\sigma_\theta^2 + \sigma_\eta^2\right)^2\sigma_\varepsilon^4}.$$

Setting the expression above to zero, we obtain two solutions for α:

$$\alpha^K = \left[\frac{\sigma_\varepsilon^2\,\left(\sigma_\eta^2 + k\,\sigma_\theta^2\right)}{\sigma_\theta^2\,\left(k\,\sigma_\varepsilon^2 + \sigma_\tau^2\right)}, -\frac{\sigma_\varepsilon^2\,\left(\sigma_\eta^2 + k\,\sigma_\theta^2\right)}{\sigma_\theta^2\,\left(k\,\sigma_\varepsilon^2 + \sigma_\tau^2\right)}\right].$$

Variances have to be positive and additionally, $\alpha \in (0,1)$. Therefore, the second solution for α^K can be neglected. In this setting, it is assumed that $\alpha < \alpha^C$. Since $k \geq 1$, α^K always exceeds α^C. Therefore, in this setting, $\alpha < \alpha^C < \alpha^K$ and an under-investment always occurs, $\Delta > 0$. To identify whether the additional precision k weakens or strengthens the under-investment, we insert (18) and (19) in (13) and (17), differentiate both with respect to k, and simplifying yield:

$$\frac{\partial d^*(k)}{\partial k} = \frac{2\,\sigma_\theta^4\,\alpha^2\left(k\,\sigma_\varepsilon^2 + \sigma_\tau^2\right)\left(-\sigma_\tau^2\,\sigma_\theta^2 + \sigma_\varepsilon^2\,\sigma_\eta^2\right)}{\left(\sigma_\eta^2 + k\,\sigma_\theta^2\right)^3\,\sigma_\varepsilon^4} < 0, \tag{A.4}$$

$$\frac{\partial \Delta(k)}{\partial k} = -\frac{2\,\sigma_\theta^4\,\alpha^2\left(k\,\sigma_\varepsilon^2 + \sigma_\tau^2\right)\left(-\sigma_\tau^2\,\sigma_\theta^2 + \sigma_\varepsilon^2\,\sigma_\eta^2\right)}{\left(\sigma_\eta^2 + k\,\sigma_\theta^2\right)^3\,\sigma_\varepsilon^4} > 0. \tag{A.5}$$

Since, in this seeting, we assume $\sigma_\theta^2 > \frac{\sigma_\varepsilon^2\sigma_\eta^2}{\sigma_\tau^2}$, d^* strictly decreases in k. The optimal Δ is always negative ($\alpha < \alpha^C$) and, therefore, the amount of real earnings management increases in k, $\left(\frac{\partial \Delta(k)}{\partial k} > 0\right)$.

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Essay III

Title

Earnings management during family firm succession:

An analytical perspective of the influence of socioemotional wealth

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Earnings management during family firm succession: An analytical perspective of 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.

1 Introduction

One of the most essential issue in family business research is the inter-generational turnover. As the turnover process is often accompanied by policy revisions and restructurings, it is one of the greatest challenge for corporations to manage changes in ownership and control. Especially for family firms, the provision of succession is a considerable task since they often have additional family-related motivations. 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] To summarize and following Gomez-Mejia et al. (2007), these family-related and non-monetary motivations can be aggregated to the concept *socioemotional wealth* (SEW). The 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] However, due to a change in ownership and control, incentives for earnings management behavior may arise. In order to alter the own utility, incentives to manipulate reports and/ or investment decisions can occur. How these incentives change, while regarding the SEW concept, is the aim of this work.

The field of earnings management is extensively analyzed in the literature, where instead earnings management during a turnover in family firms is 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

[1] More detailed views on the idiosyncrasy of family firms can be found in Handler (1994).
[2] There are several other sources influencing SEW (see, e.g., Westhead et al., 2001; Habbershon and Pistrui, 2002).
[3] Reviews to the state of research concerning earnings management in family firms can be found in Gomez-Mejia et al. (2014), Paiva et al. (2016), and Carrera (2017).

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 and there is apparently no literature addressing earnings management in family firms with respect to successions (e.g., Stockmans et al., 2010). Finally, the majority of the empirical literature on earnings management in family firms focuses predominately on accrual-based earnings management which is mainly driven by short-term considerations.[4] Due to dynastic thoughts of long-term sustainability,[5] it appears reasonable to consider also long-term investment decisions and if there are deviations to the economic optimal level, namely if there exists real earnings management.[6]

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 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 therefore 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 hiring 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?

[4] 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.

[5] Indeed, there is a consensus view that family firms attempt to ensure inter-generational sustainability, see Berrone et al. (2012).

[6] *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).

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 in which the junior obtains the senior's firm shares and their leadership, 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 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 (over-investment) or are below the economically optimal level (under-investment). 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. Therefore, agency costs occur.[9] Similar to the internal succession scenario,

[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".
[9] In our setting, agency costs arise due to a too low effort and a biasing activity by the external in period two.

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 over-investment 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.[10] However, most of these studies investigate either accrual manipulation or real earnings management.[11] 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.

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).[12] 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

[10] 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).
[11] Notable exceptions are Ewert and Wagenhofer (2005).
[12] In 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 $i = (s, j, m)$.

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:

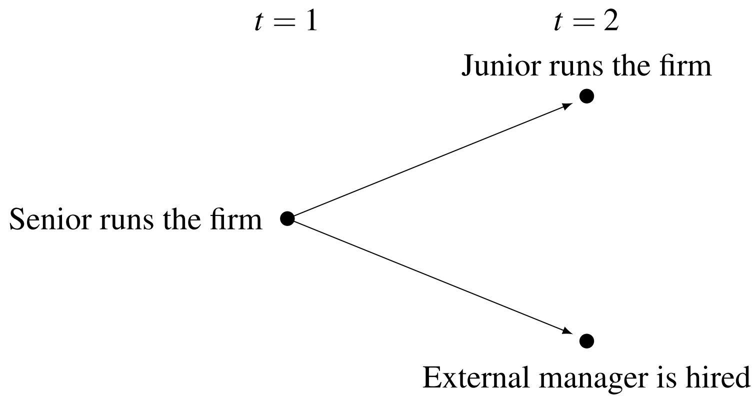

Figure 1: Succession scenarios

We assume that, following the firm succession, the ownership remains 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.[13]

Economic earnings

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

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

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

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.[14] 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

[13] We 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.

[14] Similar to Bhattacharya and Ravikumar (2001), the capital stock is fully consumed after one period.

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.[15]

Investment $d_{1,s}$ lowers current earnings but leads to growth in the future capital stock. Correspondingly, the capital stock of period two is modeled as an increasing (concave) function of the previous investment $K(d_{1,s}) = \sqrt{d_{1,s}}$.[16] 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 $\tilde{\theta}_t \sim N(1, \sigma_\theta^2)$. The strength of its impact on the economic earnings depends on the size of the capital stock.

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:

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

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

where $\tilde{\varepsilon}_t \sim N(0, \sigma_\varepsilon^2)$ is again an independent and identically distributed random variable and 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

[15] This 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.

[16] To simplify the model, we exclude investment decisions in the second period. As an investment in the second period would only lower the current cash flow, this would persuade the agent in charge to undertake no investment at all. Therefore, our results would not change.

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 these shifting activities, this can be interpreted as accrual-based or accounting earnings management.

In our model, the accounting signals are in use for two different purposes: for contracting with non-family managers and as a base for inheritance taxation. First, since the economic earnings are not observable and, hence, are not a reliable performance measure for contracting purposes, an incentive contract must be based on publicly available accounting numbers.[17] Second, 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 simplification, we assume that the first-period signal serves for the assessment of the inheritance tax of the transfer of the firm shares.[18] 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 tax rate is defined as $h \in [0, \frac{1}{2})$.[19]

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

[18] For inheritance tax purposes, corresponding assets are often valued at their open market value at the transfer date. For example in Great Britain (see Inheritance Tax Act, Ss 160-170) or in Germany (§11, 12 ErbStG and §§199-203 BewG). Therefore, accounting signals of the past years serve as an indicator for the market value. For simplification, we consider a one-book accounting system. Therefore, accounting signals are also used for taxation purposes.

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

The players' utility functions

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

$$U_s = x_1 - c_{1,s} + \underbrace{\Psi \cdot U_j + \Omega}_{SEW}. \tag{5}$$

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 which comprises two factors: 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 (Gomez-Mejia 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, i.e., $\Omega > 0$. In contrast, if an external manager leads the firm, Ω will be zero.[20] Secondly, family members care for the welfare of relatives and act altruistically to each other (Schulze et al., 2003; Zahra and Sharma, 2004). Therefore, in our setting, the future utility of the junior also generates positive value for the senior. This is captured by $\Psi \cdot U_j$, with $\Psi \in [0,1]$ which describes the extent to which "altruistic SEW" enters the senior's utility function. The senior suffers disutility coming from 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.

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.

[20] This parameter would be negative if the senior could sell the firm shares.

Thus, we have:

$$U_j = x_2 - h \cdot y_1 - \begin{cases} c_{2,j} & \text{if the junior runs the firm,} \\ w & \text{if the junior hires a manager.} \end{cases} \tag{6}$$

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:

$$U_m = w - c_{2,m}. \tag{7}$$

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 are also subject to internal controls (e.g., board monitoring) which makes manipulation activities for an external more costly.[21] This is expressed by $\lambda > 1$. The manager's reservation wage is set to zero without loss of generality.

[21] We 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:

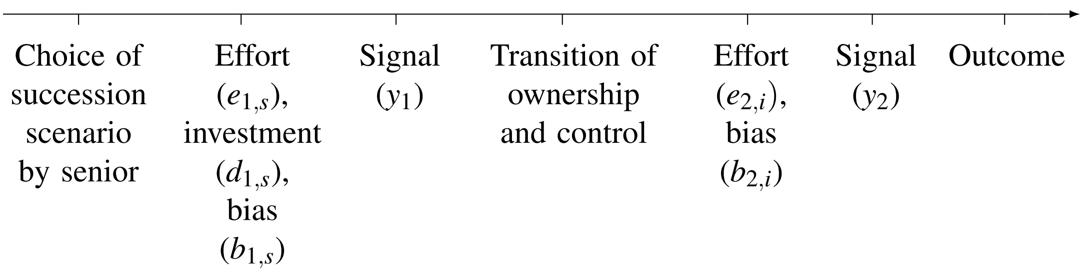

Figure 2: Timeline of events

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:

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

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:*

$$e_{1,s}^{B} = k_0, \tag{9}$$

$$e_{2,s}^{B} = \sqrt{d_{1,s}^{B}}, \tag{10}$$

$$b_{1,s}^{B} = 0, \tag{11}$$

$$b_{2,s}^{B} = 0, \tag{12}$$

$$d_{1,s}^{B} = 1. \tag{13}$$

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.[22] 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.

[22] All *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:[23]

$$\max_{e_{1,s},\, d_{1,s},\, b_{1,s}} E\left[U_s(e^F_{2,j}, b^F_{2,j})\right] = E\left[x_1 - c_{1,s} + \Omega + \Psi\, U_j(e^F_{2,j}, b^F_{2,j})\right]. \tag{14}$$

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:*

$$e^F_{2,j} = \delta_j \sqrt{d^F_{1,s}}, \tag{15}$$

$$b^F_{2,j} = 0, \tag{16}$$

$$e^F_{1,s} = k_0\ (1 - \Psi h), \tag{17}$$

$$d^F_{1,s} = \frac{\Psi^2}{(2 - \Psi\ (2h + \delta_j^2))^2}, \tag{18}$$

$$b^F_{1,s} = -h\, \Psi k_0^2. \tag{19}$$

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 $\delta_j = \{\frac{1}{2}, 1\}$. The senior's effort is below the benchmark ($e^F_{1,s} < e^B_{1,s}$). The reason for this finding is the altruistic SEW Ψ which tempts the senior to lower the effort level the more she is interested in the junior's utility. This 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

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

earnings of the first period and, therefore, by lowering her effort, the senior reduces the junior's tax base which in turn increases both the junior's utility and (via Ψ) the senior's utility. This indirect effect on the senior's effort is accompanied by the negative direct effect of the tax rate, wherefore tax rate h and altruistic SEW Ψ are substitutes. The level of investment is also determined by the altruistic 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 to a higher effort of the junior and, consequently, an increase in the equilibrium surplus of the junior. Moreover, the growth effect from the initial investment in period one expands itself further in period two.[24]

To which extent the junior is able to generate earnings from the capital stock 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.[25] 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 effect of different parameters on the senior's investment behavior is summarized in the following result.

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

[25] In 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).

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

Proof: See the Appendix.

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 altruistic SEW and on the inheritance tax rate. Whenever the senior's altruism is sufficiently high (low), $\Psi > \widehat{\Psi} = \frac{1}{h+1}$ $(\Psi < \widehat{\Psi})$, the investment $d^F_{1,s}$ exceeds (is below) the benchmark $d^B_{1,s}$.*

Proof: See the Appendix.

Our 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, 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 SEW via the junior's utility and, beside the lower effort $e^F_{1,s} < e^B_{1,s}$ as stated in Lemma 2, also accrual-based earnings management is used in order to increase the junior's utility and finally, the own utility. Intuitively, the bias increases also in the inheritance tax rate, $\frac{\partial b_{1,s}^F}{\partial h} > 0$, to offset a corresponding higher tax payment.

From a real manipulation perspective, the question whether an over- or under-investment occurs critically depends on the senior's level of altruistic 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 over-invest if her interest for the junior is high enough ($\Psi > \widehat{\Psi}$). 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 under-investment 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 because the current utility has a higher impact on the total utility ($\Psi > \widehat{\Psi}$). Note, that the critical value for an over- or under-investment itself depends on the inheritance tax rate $\left(\frac{1}{h+1}\right)$. Therefore, it is more likely to observe under-investment when the tax rate decreases. Thus, we predict that an over-investment is less likely in countries with a low inheritance tax rate or exception for firm shares.

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 a separation of ownership and control in family firms following a succession. By assuming that an external manager is hired in period two, we 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: $w = f + v \cdot y_2$.[26] 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. 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:

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

subject to

$$E[U_m] \geq 0, \tag{21}$$

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

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.[27]

[26] From 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, given the family firm context, we assume that owners have a strong emotional connection to the firm (e.g., due to long-term employees or the firm name being the family name) and would like to continue influencing the company. Thus, franchising the firm to an external agent is excluded by assumption.

[27] Results in the *external* succession scenario are symbolized by the superscript E

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

$$e^E_{2,m} = \frac{\lambda \sqrt{d^E_{1,s}}}{\lambda + 1}, \tag{23}$$

$$b^E_{2,m} = \frac{d^E_{1,s}}{\lambda + 1}, \tag{24}$$

$$v^E = \frac{\lambda}{\lambda + 1}. \tag{25}$$

Proof: See the Appendix.

Since we consider a risk-neutral setting, the incentive rate is not affected by risk sharing 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 $\lim_{\lambda \to \infty} v^E = 1$. 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:*

$$d^E_{1,s} = \frac{(\lambda + 1)^2 \Psi^2}{(\Psi(\lambda + 2h(\lambda + 1)) - 2\lambda - 2)^2}, \tag{26}$$

$$e^E_{1,s} = k_0 (1 - \Psi h), \tag{27}$$

$$b^E_{1,s} = -h\, \Psi\, k_0^2. \tag{28}$$

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.[28] The question whether the investment exceeds the extent in the benchmark solution is answered in the next result.

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 $\Psi > \breve{\Psi} = \frac{\lambda+1}{\lambda(h+1)+h+\frac{1}{2}}$ ($\Psi < \breve{\Psi}$), the investment d_1^E exceeds (is below) the benchmark.*

Proof: See the Appendix.

Similar to the internal succession setting, the senior uses accrual-based earnings management to shift earnings into the second period 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 why the senior does undertake accrual-based earnings management which artificially increases the manager's contractual base y_2. The answer can be found by taking a look at the fixed payment. Since $\frac{\partial f^E}{\partial b_{1,s}^E} < 0$, it becomes clear that 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.

[28] See the Appendix: Proof of Lemma 4.

Regarding the investment volume, the extent of deviation compared to the benchmark solution depends on the altruistic SEW of the senior and on the agency costs. Note that, as opposed to the internal succession scenario, in the external succession scenario there is also accrual earnings management in period two ($b^E_{2,m} > 0$) 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.[29]

The last part of Result 3 shows that real earnings management of the senior still critically depends on her own altruistic SEW: There also is a critical vale $\breve{\Psi}$ which determine whether first-period over- or under-investment occurs. Moreover, in comparing to the internal scenario, a higher altruistic degree of the senior must be needed for an over-investment in the first period. Since an external manager leads to agency costs which, in turn, provide lower investment incentives to the senior, $\breve{\Psi}$ exceeds $\widehat{\Psi}$.[30]

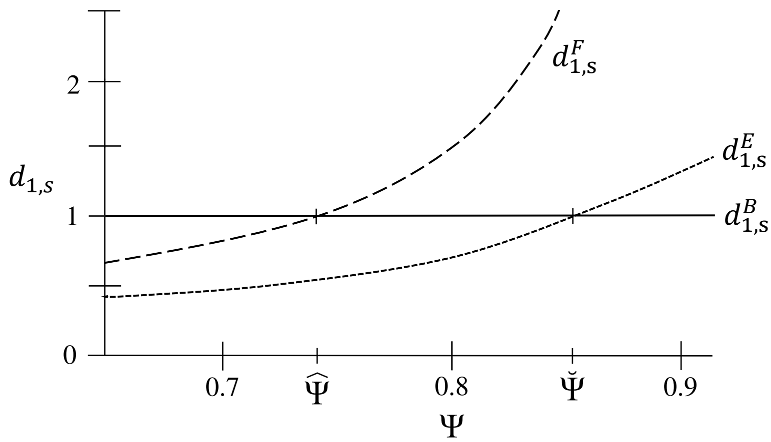

Figure 3: Investment levels of different scenarios (parameters: $h = 0.35$, $\lambda = 2$).

[29] In 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.

[30] Recall that, to consider the real earning management behavior, the productivities of all players equal one. The influence of a lower productivity of the junior ($\delta_j < \delta_m$) on investment is investigated in Section 4.

Figure 3 illustrates the investment levels of the different succession scenarios as functions of the altruistic SEW Ψ. It demonstrates the effect of the critical values of SEW on the real earnings management behavior. If $\Psi < \widehat{\Psi}$, the senior's investment is below the benchmark level in both scenarios. In contrast, independent of the succession scenario, the senior always over-invests if $\Psi > \breve{\Psi}$. Although, the real activity manipulation differ from each other due to their absolute level, however, the manipulation strategy is identical. Only in the area between $\widehat{\Psi}$ and $\breve{\Psi}$, the real earnings management strategy is different. While the senior over-invests if her offspring will lead the firm, in the case of an external manager, the investment is strictly below the benchmark. Consequently, if the firm's leadership remains within the family, an over-investment 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, note that by having the authority over the succession, she can implement that, e.g., establish in the firm's articles of association that the company, only an external manager has the executive rights whereas next-generation family members can only be members of the 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: $\Delta = E[U_s^F] - E[U_s^E]$.[31] 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.[32] 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

[31] Note, that the difference is expressed in absolute values. Thus, it can take positive and negative values.
[32] See section 3.3 for a closer analysis of the agency costs.

succession more beneficial.[33] 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 (Ω) is significantly high. It is straightforward that an increase of both (δ_j, Ω) reduces the advantage of hiring a professional external.

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.[34]

Result 4 *Assume a sufficiently high degree of altruistic 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, earnings differences between

[33] Recall 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 $\delta_j \in \{\frac{1}{2}, 1\}$.

[34] Note 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, the influence of the tax rate on the senior's succession decision, holds also for lower values of Ψ. See the Appendix.

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 $\left(\frac{\partial b_{2,m}^E}{\partial d_{1,s}} > 0\right)$ 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 succession 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" strictly dominate the "agency effect", i.e., a higher tax rate makes hiring a non-family CEO more beneficial. These findings can also be presented graphically in Figure 4. Assume the junior's productivity $\delta_j = \frac{1}{2}$, a dynastic SEW of $\Omega = 0.2$, an initial capital stock of $k_0 = 2$, and two possible monitoring technologies $\lambda_{low} = 1$ and $\lambda_{high} = 3$.

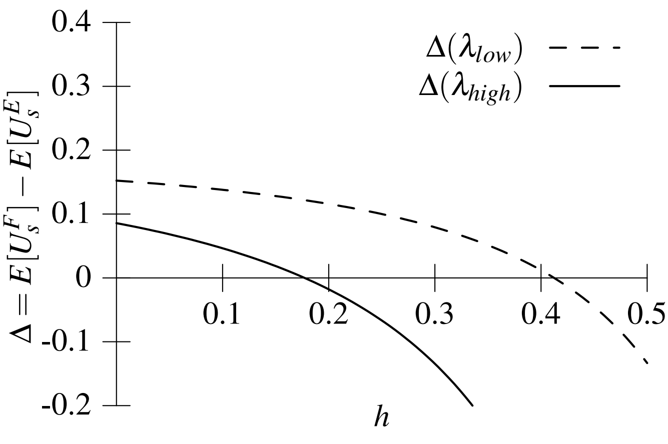

Figure 4: Succession decision of the senior

Figure 4 shows two functions $\Delta(h)$ for each monitoring technology. The dashed (solid) line illustrates low (high) monitoring of the external agent. It illustrates that an effective monitoring increases the range where an external CEO is implemented quite significantly. With a strong monitoring, an internal succession would only take place for inheritance tax rates $h < 0.177$. In contrast, when monitoring is weak, an external becomes beneficial at $h \geq 0.412$.

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 also 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 the liquidation of the firm in this model, however, her findings still do correspond to our result: if we assumed a sufficiently high level of h, the expected surplus of both succession scenarios $\left(E[U_s^F] \text{ and } E[U_s^E]\right)$ would become negative, making the firm's liquidation the 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 to 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 altruistic SEW. 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,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:

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

Solving the equation system for $e_{1,s}$, $e_{2,s}$, $d_{1,s}$, $b_{1,s}$ and $b_{2,s}$, and given $\delta_s = 1$, 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:

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

The senior's expected utility is given by:

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

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:

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

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 $b^F_{1,s}$. 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. From a real earnings management perspective, the productivity of the player does not need to be considered. To eliminate productivity effects, we set δ_s and δ_j to one. Using (13) and (18), we obtain:

$$d^B_{1,s} - d^F_{1,s} = \frac{4(\Psi h - 1)(\Psi h + \Psi - 1)}{(2\Psi h + \Psi - 2)^2}.$$

Solving $d^B_{1,s} - d^F_{1,s} = 0$ 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 over-investment 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:

$$\frac{\partial E[U^E_m]}{\partial e_{2,m}} = 0 \Longleftrightarrow e^E_{2,m} = v^E \delta_m \sqrt{d^E_{1,s}},$$
$$\frac{\partial E[U^E_m]}{\partial b_{2,m}} = 0 \Longleftrightarrow b^E_{2,m} = \frac{v^E d^E_{1,s}}{\lambda}.$$

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 mangers utility $E[U_m]$, which is given by equation (7), and simplifying yield:

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

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

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. From a real earnings management perspective, the productivities of the players do not need to be considered. To eliminate productivity effects, we set δ_s and δ_m to one. 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:

$$\breve{\Psi} = \frac{\lambda+1}{\lambda(h+1)+h+\frac{1}{2}},$$
$$\overline{\Psi} = \frac{\lambda+1}{\lambda\,h+h-\frac{1}{2}}.$$

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

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

$$\widehat{\Psi} - \breve{\Psi} = -\frac{0.5}{(1+h)\,(\lambda\,(h+1)+h+0.5)} < 0.$$

This shows that the critical value of the altruistic SEW in the external setting is strictly higher. Therefore, an under-investment rather takes place if an external manager will run 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 simplifying, a high degree of altruism ($\Psi = 1$) is assumed. Inserting $e^F_{1,s}$, $b^F_{1,s}$, $e^F_{2,j}$, $b^F_{2,j}$ and $d^F_{1,s}$ in the senior's utility $E[U_s]$ which is given by $(A.1)$, and we obtain the equilibrium surplus $E[U^F_s]$ 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 $e^E_{1,s}$, $b^E_{1,s}$, $e^E_{2,m}$, $b^E_{2,m}$, v^E, f^E and $d^E_{1,s}$ into the senior's utility $E[U_s]$, we obtain $E[U^E_s]$. The senior's utility between the internal and the external succession scenario is given by

$$E[U^F_s] - E[U^E_s] = \Delta. \tag{A.3}$$

(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:

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

Differentiating above with respect to h and simplifying yield:

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

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:

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

Differentiating above with respect to h and simplifying yield:

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

Since $h \in (0, 0.5]$, $\frac{\partial \Delta}{\partial h}$ is strictly negative. In this scenario, a higher tax rate makes hiring of 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 altruistic SEW ($\Psi = 0.5$). Inserting these values in $(A.3)$ and differentiating the expression with respect to h yield:

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

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 altruistic SEW ($\Psi = 0.5$) and a stronger monitoring ($\lambda = 2$), substitution and differentiation yield:

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

As in (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 $\Psi = 1$.

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

In the 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, using (A.3) and assuming $\delta_j = 1$, $\lambda = 2$ and $\Omega = 0$:

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

Since $h \in [0, \frac{1}{2})$, the equation above is strictly positive and, therefore, a family-member CEO is always preferred. Note that we do not consider the influence of a dynastic SEW ($\Omega = 0$) which will lead to higher $E[U_s^F]$ and, thus, to an increase in Δ.

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