

Chief financial officer (CFO) characteristics and ERP system adoption

ERP system
adoption

An upper-echelons perspective

85

Martin R.W. Hiebl

Management Accounting and Control, University of Siegen, Siegen, Germany

Bernhard Gärtner

Institute of Management Control and Consulting, Johannes Kepler University Linz, Linz, Austria, and

Christine Duller

Department for Applied Statistics, Johannes Kepler University Linz, Linz, Austria

Abstract

Purpose – This paper aims to examine the relationship between characteristics of chief financial officers (CFOs) and enterprise resource planning (ERP) system adoption. Following upper echelons theory, the authors theorize that CFO age, education, tenure and recruitment influence ERP system adoption, and that this relationship is moderated by the CFO being responsible for firm-wide information technology (IT) functions.

Design/methodology/approach – The empirical analysis is based on a survey of 296 large and medium-sized Austrian firms. Logistic regression analyses were used to test the association between CFO characteristics and ERP system adoption.

Findings – The authors find that firms with externally recruited CFOs have adopted ERP systems significantly more often than firms with internally promoted CFOs. Surprisingly, the results indicate that firms with less educated CFOs more often adopted an ERP system, and that the relationship between CFO characteristics and ERP system adoption is not moderated by the CFO being responsible for IT.

Research limitations/implications – This paper adds to the literature by corroborating case-based evidence that CFOs and their characteristics influence ERP system adoption. Extending previous research which indicates that CFO characteristics influence accounting practices, the authors show that CFO characteristics also influence technological innovation such as the adoption of ERP systems. Future research on technological innovation may therefore pay closer attention to the influence of CFOs.

Originality/value – This paper is the first to quantitatively test the influence of CFO characteristics on ERP system adoption.

Keywords Enterprise resource planning, ERP, CFO, Technological innovation, Chief financial officer, Upper echelons

Paper type Research paper

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1. Introduction

Because of significant changes in information technology (IT) and economic development in recent years, companies have increasingly implemented enterprise resource planning (ERP) systems to raise effectiveness and efficiency in the supply of information (Granolund and Malmi, 2002; Scapens and Jazayeri, 2003; Burns and Quinn, 2011; Chen *et al.*, 2012). Although ERP systems have been constituting one of the major IT developments in the past few decades (Rom and Rohde, 2006; Spathis, 2006; Dorantes Dosamantes, 2007; Kanellou and Spathis, 2013), their implementation varies greatly between companies, industries and national culture (Burns and Quinn, 2011; Silva *et al.*, 2015). Moreover, despite technological advantages, a considerable number of companies still do not use ERP systems. One reason for this is may be ERP system implementation risk. While some companies have successfully implemented ERP systems, others have failed and thus suffered from substantial follow-up costs, data errors and other malfunctions (Davenport, 1998; Bingi *et al.*, 1999; Chen, 2001; Kholeif *et al.*, 2007; Sangster *et al.*, 2009; Krotov *et al.*, 2011).

Successful ERP system implementation depends on various factors (Dorantes Dosamantes, 2007), with human factors usually considered to have the greatest influence (Kumar and van Hillegersberg, 2000; Sarker and Lee, 2003). This is why Bingi *et al.* (1999, p. 9) assert that ERP implementation often “is about people, not processes or technology”. Among the human factors, the role of the top management team and each individual member seems very important as the decision to adopt an ERP system and the subsequent integration of the system into the organization has to be borne by the top management team. For instance, Somers and Nelson (2001) identified top management support as the most important factor of success in an ERP system implementation, and Bingi *et al.* (1999) postulated that the success depends on the strong and sustainable commitment of the firm’s top executives. Similarly, Sarker and Lee (2003) reported a significant link between a strong and binding leadership through the top management team and successful ERP system implementations.

Thorough support has emerged from the literature as a prerequisite for successful ERP system implementations not only by the chief executive officer (CEO) but also by the entire top management team (Bingi *et al.*, 1999; Granolund, 2001; Spathis, 2006; Sangster *et al.*, 2009; Grabski *et al.*, 2011). In this connection, Chen (2001, p. 380) states that “top management commitment [...] is much more than a CEO giving his or her blessing to the ERP system”, and that top managers other than the CEO also have to support an ERP system adoption for it to be successful. So, it seems that ERP system adoptions represent strategic decisions in which not just the CEO but all or at least some other C-level officers[1] are involved to a significant extent (Caglio, 2003; Law and Ngai, 2007; Ramdani *et al.*, 2009).

However, some field study evidence indicates that while support from the entire top management team may be beneficial, single C-level officers may exert especially high influence on ERP system adoption decisions and later implementations, for instance by serving as project champions throughout the entire process from the decision to adopt an ERP system until its implementation (Shaul and Tauber, 2012). Here, the specific role of the chief financial officer (CFO) in ERP system adoption decisions comes into play. Besides the CEO, a firm’s CFO can be expected to play a decisive role in this process, because decisions on ERP system implementations are often jointly made by the CEO and the CFO (Brown, 2004). Moreover, if there is no board-level chief information officer (CIO), many CFOs take board-level responsibility for their firm’s IT, with IT managers reporting to the CFOs and not directly to their CEOs (Denford and Dacin, 2009; Banker *et al.*, 2011; Schult and Wolff, 2012). Thus, CFOs usually exert great influence not only on finance and accounting systems (Ge *et al.*, 2011; Huang and Kisgen, 2013; Hiebl, 2014; Plöckinger *et al.*, 2016) but also on strategic

IT decisions, such as ERP system adoption, especially when taking responsibility for IT at the board level. In this regard, Knapp and Shin (2001) reported that the CFO has a higher impact on ERP system implementations in companies compared with other executives, as the finance module determines ERP system implementations in most cases. Case study evidence further shows that CFOs may also assume the final responsibility for ERP system implementation projects (Boonstra, 2006; Caglio, 2003; Grabski *et al.*, 2009; Krotov *et al.*, 2011). Thus, we can infer that CFO influence on ERP system adoption is most pronounced if CFOs have board-level responsibility for the IT function.

Admittedly, however, not every CFO takes board-level responsibility for the IT function or ERP system implementation projects. Nevertheless, we can theorize that even in firms where CEOs or CIOs head the IT function and/or ERP system implementation, the CFO may exert decisive influence. The decision to adopt an ERP system usually results in significant implementation costs and consequently also in significant operating costs (Wei *et al.*, 2005). As with other considerable capital investment decisions (Mian, 2001; Schobel and Denford, 2012), it seems likely that CFOs are consulted when it comes to ERP system adoption and questioned as to how this investment impacts current and future earnings and cash flows and how the implementation costs can be financed. The CFO's opinion on and analyses of the potential ERP system adoption may therefore have a decisive influence on whether the respective firm eventually adopts an ERP system. Therefore, even if CFOs are not responsible for the IT function, because of their expertise and influence on investment decisions, they are likely to contribute significantly to decisions on ERP adoption. If CFOs are responsible for the IT function at the board level, as pointed out above, their influence on ERP system adoption decisions should be even stronger. This is why in the present study we examine whether the relationship between CFO characteristics and ERP system adoption is moderated by CFOs being responsible for the IT function.

In summary, based on these considerations, we can conclude that CFOs can be expected to have a significant impact on ERP system adoption. However, the above-mentioned studies did not focus on CFO roles or characteristics, but rather treated the CFO as one of many variables. Thus, the influence of CFOs and their characteristics on ERP system adoption can be regarded as not having been sufficiently considered in research.

Therefore, in this paper, we aim to analyze a CFO's influence on ERP system adoption. To do so, we follow the upper echelons theory (Hambrick and Mason, 1984; Hambrick, 2007) and study the relationship between CFO characteristics and ERP system adoption. More specifically, we study the direct effects of CFO age, education, tenure and recruitment on ERP system adoption and also whether these effects are moderated by the CFO bearing final responsibility for a firm's IT function. Although our data do not show a significant relationship between CFO age and tenure and ERP system adoption, our results do indicate that firms with externally recruited CFOs adopted an ERP system significantly more often than firms with internally promoted CFOs. Surprisingly, we find that in firms where the CFO has not received a university education, ERP systems are adopted more often than in firms with university-educated CFOs. Our analysis of interaction effects between CFO characteristics and the CFO being responsible for IT on ERP system adoption did not yield significant results, indicating that CFO recruitment and education are associated with ERP system adoption regardless of whether the CFO bears responsibility for IT.

In our view, our results add to the literature in two ways. First, to the best of our knowledge, this is the first study to exclusively focus on the CFO's effect on ERP system adoption. Our findings can be seen as corroborating extant case study-based evidence that externally hired CFOs might exert decisive influence and might be important players when it comes to ERP system adoption or implementation processes. Second, we contribute to the

broader literature on the effects of CFOs on organizational outcomes. While the literature has so far focused on the impact of CFOs or CFO characteristics on accounting and management practices (Hiebl, 2014; Plöckinger *et al.*, 2016) or firm performance (Mian, 2001), we show that CFO characteristics are also related to technological innovation such as the adoption of ERP systems.

The remainder of this paper is organized as follows. In Section 2, we discuss our application of upper echelons theory and develop five hypotheses. We then present our sampling procedures and the construction of our measures in Section 3. Finally, we report on our findings and end with a discussion of the results and conclusions from our study.

2. Theory and hypotheses

Given the above-described importance of CFOs for a firm's strategic IT decisions and major investment decisions in general, we propose a relationship between CFO characteristics and one particular major strategic IT decision which is usually associated with heavy financial investment – the adoption of an ERP system. This assumption is based on the upper echelons theory's central idea that organizational outcomes can (at least partially) be predicted from characteristics of a firm's top executives (Hambrick and Mason, 1984; Finkelstein and Hambrick, 1996; Hambrick, 2007). According to Hambrick and Mason (1984) and Carpenter *et al.* (2004), there are various organizational outcomes that are affected by upper echelon characteristics. These include strategic choices such as product innovation or diversification and also aspects which rather address an organization's (financial) structure such as financial leverage or administrative complexity.

In this paper, we regard whether a firm has adopted an ERP system to be an aspect of administrative complexity and thus an organizational outcome in the sense of the upper echelons theory. Admittedly, there are arguments presented in the literature that ERP systems may reduce the complexity of a firm's IT landscape by harmonizing and standardizing systems that had earlier been separated (Cadili and Whitley, 2005; Choi *et al.*, 2013). By contrast, studies also clearly mark ERP systems as complex administrative systems (Dillard *et al.*, 2005; Grabski *et al.*, 2011). More critical studies also note that ERP system adoption (unintendedly) adds to administrative complexity (Wagner and Newell, 2004; Elbanna, 2007). Dillard *et al.* (2005, p. 107) even view ERP systems as a "physical manifestation of administrative evil". While we would not go that far, we find that ERP systems do follow Hambrick and Mason's (1984) description of "complex administrative systems". Hambrick and Mason (1984) associate "complex administrative systems" with the formalization and thoroughness of such systems. For instance, they mention the "thoroughness of formal planning systems, complexity of structures and coordination devices" and "budgeting detail and thoroughness" as specific forms of administrative complexity (Hambrick and Mason, 1984, p. 201). Of course, at the time when Hambrick and Mason (1984) wrote their seminal paper on the upper echelons perspective, what we know as ERP systems at present did not exist. However, given their description of "complex administrative systems", we are convinced that ERP systems fall into this category of organizational outcomes. This is why, in this paper, we view ERP systems as a form of administrative complexity in the sense of the upper echelons theory.

The upper echelons theory deliberately focuses on observable managerial characteristics' impact on organizational outcomes, suggesting that managerial characteristics serve as a proxy for an executive's underlying (and unobservable) psychological patterns, such as values or ways of thinking, which significantly influence an organization's course (Hambrick and Mason, 1984; Schult and Wolff, 2012). Since Hambrick and Mason's (1984) seminal paper on the upper echelons theory was published, a variety of research has confirmed that

managerial characteristics are indeed able to predict organizational outcomes (Carpenter *et al.*, 2004; Hambrick, 2007; Menz, 2012).

In addition to the direct effects of managerial characteristics on organizational outcomes, Hambrick and Finkelstein (1987) later introduced the concept of managerial discretion as a moderator of the relationship between upper echelon characteristics and organizational outcomes. Meanwhile, the relevance of managerial discretion is well established in upper echelon studies (Hambrick, 2007; Hiebl, 2014). Managerial discretion refers to the latitude of options top managers have at their disposal (Hambrick and Finkelstein, 1987). It acts as a moderator of the upper echelons theory in the sense that managerial characteristics have more impact on organizational outcomes and strategy if managerial discretion is high, which translates into managers having more freedom of action (Finkelstein and Hambrick, 1990; Hambrick, 2007; Crossland and Hambrick, 2007, 2011). For this reason, we also include the concept of managerial discretion in this study. We expect that a CFO's discretion over IT decisions such as ERP system adoption is higher if the CFO is the top management team member responsible for IT, which is frequently the case in practice (Denford and Dacin, 2009; Banker *et al.*, 2011; Schult and Wolff, 2012). Put differently, if a top management team member other than the CFO – such as the CEO or a board-level CIO – is responsible for IT, we expect that CFO characteristics are less well suited to predict ERP system adoption decisions.

To summarize, in this paper, we specifically investigate the direct effects of a CFO's age, tenure, education and recruitment on ERP system adoption. Moreover, we propose that these effects should be moderated by the CFO being the top management team member responsible for IT or not. An overview on our research model and the hypotheses presented are shown in Figure 1. We now develop our hypotheses on these effects in more detail.

2.1 Direct effects

Research has shown that younger managers tend to be more risk-seeking and innovative (Young *et al.*, 2001). This relationship is explained by older managers having less physical or mental stamina, needing more time to make decisions, having greater commitment to preserve the status quo and avoiding risk to their financial and career security due to nearing retirement (Hambrick and Mason, 1984). For CFOs, research results indicate that a higher CFO age leads to lower adoption of innovative management accounting systems (Naranjo-Gil *et al.*, 2009) and lower usage of innovative cost management systems (Pavlatos, 2012).

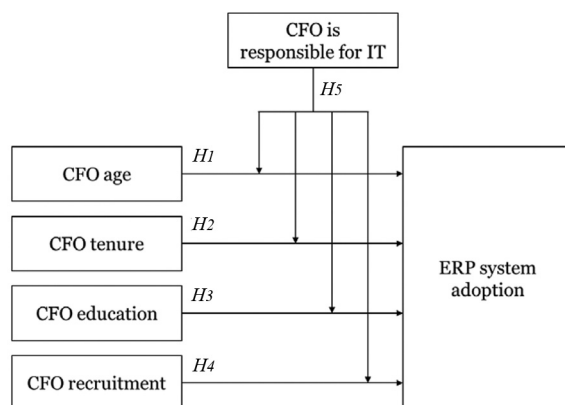


Figure 1.
Research model

A firm's decision to implement an ERP system not only undoubtedly marks a major innovation to a firm's business processes (Karimi *et al.*, 2007) but also involves the risk of the ERP implementation failing, thereby creating significant additional costs or producing incorrect and business-harming information (Sumner, 2000; Krotov *et al.*, 2011). Thus, older CFOs might rather shy away from pushing on the adoption of ERP systems for the above-stated reasons. Moreover, older CFOs may not have been educated in the benefits (and downsides) of ERP systems, because at the time of their education, ERP systems were probably less common or not present at all. Thus, in accordance with Hambrick and Mason's (1984) proposition that younger top managers are more open to innovative practices, older CFOs might not take full advantage of the potential benefits of ERP systems and therefore not promote their adoption. We therefore propose:

H1. Firms that have a relatively old CFO have adopted an ERP system less often than firms that have a relatively young CFO.

Similar to CFO age, a CFO's tenure in his or her position is also likely to influence organizational outcomes (Hambrick and Mason, 1984). Longer-tenured CFOs can be expected to have developed substantial power basis, work routines and social networks within the firm, which could be at risk if they opted to pursue risky ventures such as an ERP system adoption, even if they might regard such innovation as beneficial to the firm (Finkelstein and Hambrick, 1996; Young *et al.*, 2001). In the literature, there is an abundance of data indicating that top managers' tenure negatively affects firm innovation (Finkelstein and Hambrick, 1990; Boeker, 1997; Geletkanycz and Hambrick, 1997; Young *et al.*, 2001), suggesting that longer-tenured managers get "stale in the saddle" (Hambrick, 2007, p. 337). In this vein, extant upper echelons research on the CFO confirms that longer-tenured CFOs also tend to be less innovative than shorter-tenured CFOs (Naranjo-Gil *et al.*, 2009; Burkert and Lueg, 2013). Interestingly, Pavlatos (2012) reported that longer CFO tenure is also negatively associated with a firm's IT quality, which might indicate that longer-tenured CFOs are also less likely to foster major IT investments, such as ERP system adoptions. Thus, we propose a negative relationship between both CFO age and tenure and ERP system adoption:

H2. Firms that have a relatively long-tenured CFO have adopted an ERP system less often than firms that have a relatively short-tenured CFO.

Besides age and tenure, a top manager's education marks another characteristic of top managers regularly studied in upper echelons studies (Carpenter *et al.*, 2004; Menz, 2012). For CFOs, extant empirical research concordantly reports a significant relationship between a CFO's education (measured as more business-oriented or more operations-oriented) and the usage of innovative accounting, costing and value-based management systems (Naranjo-Gil *et al.*, 2009; Pavlatos, 2012; Burkert and Lueg, 2013). Originally, Hambrick and Mason (1984, p. 200) proposed that the level of education is "positively related to receptivity to innovation". This proposition is rooted in the idea that more education increases a person's knowledge and skill base, and that more knowledge and skills enable higher levels of innovation. Moreover, and especially important for this paper, Hambrick and Mason (1984) also proposed that a formal university education – especially in the field of business administration – leads to managers relying heavily on formal and complex administrative systems, because a university education tends to emphasize on the importance of such systems. Given the notion discussed above that ERP systems can certainly be regarded as complex administrative systems (Dillard *et al.*, 2005; Grabski *et al.*, 2011), a positive connection between CFOs having or not having received a university education and ERP

system adoption seems likely. Thus, in this study, we distinguish between CFOs who have obtained and who have not obtained a university education and expect the CFOs' education to be related to ERP system adoption. Thus:

H3. Firms that have a university-educated CFO have adopted an ERP system more often than firms that have a non-university-educated CFO.

Similar to the level of education, the diversity of a top manager's experience is also likely to broaden his or her mind and to foster innovative strategic choices (Hambrick and Mason, 1984; Hambrick, 2007). Specifically, Hambrick and Mason (1984) relate this proposition to findings showing that executives brought in from the outside of a firm tend to make more changes to a firm's structures and procedures than those chosen from within. Therefore, in this paper, we study whether firms with externally hired CFOs have adopted an ERP system more often than firms with internally promoted CFOs. Related CFO research has shown that hiring a CFO from outside the firm leads to substantial changes in accounting practices (Geiger and North, 2006) and firm performance (Mian, 2001). Case study evidence further indicates that firms also hire CFOs from the outside who have experience in ERP system implementations to support the implementation process (Caglio, 2003; Magnusson *et al.*, 2010). This finding indicates that firms that want to push forward ERP system implementation might hire CFOs from the outside to acquire necessary knowledge, which further underpins the importance of CFOs – especially externally hired ones – for ERP system adoption. Similar to the argument on the relationship between CFO tenure and ERP system adoption and the relationship between CFO recruitment and ERP system adoption, it can be expected that compared to externally hired CFOs, internally promoted CFOs are less inclined to foster substantial organizational changes, such as ERP system implementations, due to risk-avoidance (Hambrick and Mason, 1984). Thus, we propose:

H4. Firms that have an externally hired CFO have adopted an ERP system more often than firms that have an internally promoted CFO.

2.2 Interaction effects

As already indicated above, besides CEOs or board-level CIOs, CFOs are often the board members responsible for firm-wide IT functions (Denford and Dacin, 2009; Banker *et al.*, 2011; Schult and Wolff, 2012). If the CFO is the one top manager who bears final responsibility for IT on the management board, then we expect that the CFO's characteristics are better suited for predicting the adoption of ERP systems. In such situations, the CFO should have more influence on and higher managerial discretion of strategic IT decisions, such as ERP system adoptions. Thus, as predicted by Hambrick (2007), in such cases of higher managerial discretion, CFO characteristics should have more influence on strategic IT outcomes. We therefore propose an interaction effect between CFO characteristics and the CFO being responsible for IT:

H5. The relationships between CFO characteristics and ERP system adoption, as predicted in *H1–H4*, will be more pronounced if the CFO is responsible for IT at the board level.

3. Methods

3.1 Sampling procedures

To test the five hypotheses drawn, we gathered data using a standardized online questionnaire between June and July 2012. An invitation to participate in our survey was sent out by e-mail to the CFOs of all 5,827 Austrian companies that had at least 50 employees at the time of our study. We addressed CFOs as target persons for our survey, because they can

be expected to know their personal characteristics best. We pointed out a number of times (e.g. e-mail text and subject line) that the CFO should answer the questions mentioned. The e-mail addresses were acquired through the Compass database. Our invitation e-mails contained a cover letter with explanations on the background of the study and a link to an online questionnaire. After the first wave of invitation e-mails were sent out in June 2012, we sent out a reminder in July 2012 to the CFOs who had not responded to the first invitation.

The quality of the data was verified by various controls. First, before the actual survey was carried out, we conducted a pretest with ten CFOs working for firms of various sizes and industries. According to [Atteslander \(2010\)](#), these pretests correspond to the selected sample of the overall study. In the scope of the pretests, the content and usability of the online questionnaire was tested ([Evans and Mathur, 2005](#)). The results of the pretests were collected, discussed and incorporated into the final version of the questionnaire. Second, we assigned individual token keys to every e-mail invitation to prevent multiple answers from identical participants. Third, to control for non-response bias, we compared the first one-third of the respondents with the last one-third of the respondents. There was no indication of a non-response bias as no significant differences could be detected between early and late respondents ([Leslie, 1972](#); [Armstrong and Overton, 1977](#)).

Of the 5,827 invitations we sent out, we received 488 answers. Of the 488 answered questionnaires, 192 had to be eliminated as a consequence of incomplete answers. Finally, 210 of 296 CFOs answered that their company had adopted an ERP system. Thus, the remaining 210 answers built the basis of the results presented below, which represented a response rate of usable data of 3.6 per cent.

3.2 Measures

An overview on the variables included in our study is shown in [Table I](#). Most variables feature a dichotomous level of measurement due to the basic characteristic inherent in upper echelons studies to focus on “observable managerial characteristics” ([Hambrick and Mason, 1984](#), p. 196). Thus, the prevalence of dichotomous variables stems from the fact that CFOs do or do not feature a certain characteristic and firms do or do not adopt an ERP system.

The dichotomous variable “ERP System adoption” serves as the dependent variable in our analysis. Because of extant literature offering various different definitions of ERP systems, individual survey respondents may also have different understandings of the term “ERP system” ([Buonanno et al., 2005](#); [Kallunki et al., 2011](#)). Therefore, we included a brief note in the questionnaire explaining what the term “ERP system” means in our context: we defined ERP systems as “multi-module application systems that support the operational processes of an entire enterprise in all key functional areas” ([Mabert et al., 2003](#); [Scapens and Jazayeri, 2003](#); [Grabski et al., 2011](#)). After this ERP system definition, we offered survey participants a range of ERP systems commonly used in Austrian firms (BMD, Microsoft, SAP, Infor and Oracle) and asked them whether their firm had adopted any of these systems (participants could also indicate that their firm had adopted another ERP system) at the time of our investigation. Survey participants could also opt for “none”, indicating that their firm had not adopted any ERP system. For all participants who indicated that they had adopted any of the named ERP systems or another ERP system, the variable “ERP system adoption” was coded as “1”. For all participants who indicated that their firm had not adopted any ERP system, the variable “ERP system adoption” was coded as “0”. Therefore, firms both having and not having adopted an ERP system were included in our sample.

In the pretests, it became apparent that being asked when the ERP system was adopted led to serious interpretation problems for survey participants, because in some firms, they are adopted gradually (by so-called “gradual phase-in”, [Abdinnour-Helm et al., 2003](#);

Variable	Level of measurement	Description
<i>Dependent</i>		
ERP system adoption	Dichotomous	Indicates whether the firm has (=1) or has not (=0) adopted an ERP system
<i>Independent</i>		
CFO age	Dichotomous	Indicates whether the CFO's age is over 45 years (=1) or equal to or lower than 45 years (=0)
CFO education	Dichotomous	Indicates whether the CFO has (=1) or has not (=0) received a university education
CFO tenure	Metric	Tenure of the CFO in current position in years
CFO recruitment	Dichotomous	Indicates whether the CFO was promoted to the current position internally (=1) or was hired into the current position from outside the firm (=0)
<i>Moderator</i>		
CFO responsible IT	Dichotomous	Indicates whether the CFO is responsible for IT at the board level (=1) or not (=0)
<i>Controls</i>		
Firm size	Dichotomous	Indicates whether the firm can be regarded as medium-sized (=0) or as large (=1); for size classification, we relied on employee numbers as set by the European Commission (2003) and regarded firms with 50-249 employees as "medium-sized" and firms with at least 250 employees as "large"
Industry manufact	Dichotomous	Indicates whether the firm can be regarded as belonging to the manufacturing sector (=1) or not (=0)
Industry retail	Dichotomous	Indicates whether the firm can be regarded as belonging to the retail sector (=1) or not (=0)
Industry service	Dichotomous	Indicates whether the firm can be regarded as belonging to the service sector (=1) or not (=0)
Industry other	Dichotomous	Indicates whether the firm can be regarded as belonging to a sector other than manufacturing, service, and retail (=1) or not (=0)
Listed	Dichotomous	Indicates whether the firm is stock-market listed (=1) or not (=0)
Subsidiary	Dichotomous	Indicates whether the firm is a subsidiary of another firm (=1) or not (=0)
Family firm	Dichotomous	Indicates whether the firm can subjectively be regarded as a family firm (=1) or not (=0)
Strategy cost	Dichotomous	Indicates whether the firm can subjectively be considered as following a cost leadership strategy (=1) or not (=0)
Strategy different	Dichotomous	Indicates whether the firm can subjectively be considered as following a differentiation strategy (=1) or not (=0)
Strategy focus	Dichotomous	Indicates whether the firm can subjectively be considered as following a focus strategy (=1) or not (=0)

*(continued)***Table I.**
List of variables

Variable	Level of measurement	Description
Perf sales above	Dichotomous	Indicates whether the firm can subjectively be considered as having achieved an above-average sales performance in the preceding three years (=1) or not (=0)
Perf sales average	Dichotomous	Indicates whether the firm can subjectively be considered as having achieved an average sales performance in the past three years (=1) or not (=0)
Perf sales below	Dichotomous	Indicates whether the firm can subjectively be considered as having achieved a below-average sales performance in the past three years (=1) or not (=0)
Perf earn above	Dichotomous	Indicates whether the firm can subjectively be considered as having achieved an above-average earnings performance in the preceding three years (=1) or not (=0)
Perf earn average	Dichotomous	Indicates whether the firm can subjectively be considered as having achieved an average earnings performance in the past three years (=1) or not (=0)
Perf earn below	Dichotomous	Indicates whether the firm can subjectively be considered as having achieved a below-average earnings performance in the past three years (=1) or not (=0)

Table I.

Gargeya and Brady, 2005; Beheshti, 2006). Participants from firms with gradually phased-in ERP systems could therefore not give a specific date. Thus, we eliminated this question from our questionnaire to not confuse survey respondents and potentially cause a lower response rate. Consequently, we can report only on associations between a firm's current CFO and whether the firm has adopted an ERP system, which is also reflected in the formulation of our hypotheses.

As the dependent variable "ERP system adoption" is dichotomous, we opted to use logistic regression analysis to test our hypotheses. As a consequence of this methodological choice, we constructed the other variables as either featuring dichotomous (dummy coding) or metric scale level as variables of other levels of measurement, such as multi-value nominal or ordinal variables that cannot be readily used in (logistic) regression analysis (Fahrmeir *et al.*, 2009).

The four variables, namely, "CFO age", "CFO tenure", "CFO education" and "CFO recruitment", serve as independent variables in our analysis. The metric variable "CFO tenure" was generated by open-ended numerical text fields in which CFO survey participants could fill in their tenure in their current position in years. The dichotomous variables "CFO age", "CFO education" and "CFO recruitment" provide information on the survey participants whether their age equals 45 years or less[2], whether they have received a university education and whether they were recruited into their current CFO position from outside their current employer. Similarly, the moderator variable "CFO responsible IT" was created by asking survey respondents whether CFOs are responsible for IT issues in their firm at the board level.

In the logistic regression analysis presented below, we control for firm size, industry sector, stock-market listing, subsidiary status, family firm status, competitive strategy and subjective performance. We included "firm size" as a control variable, as extant research on ERP system adoption shows that larger firms are more likely to have introduced an ERP system compared to smaller firms (Mabert *et al.*, 2003; Buonanno *et al.*, 2005; Grabski

et al., 2011; Gärtner *et al.*, 2013). To increase the overall response rate of our survey, we opted to ask participants to locate their firms within a closed number of size classes (defined by number of employees). We did not ask for firms' exact employee numbers, because survey participants may not have the exact number to hand, which might in turn inhibit questionnaire completion.

To control for the firm's industry sector, we offered participants a closed range of industry sectors and asked them to indicate into which of these sectors their firm fits best. Based on this multi-value nominal variable, we created four dichotomous variables, namely, "industry manufact" (indicating affiliation with the manufacturing sector), "industry retail" (retail sector), "industry service" (service sector) and "industry other" (indicating non-affiliation with any of the former three sectors). For creating the dichotomous control variable "listed", we asked survey participants to indicate whether their firms are publicly listed on the stock market. Similarly, we asked survey participants to disclose if their firms are subsidiaries of other firms. The resulting control variable "subsidiary" was included because a firm's subsidiary status might reduce the impact of CFO characteristics on organizational choices, as organizational outcomes may to some extent be prescribed by the respective parent companies (Kim and Mauborgne, 1993). In addition, we asked survey participants to indicate whether their firm can be regarded as a family firm, because recent research has shown that the role and influence of CFOs and accountants may vary considerably depending on family influence (Gallo and Vilaseca, 1998; Gurd and Thomas, 2012; Hiebl, 2013; Senftlechner and Hiebl, 2015). Although a generally agreed-upon definition of how to measure the family firm status of a firm is missing in the literature, such self-reporting by respondents on their firm's status as a family firm is an accepted method in family business research (O'Boyle *et al.*, 2012; Steiger *et al.*, 2015).

To control for the sample firms' underlying strategies, we relied on Porter's (1980) concept of three generic competitive strategies. After providing a short description of Porter's (1980) generic strategies, we asked survey participants to indicate on a five-point Likert scale (ranging from "I agree" to "I disagree") in how far their firm followed each of the three competitive strategies of cost leadership, differentiation and focus. In preparation for the logistic regression analysis, we then created a dichotomous variable for each of the three strategies. If survey participants opted for "I agree" or "I rather agree" for a given strategy, we coded the dichotomous variable as "1", which indicates that the firm follows the strategy. If participants opted for "neutral", "I rather disagree" or "I disagree", we coded the respective variable as "0", indicating that the firm does not follow the strategy. To control for firm performance, we asked survey participants for their subjective views on their firm performance in comparison to their peers over the preceding three years in terms of sales and earnings development. For each of these two performance dimensions, our questionnaire offered survey participants the option to indicate that their firm's performance had been average, above average or below average. Based on their answers, we constructed three dichotomous variables for each of the two performance dimensions, obtaining a total of six control variables on firm performance (Table I).

4. Findings

Descriptive statistics for our sample can be seen in Table II. As can be seen, the firms in our sample are predominantly medium-sized (58.1 per cent) and are not stock-market-listed (68.8 per cent). Approximately 40 per cent of the sample firms can be regarded as manufacturing firms, 27.3 per cent belong to the service sector, 18.2 per cent are retail firms and 14.8 per cent of the firms belong to a sector other than the three aforementioned. Approximately three-fourths of the CFOs in our sample have received a university education, and roughly

Variable	Categories	Frequency (valid)		Valid cases		
		Absolute	Relative (%)			
ERP system adoption	0 = not adopted	39	18.6	210		
	1 = adopted	171	81.4			
CFO age	0 = 45 or below	109	52.2	209		
	1 = over 45	100	47.8			
CFO education	0 = non-university	54	25.8	209		
	1 = university	155	74.2			
CFO recruitment	0 = external	96	46.4	207		
	1 = internal	111	53.6			
CFO responsible IT	0 = CFO not responsible	120	60.6	198		
	1 = CFO responsible	78	39.4			
Firm size	0 = medium-sized	122	58.1	210		
	1 = large	88	41.9			
Industry manufact	0 = non-manufacturing	126	60.3	209		
	1 = manufacturing	83	39.7			
Industry retail	0 = non-retail	171	81.8	209		
	1 = retail	38	18.2			
Industry service	0 = non-service	152	72.7	209		
	1 = service	57	27.3			
Industry other	0 = non-other	178	85.2	209		
	1 = other	31	14.8			
Listed	0 = not listed	97	68.8	141		
	1 = listed	44	31.2			
Subsidiary	0 = no subsidiary	112	53.6	209		
	1 = subsidiary	97	46.4			
Family firm	0 = non-family firm	134	63.8	210		
	1 = family firm	76	36.2			
Strategy cost	0 = no cost leadership strategy	119	61.7	193		
	1 = cost leadership strategy	74	38.3			
Strategy different	0 = no differentiation strategy	18	9.5	190		
	1 = differentiation strategy	172	90.5			
Strategy focus	0 = no focus strategy	68	34.9	195		
	1 = focus strategy	127	65.1			
Perf sales above	0 = no above-average sales performance	81	43.3	187		
	1 = above-average sales performance	106	56.7			
Perf sales average	0 = no average sales performance	119	63.6	187		
	1 = average sales performance	68	36.4			
Perf sales below	0 = no below-average sales performance	174	93.1	187		
	1 = below-average sales performance	13	6.9			
Perf earn above	0 = no above-average earnings performance	95	50.8	187		
	1 = above-average earnings performance	92	49.2			
Perf earn average	0 = no average earnings performance	114	61.0	187		
	1 = average earnings performance	73	39.0			
Perf earn below	0 = no below-average earnings performance	165	88.2	187		
	1 = above-average earnings performance	22	11.8			
Variable	Minimum	Maximum	Mean	Median	Standard error	Valid cases
CFO tenure	0	40	7.7	5	7.04	207

Table II.
Descriptives

half of the CFOs have been recruited into their current position from outside their current firm. Approximately 48 per cent of the CFOs are older than 45 years. The age of 45 was chosen, because 45 was the median of age of the CFOs. The CFOs have held their position for almost eight years on average. Approximately 40 per cent of the CFOs have ultimate responsibility for IT issues in their firms at the board level, which also corroborates our finding that CFOs are often the board members responsible for IT in this Austrian sample.

In addition, Table III presents information on the specific ERP systems implemented in our sampled firms. As can be seen, the position of SAP as market leader in ERP systems in Europe (Van Everdingen *et al.*, 2000) is also reflected in our sample. Around one-third of the sampled firms have adopted an ERP system by SAP, while ERP systems by BMD and Microsoft are each used by 11 per cent of the respondents. A further one-third of the respondents had adopted ERP systems not specifically listed in our questionnaire; according to free text answers, these were mostly systems specifically designed for the firms' respective industries or systems developed in house. As can also be seen in Table III, XXXIX respondents indicated that their firm had not adopted an ERP system. For these 39 firms, the dependent variable in our regression models "ERP system adoption" was coded as "0" (Table II). For all other firms, this variable was coded as "1", indicating that they had adopted an ERP system.

To test whether multicollinearity of variables might affect our analysis, we present correlations among all variables used in Table IV. Although we find several significant correlations among the included variables, only two of them are at or above the critical level of 0.6-0.8 (the correlations between "perf sales above" and "perf sales average" and between "perf earn above" and "perf earn average"), which indicates the potential presence of multicollinearity (Grewal *et al.*, 2004; Tabachnick and Fidell, 2007). However, these negative correlations were to be expected because of the operationalization of the performance variables. If respondents indicated that their sales or earnings performance had been above average, then the performance could not be regarded as average at the same time. Therefore, multicollinearity does not seem to be critical in our models, and the application of logistic regression analysis should not be precluded.

We estimated three logistic regression models to test our hypothesized relationships between CFO characteristics and ERP system adoption. All three models presented in Table V represent final regression models and were determined using forward stepwise regression based on significance of the likelihood ratio statistic. Therefore, for coefficients not significantly contributing to an explanation of the dependent variable (and therefore not included in the final model), neither β coefficients nor $\exp(\beta)$ or p -values are presented.

ERP system	Frequency	
	Absolute	Relative (%) ^a
SAP	69	32.9
BMD	25	11.9
Microsoft	23	11.0
Oracle	13	6.2
Infor	7	3.3
Other ERP system	62	29.5
No ERP system adopted	39	18.6

Note: ^aNote that the sum of relative frequencies exceeds 100%, because respondents could also indicate that more than one ERP system had been adopted in their respective firms

Table III. ERP systems adopted in sampled firms

Table IV.
Correlation matrix

Variables	1	2	3	4	5	6	7	8	9	10	11
1. ERP system Adoption	1.000										
2. Firm size	0.282 ^{1****}	1.000									
3. Industry service	-0.258 ^{8****}	-0.016 ³ n.s.	1.000								
4. Industry manufact	0.263 ^{4****}	0.187 ^{6****}	-0.497 ^{6****}	1.000							
5. Industry retail	0.067 ³ n.s.	-0.096 ³ n.s.	-0.289 ^{9****}	-0.383 ^{4****}	1.000						
6. Industry other	-0.111 ^{1*}	-0.134 ^{4****}	-0.256 ^{3****}	-0.339 ^{3****}	-0.197 ^{3****}	1.000					
7. Listed	0.183 ^{2**}	0.051 ¹ n.s.	-0.133 ^{2*}	0.225 ^{5****}	-0.032 ² n.s.	-0.120 ³ n.s.	1.000				
8. Subsidiary	0.115 [*]	-0.016 ³ n.s.	-0.089 ³ n.s.	0.183 ^{3****}	-0.018 ¹ n.s.	-0.121 ^{2*}	0.222 ^{2****}	1.000			
9. Family firm	0.003 ⁸ n.s.	-0.037 ³ n.s.	-0.217 ^{3****}	0.078 ³ n.s.	0.134 ^{4****}	0.020 ³ n.s.	-0.356 ^{3****}	-0.265 ^{7****}	1.000		
10. Strategy cost	-0.044 ¹ n.s.	0.020 ³ n.s.	-0.053 ³ n.s.	0.042 ² n.s.	-0.003 ³ n.s.	0.013 ³ n.s.	0.108 ² n.s.	0.065 ² n.s.	-0.046 ² n.s.	1.000	
11. Strategy different	0.032 ² n.s.	0.057 ³ n.s.	0.031 ¹ n.s.	-0.021 ¹ n.s.	0.007 ³ n.s.	-0.017 ³ n.s.	0.040 ³ n.s.	-0.149 ^{9****}	-0.028 ¹ n.s.	0.101 ³ n.s.	1.000
12. Strategy focus	0.012 ² n.s.	-0.126 ^{3**}	-0.150 ^{3****}	0.096 ³ n.s.	0.054 ⁴ n.s.	-0.004 ³ n.s.	0.063 ³ n.s.	-0.085 ² n.s.	0.091 ¹ n.s.	0.077 ³ n.s.	0.069 ⁶ n.s.
13. Perf sales above	-0.008 ⁸ n.s.	0.117 ^{**}	0.051 ¹ n.s.	-0.096 ³ n.s.	0.135 ^{5****}	-0.087 ² n.s.	0.037 ² n.s.	0.004 ² n.s.	-0.012 ² n.s.	0.006 ² n.s.	0.120 ^{**}
14. Perf sales average	0.000 ⁷ n.s.	-0.113 ^{3**}	-0.021 ¹ n.s.	0.050 ³ n.s.	-0.157 ^{3****}	0.122 ^{2**}	-0.077 ³ n.s.	-0.065 ² n.s.	0.006 ² n.s.	-0.182 ^{3****}	0.120 ^{**}
15. Perf sales below	0.016 ³ n.s.	-0.015 ³ n.s.	-0.059 ³ n.s.	0.072 ² n.s.	0.034 ⁴ n.s.	-0.063 ³ n.s.	0.068 ³ n.s.	0.114 ⁴ n.s.	0.012 ² n.s.	-0.091 ² n.s.	-0.151 ^{1**}
16. Perf earn above	0.063 ³ n.s.	0.144 ^{4****}	0.050 ² n.s.	0.029 ² n.s.	-0.003 ³ n.s.	-0.095 ³ n.s.	0.107 ² n.s.	0.053 ² n.s.	-0.021 ¹ n.s.	0.111 ^{1**}	0.021 ¹ n.s.
17. Perf earn average	-0.003 ⁸ n.s.	-0.099 ³ n.s.	-0.017 ³ n.s.	-0.050 ³ n.s.	-0.021 ¹ n.s.	0.110 ^{**}	-0.110 ² n.s.	-0.087 ² n.s.	-0.021 ¹ n.s.	-0.106 ³ n.s.	0.022 ² n.s.
18. Perf earn below	-0.092 ² n.s.	-0.073 ³ n.s.	-0.051 ¹ n.s.	0.030 ³ n.s.	0.037 ² n.s.	-0.020 ³ n.s.	0.000 ³ n.s.	0.049 ² n.s.	0.065 ² n.s.	-0.012 ² n.s.	-0.067 ² n.s.
19. CFO age	-0.120 ^{1*}	-0.099 ^{**}	0.023 ³ n.s.	-0.018 ³ n.s.	0.043 ³ n.s.	-0.051 ¹ n.s.	-0.047 ² n.s.	-0.066 ² n.s.	0.092 ² n.s.	0.133 ^{3****}	-0.026 ² n.s.
20. CFO education	0.032 ² n.s.	0.171 ^{4****}	-0.086 ³ n.s.	0.169 ^{3****}	-0.117 ^{3**}	0.001 ¹ n.s.	0.133 ^{3****}	0.133 ^{3****}	-0.031 ¹ n.s.	-0.094 ³ n.s.	-0.097 ² n.s.
21. CFO tenure	-0.152 ^{2****}	0.159 ^{2****}	-0.035 ³ n.s.	-0.125 ^{2****}	0.054 ^{4****}	0.156 ^{3****}	-0.120 ^{2**}	-0.282 ^{2**}	0.223 ^{3****}	0.096 ^{2*}	0.123 ^{3****}
22. CFO recruitment	-0.171 ^{1****}	0.173 ^{3****}	0.004 ² n.s.	0.093 ³ n.s.	-0.083 ³ n.s.	-0.042 ² n.s.	-0.027 ¹ n.s.	-0.068 ³ n.s.	0.036 ³ n.s.	0.112 ^{**}	0.098 ² n.s.
23. CFO responsible IT	0.085 ³ n.s.	0.061 ¹ n.s.	-0.174 ^{4****}	0.160 ^{3****}	0.009 ² n.s.	-0.010 ³ n.s.	0.021 ¹ n.s.	0.057 ² n.s.	0.057 ² n.s.	0.044 ¹ n.s.	0.052 ² n.s.

Notes: Level of significance: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; n.s. = not significant; ^a value Phi, one-sided p -value Fisher's exact test; ^b point biserial correlation, one-sided p -value

(continued)



Variables	12	13	14	15	16	17	18	19	20	21	22	23
1. ERP system Adoption												
2. Firm size												
3. Industry service												
4. Industry manufact												
5. Industry retail												
6. Industry other												
7. Listed												
8. Subsidiary												
9. Family firm												
10. Strategy cost												
11. Strategy different												
12. Strategy focus	1.000											
13. Perf sales above	-0.042 ^a n.s.	1.000										
14. Perf sales average	-0.032 ^a n.s.	-0.865 ^a ***	1.000									
15. Perf sales below	-0.021 ^a n.s.	-0.313 ^a ***	-0.207 ^a ***	1.000								
16. Perf earn above	0.087 ^a n.s.	0.566 ^a ***	-0.463 ^a ***	-0.049 ^a n.s.	1.000							
17. Perf earn average	-0.079 ^a n.s.	-0.434 ^a ***	0.473 ^a ***	0.001 ^a n.s.	-0.787 ^a ***	1.000						
18. Perf earn below	-0.016 ^a n.s.	-0.219 ^a ***	0.001 ^a n.s.	0.422 ^a ***	-0.359 ^a ***	-0.292 ^a ***	1.000					
19. CFO age	0.106 ^a n.s.	0.000 ^a n.s.	-0.002 ^a n.s.	0.003 ^a n.s.	0.009 ^a n.s.	0.014 ^a n.s.	-0.035 ^a n.s.	1.000				
20. CFO education	0.098 ^a n.s.	0.007 ^a n.s.	-0.034 ^a n.s.	0.050 ^a n.s.	0.027 ^a n.s.	-0.077 ^a n.s.	0.074 ^a n.s.	-0.200 ^a ***	1.000			
21. CFO tenure	0.085 ^a n.s.	-0.030 ^b n.s.	0.035 ^b n.s.	-0.009 ^b n.s.	-0.087 ^b n.s.	0.101 ^b n.s.	-0.018 ^b n.s.	0.404 ^b ***	-0.188 ^b ***	1.000		
22. CFO recruitment	-0.004 ^a n.s.	0.000 ^a n.s.	0.024 ^a n.s.	-0.045 ^a n.s.	-0.020 ^a n.s.	-0.023 ^a n.s.	0.065 ^a n.s.	0.065 ^a n.s.	-0.190 ^a ***	0.235 ^a ***	1.000	
23. CFO responsible IT	-0.078 ^a n.s.	-0.111 ^a *	0.103 ^a n.s.	0.021 ^a n.s.	-0.021 ^a n.s.	0.015 ^a n.s.	0.010 ^a n.s.	-0.155 ^a ***	0.132 ^a ***	-0.070 ^b n.s.	0.021 ^b n.s.	1.000

Table IV.

Independents	Dependent	Model 1: Baseline ERP system adoption			Model 2: CFO characteristics ERP system adoption			Model 3: CFO characteristics and interactions ERP system adoption		
		β coefficient	exp(β)	p-value	β coefficient	exp(β)	p-value	β coefficient	exp(β)	p-value
CFO recruiting \times CFO responsible Γ	Reference class									
Absolute term	External	0.565	1.759	0.173	2.194	8.972	0.002***	2.194	8.972	0.002***
<i>Model fit</i>										
Cox and Snell pseudo- R^2			0.169			0.216			0.216	
Nagelkerkes pseudo- R^2			0.273			0.358			0.358	

Notes: Level of significance: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; ^a no reference class because of metric independent variable; ^c not included in final regression model

Table V.

Model 1 represents our baseline model which analyzes the influence of control variables on ERP system adoption. Not surprisingly, we find that “firm size” acts as a significant predictor of ERP system adoption, indicating that large firms have more often adopted ERP systems compared to medium-sized firms. Moreover, “industry manufact” is also included in the final model, which shows that manufacturing firms adopt ERP systems significantly more often than firms from other industry sectors. All other control variables do not appear to have a significant influence on ERP system adoption.

In our second model, we test all direct effects proposed in *H1–H4*, and thus in addition to control variables, we also include our four independent variables that represent CFO characteristics. The results show that “CFO recruitment” has a significant negative impact on ERP system adoption, indicating that firms with externally recruited CFOs are significantly more likely to have adopted an ERP system. Moreover, “CFO education” also emerges from this model as having a significant impact on ERP system adoption. However, the direction of this influence is negative, thus contradicting *H3* and showing that firms with non-university-educated CFOs have adopted an ERP system. The other two CFO characteristics (age and tenure) did not yield significant influence on ERP system adoption. Thus, based on this analysis, *H1*, *H2* and *H3* cannot be confirmed, whereas *H4* can be confirmed. Similar to regression Models 1 2, control variables “firm size” and “industry manufact” are included in the final model.

In our Model 3, in addition to control variables and independent variables, we also include interaction effects between our four CFO characteristics and the variable “CFO responsible IT” to test the applicability of *H5*. Again, direct effects of “firm size”, “industry manufact”, “CFO recruitment” and “CFO education” are included in the final model. However, we did not find any interaction effect between CFO characteristics and “CFO responsible IT” to have a significant influence on ERP system adoption. Thus, we find no support for the hypothesized interaction effects stated in *H5*.

Nevertheless, the increasing model fit statistics between Models 1 and 2 (Cox and Snell Pseudo- R^2 and Nagelkerkes Pseudo- R^2) show that the inclusion of CFO characteristics improves the models’ ability to predict ERP system adoption. This underpins the basic assumption expressed in the introductory section that CFO characteristics are important variables for predicting ERP system adoption.

5. Discussion and conclusions

In this paper, we aimed to analyze the impact of CFO characteristics on ERP system adoption. Based on the upper echelons theory and a survey of Austrian medium- and large firms, we find partial support for our basic assumption stated in the introductory section that CFO characteristics have an effect on ERP system adoption. Our data confirm the hypothesis that firms with externally recruited CFOs are more likely to have introduced ERP systems compared with firms with internally promoted CFOs. This finding complements extant case study-based research, which has shown that one reason for hiring external CFOs may be that they bring in knowledge on ERP system implementation and are sometimes also expected to lead such projects (Caglio, 2003; Magnusson *et al.*, 2010). Thus, one of our paper’s contributions to research on ERP systems is corroborating case study-based evidence on the significance of externally hired CFOs to ERP system adoption. Moreover, this finding also provides further evidence of the importance of individual top managers and their past experience and thus individual knowledge for ERP system adoption (Caglio, 2003; Boonstra, 2006; Magnusson *et al.*, 2010; Grabski *et al.*, 2011). Future research may explore the underlying dynamics of external CFO recruitment and ERP system adoption. It may be the case that before externally recruiting a new CFO, the respective firm had not considered

introducing an ERP system and that the newly hired CFO proactively pushes for ERP system adoption. Such proactive CFO behavior has already been noted in some case-based research on the effect of externally hired CFOs on accounting change (Baxter and Chua, 2008; Goretzki *et al.*, 2013). Alternatively, as indicated above, it may be that the respective firm has already decided to adopt an ERP system and hires an external CFO because of his or her experience in ERP system adoption to drive the ERP system implementation, as evidenced in some case-based research (Caglio, 2003; Magnusson *et al.*, 2010). Gaining a deeper understanding of these mechanisms would benefit both CFO and ERP system research.

In contrast to existing research findings showing that CFO age and tenure influence the adoption of innovative accounting practices (Naranjo-Gil *et al.*, 2009; Pavlatos, 2012; Burkert and Lueg, 2013), based on our survey data, we do not find evidence that CFO age and tenure are associated with ERP system adoption. Therefore, our findings suggest that the CFO characteristics of age and tenure may only be associated with core finance and accounting practices, but not with IT systems or IT practices. An alternative explanation of our finding that older and more tenured CFOs are not negatively associated with ERP system adoption may be that these CFOs somehow compensate for their potential lack of knowledge on IT systems or IT practices (e.g. by employing a knowledgeable CIO). If this was the case, it would underpin the notion that other C-level officers such as the CIO and their characteristics also – and potentially jointly with the CFO – exert influence on ERP adoption decisions (Banker *et al.*, 2011; Schult and Wolff, 2012). Because of length restrictions, we could not include other functional C-level officers' characteristics (e.g. the CIO's) in our questionnaire, which is why analyses of such interaction effects of CFOs with other functional C-level officers on ERP system adoption decisions must be left open for further research.

Against our expectation that if the CFO were responsible for IT, then the relationship between CFO characteristics and ERP system adoption would be more pronounced, our regression analyses did not show that such interaction effects have a significant influence on ERP system adoption. Based on these results, we therefore cannot confirm Hambrick's (2007) argument that higher managerial discretion (in our case, measured as the CFO being responsible for IT) moderates the relationship between top manager characteristics and organizational outcomes. Our findings suggest that CFO recruitment and education are associated with ERP system adoption, regardless of whether CFOs are responsible for IT. This finding may be explained by the notion presented in the Introduction that CFOs typically have a great influence on investment decisions and therefore potentially also on the investment decision to adopt an ERP system irrespective of their responsibility for firm-wide IT. An alternative reasoning would be that in Austria, the country of our data collection, managerial discretion is, according to Crossland and Hambrick (2011), generally lower than that in other countries such as the USA or the UK. Crossland and Hambrick (2011) suggest that the lower managerial discretion in Austria may be due to the country following a civil law tradition, where managers have, compared with common-law countries, less latitude of action because of the need to balance the objectives of many constituencies (such as owners and employees). Thus, if managerial discretion is comparatively low in Austria, having or not having the board-level responsibility for firm-wide IT would not strongly affect a CFO's influence on ERP system adoption, which is, according to our data, nevertheless present. Therefore, it would be interesting for future research to replicate our findings in a common-law country such as the USA, the UK, Canada or Australia to explore whether our non-findings on the moderating role of CFOs being responsible for IT might be due to the differing levels of managerial discretion in various countries and legal traditions.

Counterintuitively, we find that significantly more firms with CFOs that do not have a university education have adopted ERP systems. This finding contradicts extant results

showing positive direct impact of more specialized CFO education on the adoption of innovative accounting and management practices (Naranjo-Gil *et al.*, 2009; Pavlatos, 2012; Burkert and Lueg, 2013). A reason for this contradiction might be found in our measurement of “CFO education”. In contrast to Naranjo-Gil *et al.* (2009), Pavlatos (2012) and Burkert and Lueg (2013), we do not distinguish between business-oriented and operations-oriented education of the CFOs. Instead, we followed more closely Hambrick and Mason’s (1984, p. 200) suggestion to study “the amount, but not the type, of formal education” in upper echelon studies and operationalized “CFO education” as the CFOs having a university education or not. Therefore, future upper echelon studies might include both type and level of top manager education to clarify this contradiction between our results and extant results on the relationship between CFO education and organizational outcomes (Naranjo-Gil *et al.*, 2009; Pavlatos, 2012; Burkert and Lueg, 2013). Apart from the measurement of education, our findings might also indicate that the traditional upper echelons argument that more education leads to more sophisticated organizational structures (Hambrick and Mason, 1984) does not hold for IT systems such as ERP systems. Why less educated top management team members such as CFOs might show a higher propensity to adopt complex IT systems, however, remains an interesting opportunity for further research.

On a broader note, our evidence adds to the literature showing that external CFO recruitment and CFO changes more generally may lead to significant organizational changes (Baxter and Chua, 2008; Geiger and North, 2006; Goretzki *et al.*, 2013; Li *et al.*, 2010). The identified relationships between external CFO recruitment and education and ERP system adoption contribute to the literature by providing evidence of the additional potential outcomes of external CFO recruitment and CFO education. For instance, in addition to changes in accounting practices (Geiger and North, 2006; Hiebl, 2014) and improved firm performance (Mian, 2001), our findings suggest that externally hired CFOs are also associated with technological innovations such as the adoption of ERP systems. In addition to this implication for research on CFOs, our findings also contribute to the literature on technological innovation. Studies analyzing the influence of managerial characteristics on technological innovation have mostly focused on the impact of CEOs (Chen, 2013; Howell and Higgins, 1990; Papadakis and Bourantas, 1998; Thong and Yap, 1995) or technology experts such as CIOs (Li *et al.*, 2006; Peppard, 2010; Saldanha and Krishnan, 2011). However, our findings indicate that CFOs and their characteristics may also have a substantial influence on technological innovation. This relationship is most likely due to the decisive influence of CFOs on major investment projects (Mian, 2001; Schobel and Denford, 2012). As technological innovation often requires major investment (Howell and Higgins, 1990; Sirilli and Evangelista, 1998), CFOs may be closely involved in such decisions. Thus, future research on the impact of top managers on technological innovation should benefit from examining in more detail the impact of CFOs and their characteristics.

Our findings also have some practical implications. For ERP system providers, our findings suggest that for firms which have not yet adopted an ERP system and have recently hired a new CFO from outside, chances may have increased that they would be willing to adopt an ERP system. Thus, such firms – especially small- and medium-sized firms which have not yet adopted an ERP system – could constitute prime targets of sales efforts for ERP system providers. Similarly, our findings also indicate that such sales efforts may be especially fruitful in firms with non-university-educated CFOs. From the perspective of CEOs and firm owners, our findings indicate that when aiming to adopt an ERP system, the chances of eventually realizing this step should be higher when hiring external and non-university-educated candidates for the CFO position.

In addition to the research opportunities indicated above, various other fruitful avenues of further research on the link between finance and accounting personnel and ERP systems remain. In this study, we analyzed the effect of CFO characteristics on ERP system adoption. As related case-study results (Caglio, 2003; Magnusson *et al.*, 2010) as well as our findings on externally hired CFOs indicate, it might also be valuable to study the impact of CFOs on the actual ERP system implementation process. Some extant case studies also touch upon the CFO's influence in this process (Boonstra, 2006; Caglio, 2003; Magnusson *et al.*, 2010; Krotov *et al.*, 2011), but none of the studies has followed the CFO's role in or influence on ERP system implementation projects in depth. Against the background of our results, it might be especially worthwhile to study the differing role of externally hired and internally promoted CFOs as well as university-educated and non-university-educated CFOs in ERP system implementation. Moreover, besides the CFO, other top management team members or finance and accounting personnel, such as management accountants or controllers, might also yield significant influence on ERP system adoption and implementation. Although some studies have identified the presence of ERP systems for enabling management accountants to evolve into more progressive roles (Newman and Westrup, 2005; Grabski *et al.*, 2009; Chen *et al.*, 2012), none of these studies has yet analyzed the association of management accountant characteristics and ERP system adoption or implementation. However, being more on the operational level and influencing CFOs and other top managers, management accountant's characteristics might also be expected to influence ERP system adoption or implementation decisions.

Similar to any other study, this study was also subject to limitations through its underlying research methods. First and foremost, we adopted a cross-sectional research design and thus cannot provide longitudinal data on the effects, for instance, of CFO recruitment or changes in ERP system adoption. Second, using CFOs as the target group of our survey on CFO characteristics could involve the problem of social desirability bias (King and Bruner, 2000), as CFOs might try to create a better picture of themselves in the questionnaire compared with their true organizational role. However, by asking questions about demographic or organizational facts (e.g. on the CFO's tenure or the firm having adopted an ERP system or not), we tried to limit the subjectivity of answers to a minimum. Additionally, although we cannot be certain that all questionnaires were answered by the CFOs personally, we pointed out a number of times that CFOs should answer the questionnaires by themselves. Third, some variable measurements (such as "firm size") that we opted to measure in a dichotomous manner may be regarded as (too) crude; however, we opted to measure them in the way we did to avoid an even lower response rate. Generally speaking, the low absolute response rate of our survey can be regarded as another limitation of our results. However, a comparison of similar recent survey-based studies conducted in German-speaking countries (Aschauer *et al.*, 2015; Eierle and Haller, 2009; Faghfour *et al.*, 2015; Hatak *et al.*, 2015; Mitter *et al.*, 2014) reveals that our response rate of 3.6 per cent is comparable. Moreover, according to Baruch and Holtom (2008), about 5 per cent is a common response rate. Moreover, the usual disclaimer also applies to this study, which is that because of using a one-country sample, the results cannot be readily generalized to other countries, cultures or legal settings.

Notes

1. The term "C-level officers" refers to all executives carrying a "chief" in their position title. Therefore, C-level officers mostly encompass the executive team consisting of, for instance, CEO, a CFO, a chief operating officer, etc. In addition to the term "C-level officers", in the literature, the term "C-suite" can also be found to have the same or a similar meaning (Guadalupe *et al.*, 2014; Loxton, 2014; Menz, 2012; Nath and Mahajan, 2011).

2. To operationalize "CFO age", we originally offered survey participants a closed range of age classes to choose from (up to 30 years, 31-40 years, 41-45 years, 46-50 years, 51-55 years and older than 55 years). We initially tested both this fine-grained operationalization and the dichotomous operationalization of "CFO age" in our regression analyses. Neither type of operationalization was included in the final models. Consequently, to keep the number of independent variables in the logistic regression models as low as possible and improve their readability (the more fine-grained operationalization would have resulted in six variables instead of one in the regression models), we chose to present the dichotomous representation of "CFO age" in the main body of this paper.

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About the authors

Martin R.W. Hiebl is a Professor of Management Accounting and Control at the University of Siegen, Germany. Before his academic work, he worked as a management consultant at McKinsey & Company Inc. in Munich and Vienna. His research primarily focuses on the organization and management of finance functions and strategic management in family businesses and small- and medium-sized enterprises and the role of CFOs and management accountants. His research has been published in *Journal of Management Accounting Research*, *Management Decision*, *Journal of Accounting & Organizational Change*, *Qualitative Research in Accounting & Management*, *Qualitative Research in Financial Markets*, *Review of Managerial Science*, *Journal of Family Business Strategy* and the *Journal of Risk Finance*, amongst others. Martin R.W. Hiebl is the corresponding author and can be contacted at: martin.hiebl@uni-siegen.de

Bernhard Gärtner is a Postdoctoral Researcher at the Institute of Management Control and Consulting at Johannes Kepler University (JKU) Linz, Austria. Before his academic work, he worked as a management accountant at Raiffeisenverband Salzburg. His research focuses on the interactions between information systems and management accounting systems and the work of management accountants.

Christine Duller is an Associate Professor at the Department of Applied Statistics at Johannes Kepler University Linz, Austria. She focuses on teaching statistics and the application of statistics in business and medical research. Amongst other outlets, her research has been published in *Computational Statistics & Data Analysis*, *Endoscopy*, *European Journal of Gastroenterology & Hepatology*, *International Journal of Entrepreneurial Venturing*, *Journal of Accounting & Organizational Change*, *Journal of Enterprising Culture*, *Review of Managerial Science* and *Schmalenbach Business Review*.

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