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Effects of CFO Characteristics on the Use of Management Control Systems

An Upper Echelons Perspective

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Abstract

Recent management control research suggests that managerial characteristics influence the design and use of management control systems (MCS). This study draws on upper echelons theory and Simons' levers of control framework to examine how CFO characteristics affect the use of MCS. Our findings suggest that both gender and business education of the CFO are significant determinants of MCS use. The analysis is based on a unique dataset which consists of questionnaire responses from 240 CFOs of large Swedish companies and archival data. Regression analysis is used to test our five hypotheses related to gender, business education and marital status, of which we find support for three out of five. Specifically, the results suggest that female CFOs are positively associated with interactive use of MCS and that CFOs with more business education use MCS more interactively as well as diagnostically. Our empirical evidence provides further support for the relevance of upper echelons theory and extends earlier work on the use of MCS. More specifically, the study is to our knowledge the first to examine how CFO characteristics affect the use of MCS and how managerial characteristics affect the use of MCS with a cross-industrial sample.

Keywords: *Upper echelons theory, management control systems, CFO characteristics, levers of control, gender, business education, marital status*

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1. Introduction

The reasons behind the design and use of different management control systems (MCS) has been of interest for researchers for a long time. In recent decades, a perspective that has gained an increasing interest is the effects managerial characteristics have on the design and use of MCS. Hambrick and Mason (1984) argue that apart from contextual factors, characteristics of top managers have an important influence on organisational outcomes as they affect the cognitive base of the managers. Depending on the cognitive base, managers comprehend and act on information in different ways, which influences the decisions made (ibid). This argumentation resulted in the upper echelons theory which was first concretised by Hambrick and Mason in 1984. Upper echelons theory was originally applied on strategic choices in organisations, but it has been increasingly applied in research on MCS design and use (Hiebl, 2014).

A growing body of literature in the field of upper echelons and management control investigates aspects such as the adoption of certain systems (e.g. Hiebl, Gärtner & Duller, 2017; Naranjo-Gil, Maas & Hartmann, 2009), the sophistication of systems (Burkert & Lueg, 2013) and the emphasis on the systems (Firk, Schmidt & Wolff, 2019). Managerial characteristics which have received much attention due to their importance for the design and use of MCS are age, tenure and education (Hiebl, 2014). In the literature there are examples of studies which focus on top management teams (TMTs) as well as specific executives in top management. Burkert and Lueg (2013) investigate how characteristics of CEOs and CFOs in German listed companies affect the sophistication of value-based management (VBM) and the results suggest that CFOs have a greater impact. They also find that tenure of the CFO has a negative effect on the sophistication of VBM while education in business has a positive effect (Burkert & Lueg, 2013). Naranjo-Gil et al. (2009) investigate how CFOs in Spanish hospitals adopt innovative management accounting systems (MAS) differently depending on tenure, age and educational background. They find that tenure and age have a negative effect on the likelihood of adopting innovative MAS, while an increased share of education in business has a positive effect.

While most researchers in the field of upper echelons and management control have studied why specific systems are adopted and how they are designed, less attention has been given to how the systems are used. Exceptions are studies of the use of MCS in hospitals (Naranjo-Gil & Hartmann, 2006, 2007) and universities (Bobe & Kober, 2018, 2020). Recent evidence suggests that female heads of schools use interactive control systems to a greater extent than male heads of schools (Bobe & Kober, 2018) and that older deans use non-financial performance measures to a greater extent than younger deans (Bobe & Kober, 2020). To our knowledge, previous work has not addressed how CFO characteristics affect the use of MCS

and this study focuses on the effects of CFO gender, business education and marital status. Also, it has been called for more research on how systems are implemented differently as they diffuse across organisations (Ansari, Fiss & Zajac, 2010) and most research in the field of upper echelons and management control has been based on samples of specific industries of professional organisations such as hospitals and universities. Hence, this study contributes to an increased understanding of the effects managerial characteristics have on the use of MCS across industries, as called for by Bobe and Kober (2018). In a broader context, this increases the understanding of why organisations use MCS differently. From a practical perspective, this increased understanding could help organisations to account for managerial characteristics in recruitment processes.

To understand and conceptualise the use of MCS, we apply Simons (1995) Levers of Control (LOC) framework, which is commonly used in research focused on MCS use (e.g. Bedford, 2015; Bobe & Kober, 2018, 2020; Henri, 2006). In line with previous studies in the field of upper echelons and management control research (Bobe & Kober, 2018, 2020; Naranjo-Gil & Hartmann, 2006, 2007), we focus on the interactive and diagnostic levers of MCS. To capture the interactive and diagnostic use of MCS, we adopted a questionnaire from Bedford (2015). In addition to the questions related to use of MCS, the questionnaire contained questions related to CFO characteristics. The choice to focus on the effects of CFO characteristics is based on previous findings which indicate that the CFO has a greater impact on MCS than the CEO (Burkert & Lueg, 2013). Also, it has been argued that finance and accounting are responsibilities of a CFO (Burkert & Lueg, 2013), meaning that they should have the greatest influence on how the TMT uses MCS.

The purpose of this study is to extend the existing knowledge about why organisations use MCS differently. We provide further empirical evidence for the importance of managerial characteristics as the results suggest that CFO characteristics influence the use of MCS. Based on a sample of 240 CFOs in large Swedish companies[1], we find that females use MCS more interactively than males and that business education has a positive effect on the interactive and diagnostic use of MCS. We also test the robustness of the results and the analysis of these tests support our findings. The two main contributions of our study are that it increases the understanding of how CFO characteristics impact the way MCS are used, and that it provides further evidence on how managerial characteristics affect the use of MCS with a sample of companies from different industries.

[1] Following the EU definition. Described in detail in *4.1 Target Population*.

The remainder of the thesis is structured as follows: In Chapter 2, we present the theoretical foundations of the study as well as relevant previous literature. Chapter 3 builds the argumentation for and presents our hypotheses. The methodology of the study is presented in Chapter 4. This chapter contains a description of the data, a factor analysis, and the empirical model. In Chapter 5, the empirical results from the study and robustness tests are presented. Lastly, a discussion of the results in relation to previous findings is presented and the conclusions are drawn in Chapter 6.

2. Literature Review

This chapter presents the important theoretical foundations and frameworks for our thesis. We also present relevant findings from previous research in the field of upper echelons theory and management control.

2.1 Theoretical Framework

Management control research has focused on the reasons for the design and use of certain systems at least since the 1960s (Otley, 1980). A prominent theory in the field of MCS design and use is the contingency theory, which has a long tradition (Chenhall, 2003). The foundation in contingency theory is that MCSs are designed to achieve certain goals and that the choice and functioning of the systems is contingent upon the context of the organisation (ibid.). While the contingency perspective has highlighted how MCS are designed based on internal and external contextual factors (Chenhall, 2003), upper echelons theory extends this research by focusing on managerial characteristics. While there are different theories which can be used to explain the use of MCS, no other theories focus on the effects of managerial characteristics. Consequently, we use upper echelons theory as the foundation for our study.

A commonly applied framework to conceptualise the use of MCS is Simons (1995) Levers of Control (LOC). LOC characterises MCS as interactive, diagnostic, belief, and boundary systems (Simons, 1995). These control levers should be in balance and can be used by companies either in combination or separately to achieve the strategy (ibid.). The LOC framework has been used in upper echelons and management control research (e.g. Naranjo-Gil & Hartmann, 2006, 2007) as well as other types of MCS studies (e.g. Bedford, 2015; Henri, 2006; Curtis & Sweeney, 2017). Following Bobe and Kober (2018, 2020), we use the interactive and diagnostic levers of the LOC framework to conceptualise and explain the use of MCS through managerial characteristics. Based on the above argumentation, our main theoretical foundations for this thesis are the upper echelons theory and the LOC framework, which are explained in the following sections.

2.1.1 Upper Echelons Theory

Upper echelons theory was first mentioned by Hambrick and Mason in 1984, but the importance of top executives for organisational outcomes had been highlighted earlier. Hambrick and Mason (1984) argue that an important predictor of organisational outcomes is managerial characteristics, as they influence the cognitive base and values of managers. Upper echelons theory is based on behavioural theory as it emphasises that it cannot be expected that managers always make choices that maximise the economic benefits for the company (Hambrick & Mason, 1984), which means that it assumes bounded rationality as described by Cyert and March (1963). Hambrick and Mason (1984) develop a model which assumes that managers cannot gather all information connected to a situation. First, managers selectively scan the information that they can gain access to which restricts the information accounted for. They argue that this selective scan is based on managers' cognitive base and values. After this, the information that remains is evaluated by the managers, and this evaluation is also dependent on their values and cognitive bases (Hambrick & Mason, 1984).

An implication from Hambrick and Mason's (1984) model is that managers do not always make rational decisions. The decisions made are affected by the cognitive bases and values of managers, which are reflected in managerial characteristics (Hambrick & Mason, 1984). Hambrick and Mason (1984) proposed that managerial characteristics which affect organisational outcomes could be "age, tenure in the organization, functional background, education, socioeconomic roots, and financial position" (p. 196). The foundation of upper echelons theory is that environmental and firm-level factors cannot fully explain the design and use of MCS and that including managerial characteristics improves the explanatory power. Therefore, the theory includes effects that environmental and firm-level factors may have but focuses on managerial characteristics. Subsequent literature has drawn on upper echelons theory to understand different organisational outcomes (Hambrick, 2007), for example the design and use of management accounting and control systems (MACS) (Hiebl, 2014). Hiebl (2014) finds support for the relevance of upper echelons theory as he shows that there are extensive empirical findings suggesting a relation between managerial characteristics and MACS. Based on these results, it is evident that managerial characteristics are important determinants for the design and use of MCS.

2.1.2 Levers of Control

The levers in LOC can be seen as different ways in which top managers can guide and steer the activity in the organisation to achieve the strategy (Simons, 1995). Simons (1995) states that the control levers work as opposite forces, the yin and yang, and highlights the importance of balance between the levers, meaning that they are supposed to work together in order to manage the tensions in the organisation. The choice of how to use these levers is a crucial decision for managers which is affected by personal values (Simons, 1995). This is consistent

with an upper echelons perspective in which managerial characteristics are considered important determinants of MCSs design and use (Hiebl, 2014). Following previous research in the field of upper echelons theory and MCS use (Bobe & Kober, 2018, 2020; Naranjo-Gil & Hartmann, 2006, 2007), this study focuses on the interactive and diagnostic control levers when conceptualising the use of MCS. We therefore present the belief and boundary levers briefly and the interactive and diagnostic levers more thoroughly.

Belief systems focus on values, purpose and direction for the company and they are used to inspire organisational members. It is a positive control lever which aims to motivate organisational members to find new opportunities which are in line with the goals of the organisation. If successfully used, belief systems motivate employees and increase their commitment to the organisational goals. In contrast to belief systems, boundary systems restrict the actions of employees and they are described as a negative control lever. Boundary systems constrain what employees can and cannot do in their search for opportunities and solutions to problems. Together, the belief and boundary levers guide the opportunity search in organisations; while the belief systems inspire organisational members to take action, the boundary systems constrain actions. (Simons, 1995)

Diagnostic control systems are consistent with a traditional view of control which reflects a managing style that relies on standard-setting, comparing and target-setting as well as monitoring and top-down control for efficiency (Abernethy & Brownell, 1999; Henri, 2006; Naranjo-Gil & Hartmann, 2007; Kober, Ng & Paul, 2007). The purpose of diagnostic control systems is to ensure that the strategy is implemented as intended through monitoring of performance (Simons, 1995). Another aspect of diagnostic control systems is that they follow a mechanistic approach where performance is evaluated in a consistent way over time (Ferreira & Otley, 2009) to obtain predictability in goal achievement (Simons, 1995). Top management gets involved periodically when performance is evaluated, while managers in less senior positions are responsible for gathering and presenting the necessary information (Simons, 1995). Diagnostic control systems can be used for assessment (Abernethy & Brownell, 1999) and to correct deviations in order to provide motivation to achieve organisational goals (Henri, 2006; Bedford, 2015; Simons, 1995). Overall, since diagnostic control systems focus on undesirable variances and mistakes it can be considered a negative control lever (Henri, 2006; Bedford, 2015; Simons, 1995).

In contrast to the diagnostic use of MCS, top managers can push down decision-making to lower levels in the organisation in a more interactive way of controlling (Simons, 1995; Henri, 2006; Bobe & Kober, 2018; Naranjo-Gil & Hartmann, 2007). This is described as interactive control systems, which can be used to direct the attention of the organisation where management wants to (Simons, 1995). The strong involvement of top managers makes them more personally involved in steering the organisation by sending messages which motivate all

organisational members (Bisbe & Otley, 2004) and creates regular attention to important information from managers at all levels (Simons, 1995). This involvement also stimulates communication through the creation of information networks, which facilitates identification and exploitation of opportunities (ibid.). Through these information networks, information gathered through MCS can be discussed and used to challenge the strategy and organisational goals (ibid.). This means that interactive control systems can enable the creation of new strategies (ibid.). Interactive use of MCS has been argued to reduce uncertainty in organisations and consequently, it can be used to mitigate risk (Simons, 1995). Simons (1995) further highlights that MCS themselves are not interactive, but that many types of MCS can be used interactively.

Interactive use of MCS can be seen as a positive control lever since it contributes to learning and innovation in the organisation (Henri, 2006; Bisbe & Otley, 2004; Simons, 1995). However, to be successful, both diagnostic and interactive control systems need to be active in an organisation since they are used for different purposes and the joint use of them can create a dynamic tension (Simons, 1995; Kober et al., 2007; Henri, 2006), which may enable the joint achievement of goals (Curtis & Sweeney, 2017; Henri, 2006). Henri (2006) argues that the interactive and diagnostic control levers work simultaneously and that they complement each other. This means that both types of levers can be measured separately, and that more use of one lever does not necessarily reduce the use of the other (Bedford, 2015).

2.2 Upper Echelons and Management Control Research

Some of the first studies to show that managerial characteristics have effects on organisational outcomes were Bertrand and Schoar (2003) and Young, Charns and Shortell (2001). While Bertrand and Schoar (2003) find that managers with MBAs take on more risk, Young et al. (2001) find that demographic characteristics of top managers affect the adoption of total quality management (TQM). Following this, the empirical findings in the field of upper echelons theory and management control have increased with studies from Burkert and Lueg (2013) and Bobe and Kober (2018, 2020) among others. Researchers in this field have focused on entire TMTs (e.g. Dubey et al., 2018; Naranjo-Gil & Hartmann, 2007), as well as specific managers such as CFOs (e.g. Naranjo-Gil et al., 2009; Firk et al., 2019) and CEOs (e.g. Reheul & Jorissen, 2014; Burkert & Lueg, 2013). In the research stream focused on CEOs, it has been found that leadership style is related to the use of planning and control systems and performance measurement (Abernethy, Bouwens & van Lent, 2010), and that demographic characteristics are related to the design of evaluation systems (Reheul & Jorissen, 2014). More recent evidence suggests that gender of managers in universities affects the use of MCS (Bobe & Kober, 2018, 2020). However, in a review of upper echelons theory and management accounting and control research, Hiebl (2014) shows that the clearest empirical results in the field have been found for CFO characteristics. We therefore focus mainly on results related to

CFO characteristics, which is in line with the hypotheses presented in *3. Hypothesis Development.*

In the extant literature on CFO characteristics and their relation to the use of MCS, we have identified two main themes. The first is studies related to the adoption and sophistication of certain systems, while the second is how the systems in place are used. In the theme related to adoption and sophistication of MCS, a study based on a sample of German listed companies found that CFO tenure has a negative effect on value-based management (VBM) sophistication and that business education of the CFO has a positive effect (Burkert & Lueg, 2013). In a similar study, Firk et al. (2019) find that age and business education of the CFO are negatively associated with CFO emphasis on VBM. Furthermore, Naranjo-Gil et al. (2009) reported that demographic characteristics of CFOs affect the adoption of management accounting systems (MAS) in the public hospital sector in Spain. More specifically, age as well as tenure are negatively associated with innovation connected to MAS, while CFOs with a relatively business-oriented background were found to adopt more innovative MAS (Naranjo-Gil et al., 2009)

Despite the recent advances in upper echelons theory and the evidence which highlights the importance of CFO characteristics, no one as far as we know has studied the relation between CFO characteristics and MCS use. However, some studies have investigated how characteristics of other top executives affect the use of MCS. Naranjo-Gil and Hartmann have studied how characteristics of the whole TMT (2006) as well as CEOs (2007) affect the use of MCS in the healthcare sector. The results related to TMTs suggest that those with a professional background use interactive MAS more than those with an administrative background while diagnostic MAS are used less by professional TMTs than administrative TMTs (Naranjo-Gil & Hartmann, 2006). Professional TMTs are defined as those that have their main educational and functional experience in clinical areas while administrative TMTs are those that have most of their experience in general management (Naranjo-Gil & Hartmann, 2006). Similar results for CEOs suggest that a clinical background is positively associated with interactive use of management information systems (MIS), while an administrative background is positively associated with diagnostic use of MIS (Naranjo-Gil & Hartmann, 2007). Bobe and Kober study how gender (2018, 2020) and other demographic characteristics (2020) of managers in Australian universities affect the use of MCS. Female heads of schools are found to use MCS more interactively than males, while no significant gender effects are found for the use of MCS in a diagnostic manner (Bobe & Kober, 2018). Furthermore, Bobe and Kober (2020) examine how characteristics of deans affect the use of MCS and show that tenure is positively associated with interactive use of MCS.

Burkert and Lueg (2013) find that CFOs play an important role for the adoption and level of sophistication of VBM while there is limited evidence that CEO characteristics play a role. In

line with this, Hiebl (2014) reviews the field and argues that the findings on CEO characteristics are limited. For CFO characteristics on the other hand, there are consistent findings which suggest that age, tenure and education are related to MCS sophistication and innovation (Hiebl, 2014). Despite this, no studies have to our knowledge investigated how CFO characteristics affect the use of MCS in organisations. To draw clear conclusions, researchers should focus on those members of the TMT that have a significant influence on the organisational outcomes of interest (Hambrick, 2007), which we argue is the CFO in the case of MCS. Accounting and finance are generally responsibilities of the CFO (Burkert & Lueg, 2013), and this should give them influence on the use of MCS. Similarly, it has been argued that CFOs play an important role in the design and use of MAS in organisations (Firk et al., 2019; Naranjo-Gil et al., 2009).

Based on the argumentation that CFOs should have the greatest influence on MCS and the lack of research on how CFO characteristics affect the use of MCS, we focus our research on this relation. The following chapter presents our hypotheses for the relation between CFO characteristics and interactive and diagnostic use of MCS.

3. Hypothesis Development

In this chapter, we build the argumentation for and present our hypotheses which are mainly based on literature in upper echelons theory. The theoretical research model is presented in Figure 1, which illustrates the hypothesised relations between interactive and diagnostic use of MCS and the managerial characteristics gender, business education and marital status of the CFO.

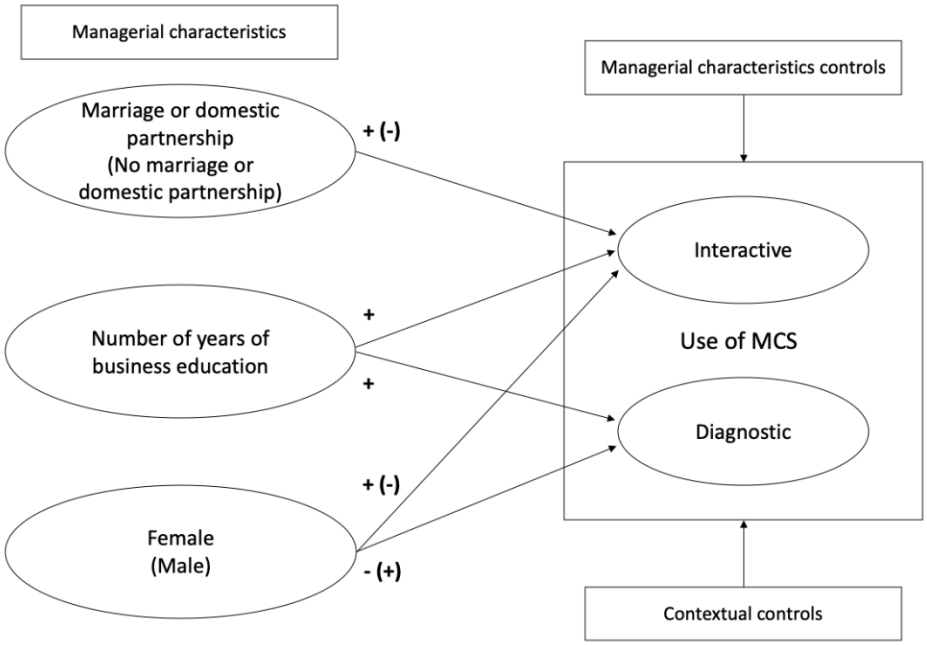

Figure 1 - Theoretical Model

Figure 1 presents the hypothesised relations between managerial characteristics and the use of MCS. "+" indicates a positive effect, while "-" indicates a negative effect on the use of MCS.

3.1 Gender

In the leadership literature, there has been extensive research indicating that there are gender differences in leadership styles. However, Bobe and Kober (2018, 2020) are the only studies that, to our knowledge, have analysed the relation between MCS and the gender of managers. Since these studies are based on managers in a sample of universities, we aim to establish whether similar results can be found for CFOs in a broad sample of organisations.

Eagly and Carli (2003) argue that women have a leadership style characterised by interaction, collaboration, and empowerment of subordinates. Male leadership on the other hand is argued to be characterised by command and control and the existence of authority. They also argue that female leadership is often characterised by a transformational style, meaning that it is focused on empowering organisational members and encouraging them to be creative (Eagly & Carli, 2003). Female leadership is further characterised by a focus on information sharing

and knowledge sharing (Krishnan & Park, 2005). By establishing themselves as role models and mentoring subordinates, transformational leaders encourage subordinates to contribute more to organisational success (Eagly & Carli, 2003). Similarly, Trinidad and Normore (2005) argue that female leadership is often characterised by democratic and participative features. This type of leadership should be consistent with the use of interactive control systems as described by Simons (1995).

More evidence on gender differences was found by Mandell and Pherwani (2003), who study how transformational leadership and emotional intelligence relate to gender. One definition proposed for emotional intelligence is the ability to handle social behaviours, traits and competencies (Mandell & Pherwani, 2003). Mandell and Pherwani (2003) argue that emotional intelligence is associated with relationships and that females are better at managing their own emotions as well as the emotions of others compared to men. The results from their study support this argumentation as they suggest that female leaders have higher emotional intelligence than male leaders. Since relationships and collaboration are crucial components for interactive use of MCS, females should be more inclined to use MCS interactively. Mandell and Pherwani (2003) also find that transformational leadership and emotional intelligence are positively related. As we argue that both transformational leadership and emotional intelligence are related to interactive use of MCS, this finding further strengthens the argument that females should use MCS more interactively.

Transformational leadership is contrasted with transactional leadership where managers engage in transactions with their subordinates (Eagly & Carli, 2003). When subordinates meet objectives, they are rewarded for this and when they fail to do so, actions are corrected. Transactional leadership is more common among male leaders (Eagly & Carli, 2003) and this leadership style should be compatible with diagnostic control systems as described by Simons (1995). Male leaders are often more likely to use coercion and their own expertise to achieve their objectives (Krishnan & Park, 2005). A coercive leadership style should be connected to the use of diagnostic control systems where subordinates are monitored, and unwanted deviations are adjusted.

One aspect of transactional leadership is management by exception (Gilbert, Horsman & Kelloway, 2016), which was mentioned as an aspect of diagnostic use of MCS by Simons (1995). When practicing management by exception, managers only take action when there are indications of a problem (Gilbert et al., 2016). Use of diagnostic MCS should be a facilitator for this type of leadership as it can be a way to alert management of deviations from targets. It has been found that male leaders are more likely to practice management by exception (Bass, Avolio & Atwater, 1996; Eagly, Johannesen-Schmidt & van Engen, 2003) and this should make them more inclined to use MCS diagnostically.

Recent research has found some support for gender differences in the use of MCS; Bobe and Kober (2018) studied how the use of MCS and performance measures differs based on the gender of managers with a sample of heads of schools in Australian universities. They find that females use interactive MCS to a greater extent than males but fail to show that there is a difference in the use of diagnostic MCS (Bobe & Kober, 2018). Since their study uses a narrow sample of managers at universities, we want to test whether the results hold in a broader sample of organisations and we hypothesise that:

H1a: Companies with female CFOs use MCS more interactively than companies with male CFOs.

H1b: Companies with female CFOs use MCS less diagnostically than companies with male CFOs

3.2 Business Education

Reheul and Jorissen (2014) argue that more well-educated managers demand a greater understanding of situations and that they have a greater capacity to achieve this. They further argue that this should lead to greater sophistication of formal planning and control mechanisms. Zor, Linder and Endenich (2019) support this as they find that budgets are used to a greater extent by managers with a higher education-level. Similarly, Young et al. (2001) find that top managers with a graduate degree are positively associated with adoption of TQM, and they argue that this could be related to their greater ability to handle complex information. This is in line with Wiersema and Bantel (1992) who argue that well-educated managers are generally more receptive towards innovation and open for changes. Hence, results from previous studies indicate that education has a positive effect on the overall use of MCS.

In addition to research on the education level of managers, there has been research on different types of education. This research has mainly focused on differences related to educational background in business and operational areas. One stream of research has argued for a connection between an educational background in business and diagnostic as well as interactive use of MCS. Naranjo-Gil and Hartmann (2006) argue that managers with a background in business, economics and law are more likely to use controls with a focus on top-down control, which is in line with diagnostic use of MCS. Results from previous studies suggest that an administrative background is positively associated with the use of MSC diagnostically for both TMTs (Naranjo-Gil & Hartmann, 2006) and CEOs (Naranjo-Gil & Hartmann, 2007). Managers with an administrative background are defined as those who mainly have education and experience from general management areas such as business and law (Naranjo-Gil & Hartmann, 2006, 2007).

Hambrick and Mason (1984) argue that individuals who prefer to organise and rationalise will to a greater extent chose a business education. They argue that this is because business schools teach management models that are administratively rigid and complex (Hambrick & Mason, 1984). In recent research, it has been suggested that if a CFO has an educational background in business, the likelihood of adoption of innovative MAS increases (Naranjo-Gil et al., 2009), which points to the use of more complex MCS by business educated CFOs. In a review of the upper echelons perspective in the field of management control research, Hiebl (2014) argues that there are consistent findings pointing towards a positive relation between the use of MCS and the amount of business education of top managers. Other studies pointing to a more extensive use of MCS for more well-educated managers are Burkert and Lueg (2013) and Naranjo-Gil et al. (2009). Burkert and Lueg (2013) find that companies with business educated CFOs use more sophisticated VBM systems. Naranjo-Gil et al. (2009) argue that CFOs with a business-oriented education will be more familiar with MAS techniques and find that business-oriented CFOs are more likely to adopt innovative MCS. They argue that the adoption of innovative MAS often leads to more advanced accounting systems being used (Naranjo-Gil et al., 2009). Based on the above argumentation, we argue that CFOs with a background in business should be more inclined to use MCS in both an interactive and diagnostic manner.

As outlined in the previous paragraphs, it is evident that the amount of education (Reheul & Jorissen, 2014; Young et al., 2001) as well as type of education (Naranjo-Gil & Hartmann, 2006; Burkert & Lueg, 2013) are related to the use and design of MCS. Previous findings suggest that an increased amount of education is generally connected to more extensive use of MCS and that business education seems to have similar effects. However, no studies have to our knowledge focused on the amount of business education and Reheul and Jorissen (2014) calls for research on this. As previously mentioned, research has found that managers with business education use MCS to a greater extent than managers with a more operationally related education (e.g. Naranjo-Gil & Hartmann, 2006, 2007) and that education level has a positive effect on the overall use of MCS (Reheul & Jorissen, 2014). We therefore argue that the amount of business education should be positively related to the overall use of MCS. Since the foundations for MCS are taught in business education and are generally based on business terminology, the positive effects of education should mainly arise from business education. Consequently, the amount of business education of a CFO should be positively associated with the use of MCS both interactively and diagnostically. Hence, we formulate the following hypotheses:

H2a: The number of years of business education of a CFO is positively associated with interactive use of MCS.

H2b: The number of years of business education of a CFO is positively associated with diagnostic use of MCS.

3.3 Marital Status

In relation to the effects of socioeconomic factors proposed by Hambrick and Mason (1984), the current civil state of a CFO may affect the use of MCS. Behavioural studies suggest that marriage affects the behaviour of individuals in several ways. For example, Chun and Lee (2001) find that marriage increases the productivity for male workers and they argue that this could be related to the specialisation of responsibilities in the household for those in a marriage. Connected to personal relationships, Davila, Karney and Bradbury (1999) find that marriage might change the attachment style. Furthermore, there seem to be biological effects such as lower testosterone levels for married males (Burnham et al., 2003; Booth & Dabbs, 1993). Hence, marriage seems to have effects on the cognitive base of individuals, and we argue that these effects should be transferable to the behaviour of CFOs.

In the business setting, there has been some interesting research on the effects marriage has on decision-making and attitudes for CEOs (e.g. Roussanov & Savor, 2014; Hilary, Huang & Xu, 2017; Hegde & Mishra, 2019). Even though research has focused on marriage, we argue that the actual characteristic of interest is whether the CFO or CEO cohabitates with their partner. This is supported by Roussanov and Savor (2014) who argue that even though they study marriage, their study would benefit from a focus on marriage-like relationships if they had access to data on this. Especially in Sweden, we argue that the difference between a domestic partnership and marriage is of limited importance in a sample of CFOs since most CFOs are at an age where they generally have stable relationships if they live together with a partner. One important effect of marriage that has been found is connected to risk attitudes in relation to corporate decision-making (Roussanov & Savor, 2014). In relation to the use of MCS, it has been argued that MCS can be used interactively to mitigate risk in companies (Bobe & Kober, 2018; Simons, 1995). While it has been suggested that married individuals take more risk in their personal portfolios (Bertocchi, Brunetti & Torricelli, 2011), several studies have found that marriage of the CEO reduces corporate risk-taking (e.g. Roussanov & Savor, 2014; Hilary et al., 2017). Hegde and Mishra (2019) find that CSR initiatives in companies, which they argue are risk mitigating activities, are positively related to married CEOs. Their results further suggest that there is a negative relationship between married CEOs and riskiness of the company.

The results from Roussanov and Savor's (2014) study suggest that married CEOs are less aggressive in their investments and that the return of their stock is less volatile compared to single CEOs. There is also evidence pointing to lower leverage in firms headed by married CEOs (Roussanov & Savor, 2014). The results are robust when the researchers control for different firm level factors, which is an indication that it is not only a selection effect that produces the results. Overall, the results suggest that married CEOs are more risk-averse than single CEOs (Roussanov & Savor, 2014). Roussanov and Savor (2014) argue that their findings

could be explained both by common characteristics among people who get married and by direct effects of the marriage itself. One explanation for the results could be that those who get married share biological characteristics which affect their risk attitude (Roussanov & Savor, 2014). For example, higher testosterone level is positively correlated with risk-taking for men (Burnham, 2007) and single men are found to have higher testosterone levels (Burnham et al., 2003; Booth & Dabbs, 1993).

Based on the above argumentation that marriage should decrease the risk appetite of CEOs, we argue that the same effect will hold for CFOs who cohabitate with their partner. Since interactive use of MCS is generally connected to risk mitigation (Bobe & Kober, 2018; Simons, 1995), we formulate the following hypothesis:

H3: Companies with CFOs who are married or in a domestic partnership use MCS more interactively.

4. Methodology

This chapter describes the methodology of the thesis, which is influenced by Bobe and Kober (2018). The research design used is a cross-sectional questionnaire which is analysed with regression analysis. Throughout this thesis the term "company" is used when we refer to either an identified group of companies or a specific company for those who are not part of an identified group, if not stated otherwise. This means that it is not the legal entities which are of interest, and the reasons for this will be further explained in the following section. We have a satisfactory sample size of 240 usable observations, which can be compared to previous studies in the field of upper echelons theory and use of MCS which report sample sizes between 56 and 166 for questionnaires (Naranjo-Gil & Hartmann, 2006, 2007; Bobe & Kober 2018, 2020). In the following sections, we present the data gathering process. This is followed by a factor analysis and a presentation of the regression model. Finally, we present how we have managed the risk of non-response bias and common method bias.

4.1 Target Population

The aim when we identified a relevant target population was to include companies with formal MCS. Another criterion was that the company has a CFO in the TMT who is responsible for the MCS. An important condition to be able to conduct the study was to get access to CFOs in such companies. We therefore chose a target population of CFOs for large Swedish companies for the questionnaire. To classify companies as large, we use the EU definition, i.e. that the company has at least 250 employees as well as EUR 50 million in annual turnover and/or EUR 43 million in balance sheet total (European Commission, 2020) reported in their last full-year financial report. Since the majority of the companies report in SEK, the EUR values were

converted to SEK to match the EU definition. This was done with the exchange rate of the balance sheet date. Other criteria for inclusion in our population are that the legal form of the company is a limited company (aktiebolag), that it is not a pure investment or holding company, and that it has its headquarters in Sweden. In companies which produce consolidated balance sheets, these have been used as the basis for inclusion in the data set. Furthermore, entities have been excluded if they do not have an independent business but are only legal entities (part of a larger group), as they are unlikely to be in charge of their MCS. We chose these criteria to achieve a target population of large companies with an independent business and MCS rather than a sample of legal entities which are classified as large. The choice to exclude companies which do not fulfil the requirements for classification as large was made since they are less likely to have well developed formal MCS.

The initial screen for companies to include was conducted through the database Retriever Business on the 4th of February 2020. This resulted in a total of 1865 limited companies fulfilling the requirements for a large company according to the EU definition. To identify companies and not legal entities, entities which are part of a larger group without a separate management team were excluded. For example, large industrial groups often consist of several legal entities which are classified as large, but do not have a separate management team. However, when it was clear that an entity had an independent business and management, it was included as a company in the population. Examples of this are large conglomerates with diverse business areas with separate management teams where several subsidiaries are included as companies. The above selection process resulted in a total population of 1 094 companies. In addition to the identification of large independent companies, a requirement was that we could identify a CFO responsible for the MCS. This reduced the population of 1 094 companies to a sample of 818 companies for which we could identify a CFO. These 818 CFOs were targeted with the questionnaire.

4.2 Data

In this section we present the data sources used to collect data for the analysis. Data on personal characteristics of the CFOs was gathered through a cross-sectional questionnaire while company specific data was gathered through databases and annual reports.

4.2.1 Questionnaire

The purpose of the questionnaire is to characterise the CFOs based on gender, educational background and marital status as well as the use of MCS in the organisation. To control for managerial characteristics which have documented effects on MCS in previous research, we included questions related to these characteristics in the questionnaire as well. This method was chosen based on two main arguments. Firstly, there are to our knowledge no databases with CFO characteristics for Swedish firms. Secondly, there is no available data on how the

companies in our population use MCS, which means that the use has to be measured through either questionnaires or interviews. Following other studies in the field, we use a questionnaire (e.g. Bedford, 2015; Naranjo-Gil, 2006, 2007; Bobe & Kober, 2018, 2020), which is appropriate when the goal is to characterise a population and be able to test relationships between variables statistically (Pinsonneault & Kraemer, 1993). By using a questionnaire instead of interviews, we were able to access a sufficient amount of data to capture the effects of gender, business education and marital status, as well as control for managerial and firm-level characteristics.

To conceptualise the use of MCS, we follow several previous studies which have focused on the interactive and diagnostic levers in Simons' (1995) LOC framework (Naranjo-Gil & Hartmann, 2007; Bobe & Kober, 2018, 2020). The measurement of interactive and diagnostic use of MCS is based on five statements for each construct following Bedford (2015). The respondents were asked to indicate the extent to which the TMT use MCS as described by the ten statements related to interactive and diagnostic use of MCS. The statements are measured on a 7-point Likert scale where 1 corresponds to *Very low extent* and 7 to *Very high extent.* Likert-scales have been widely used in previous similar research (e.g. Bedford, 2015; Bobe & Kober, 2018, 2020; Kruis, Speklé, & Widener, 2016). The respondents were not aware that we use Simons LOC to measure the use of MCS or how the ten statements relate to each other. As previously mentioned, a company can use both interactive and diagnostic MCS simultaneously and consequently, the statements related to interactive and diagnostic use are measured independently.

As stated in the introduction, the study investigates how CFO characteristics affect the use of MCS in place. Exemplifying specific systems in the questionnaire may restrict the responses to focus on these specific systems and to avoid this, we did not exemplify. This choice should increase the probability that the responses are based on the overall use of MCS in the company rather than the use of a specific system. However, the decision to not exemplify might have resulted in some respondents not understanding the definition of MCS. To limit language barriers which could introduce measurement error, we provided the questionnaire in both Swedish and English. We made some minor editorial changes to the questions in English and the questions were translated to Swedish. The total number of questions in the questionnaire is 19, of which ten relate to the use of MCS, eight to managerial characteristics and one to the company. The questionnaire was constructed and provided to the respondents in Google Forms. Before sending the questionnaire to the respondents, it was reviewed by two senior researchers, five business students and one person who has worked as a CFO for a large Swedish company. Based on their feedback, any unclarities were adjusted and editorial changes were made. The full questionnaire can be found in Appendix B.

To increase the response rate, we searched for personal email addresses for each of the CFOs in the sample; the link to the questionnaire was sent by email directly to the CFO of each of the 818 companies. The email contained a short description of the questionnaire and the study in both English and Swedish. To further increase the response rate, both the final report and a shorter summary of the main findings were offered to the respondents. The email addresses to the CFOs were collected from different sources, where most could be found either directly through the company web pages or indirectly by finding a structure for the email addresses in the company. However, for some CFOs the email address could not be found, and this resulted in a total of 787 possible respondents. The initial email was sent during two days at the end of February 2020. This resulted in 189 responses (24.02% of the possible respondents). Approximately one week later, a reminder email was sent to the CFOs who had not yet responded, and this resulted in 103 additional responses. In total, this resulted in 292 responses, yielding a response rate of 37.10% of the possible respondents.

4.2.2 Archival Data

In addition to the data gathered through the questionnaire, the data set was completed with company specific data for each of the companies of the responding CFOs. Each response was matched with the company the CFO works for; when the responses did not allow us to identify the company the CFO works for, that response was excluded. For all the matched companies, the five latest financial reports with full-year balance sheets and income statements was used as a data source. The data that was gathered from the reports was net sales, earnings before interest and taxes (EBIT), total assets, equity, untaxed reserves and number of employees. When the company produces consolidated financial statements, these have been used.

The data set was further complemented with the registration date for the company and SNI-codes[2], which were collected using Retriever Business. The SNI-code for each company was based on the legal entity with the highest net sales in the group. The companies were classified as listed if they are traded on either a regulated stock exchange or a multilateral trading facility[3]. To classify the industry of the companies, we used the Global Industry Classification Standard

[2] The Swedish Standard Industrial Classification (SNI) classifies businesses based on the activities they carry out and is a basis for statistics (SCB, 2020).

[3] Regulated stock exchanges in Sweden are Nasdaq OMX Stockholm and Nordic Growth Market Equity and Multilateral Trading Facilities are First North, Nordic MTF and Spotlight Stock Market (Avanza, 2020; Nordic Growth Market, 2020)

(GICS) effective until August 31, 2016[4]. This is the classification standard that is currently used by Nasdaq OMX Stockholm, which consists of ten industries. For the listed companies, we used the industry classification available on the respective stock exchange web page. The unlisted companies were classified into one of the ten industries based on SNI-codes as well as information available on the company webpage.

4.3 Data Handling

In this section we describe how the data has been managed to ensure that all observations are appropriate to include in the analysis. To be able to analyse whether CFOs have an influence on the use of MCS in companies, it is of great importance that they have held their position long enough to affect the use. If a CFO has held its position for a short time, it is unlikely that he/she has had the opportunity to affect the use of MCS. Change processes might have been started by the CFO, but it is unlikely that they are fully implemented and have had major effects on the use of MCS. This means that characteristics of short-tenured CFOs should not have major effects on the use of MCS. To prevent that the results are disturbed by observations in which the CFO has a short tenure, we excluded all 12 observations where the CFO has held its position for less than one year.

Additional observations were excluded based on six more criteria. *First,* responses with the same number on all measures of interactive and diagnostic use of MCS were excluded (12). This was done to mitigate the risk that we introduce measurement bias by including responses which do not reflect the actual use of MCS. *Second,* two observations were excluded because the respondents did not hold the position as CFO. *Third,* responses which were not possible to match with a company because of incomplete responses were excluded (6). *Fourth,* two companies were excluded since they fulfilled the requirements for a large company at the initial screening but not according to the last financial report available 2020-04-15. *Fifth,* companies with missing archival data were excluded from the data set (17). *Sixth,* one observation was excluded because of incomplete answers. These criteria resulted in a final data set of 240 usable responses (30.49%).

4.4 Factor Analysis

As previously mentioned, the instruments used to measure interactive and diagnostic use of MCS were based on Bedford (2015) with five items related to each. The instruments have been

[4] The difference between this standard and the GICS effective from 2016-09-01 is that the industry Financials is separated into Financials and Real Estate. Otherwise, the standards are identical. MSCI (2020)

validated by Bedford (2015) but to further ensure the reliability after translation of the questions, we conducted a principal axis factor analysis with varimax rotation in line with Bobe and Kober (2018). The factor analysis was also executed to confirm that the items loaded on the factors representing interactive and diagnostic use of MCS as expected based on theory presented by Bedford (2015). If one or several of the items would not load on the factors as expected, this could be an indication that the item does not capture interactive or diagnostic use of MCS as intended and that the item should be dropped from the analysis (Bobe & Kober, 2018).

To get an indication of whether it is appropriate to conduct a factor analysis, we examined a correlation matrix as proposed by Hair, Black, Babin and Anderson (2014). Hair et al. (2014) argue that if no correlations are above 0.3, the data is probably inappropriate for factor analysis. The correlation matrix of the items is presented in Table 1, where the variables Interactive 1-5 and Diagnostic 1-5 represent the questions presented in Table 2.

Table 1
Pearson correlation matrix

Item	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Interactive 1	1.000									
(2) Interactive 2	**0.698***	1.000								
(3) Interactive 3	**0.400***	**0.450***	1.000							
(4) Interactive 4	**0.383***	**0.346***	**0.387***	1.000						
(5) Interactive 5	**0.299***	**0.316***	**0.510***	**0.323***	1.000					
(6) Diagnostic 1	**0.269***	**0.273***	**0.284***	**0.245***	**0.209***	1.000				
(7) Diagnostic 2	**0.268***	**0.183***	**0.229***	**0.278***	**0.274***	**0.657***	1.000			
(8) Diagnostic 3	**0.263***	**0.245***	**0.299***	**0.213***	**0.414***	**0.402***	**0.528***	1.000		
(9) Diagnostic 4	**0.184***	**0.149***	**0.252***	**0.302***	**0.254***	**0.461***	**0.467***	**0.528***	1.000	
(10) Diagnostic 5	**0.158***	**0.194***	**0.363***	**0.221***	**0.346***	**0.365***	**0.379***	**0.531***	**0.428***	1.000

Table 1 presents Pearson's correlation coefficients for the items related to interactive and diagnostic use of MCS. The questions related to each item can be found in Table 2. * $p < 0.05$.

Table 1 reveals that several correlations in our data set are above 0.3, which indicates that the data is appropriate for factor analysis (Hair et al., 2014). In addition to this examination of the correlation matrix, we conducted two formal tests for the appropriateness of factor analysis. One was the Bartlett test of sphericity, which tests whether there are significant correlations in the data set (Hair et al., 2014). The p-value for this test is 0.000, which suggests that the data is appropriate for factor analysis. Another test to examine the correlations and appropriateness of factor analysis is the measure of sampling adequacy (MSA) (ibid.). This test generates a value of 0.804, which is a satisfactory level according to Hair et al. (2014). Based on these tests, we argue that the data is appropriate for factor analysis and this analysis is presented in the following paragraphs.

Based on the argumentation in *4.2.1 Questionnaire*, we expect that two factors will explain most of the variation in the items as they measure interactive or diagnostic use of MCS. If the instruments measure interactive and diagnostic use of MCS as expected, the questions related

to interactive use should have the strongest loading on one factor and the questions related to diagnostic use on another (Bobe & Kober, 2018; Bedford, 2015). The scree plot (presented in Appendix A) shows, as we expected, that two factors have eigenvalues above 1 and that the curve levels off after the second factor. This indicates that these two factors should be retained (Hair et al., 2014). The result from the factor analysis is presented in Table 2.

Table 2
Validity and reliability tests for interactive and diagnostic management control system use

	Factor Loadings	
Item	**MCS Diagnostic Use**	**MCS Interactive Use**
Provide a recurring and frequent agenda for top management activities (Interactive 1)		0.8160
Provide a recurring and frequent agenda for subordinates activities (Interactive 2)		0.8400
Enable continual challenge and debate of underlying data, assumptions and action plans with subordinates and peers (Interactive 3)		0.6853
Focus attention on strategic uncertainties (i.e. factors that may invalidate current strategy or provide opportunities for new strategic initiatives (Interactive 4)		0.5804
Encourage and facilitate dialog and information sharing with subordinates (Interactive 5)		0.5317
Identify critical performance variables (i.e. factors that indicate achievement of current strategy (Diagnostic 1)	0.7184	
Set targets for critical performance variables (Diagnostic 2)	0.7870	
Monitor progress toward critical performance targets (Diagnostic 3)	0.7623	
Provide information to correct deviations from pre-set performance targets (Diagnostic 4)	0.7583	
Review key areas of performance (Diagnostic 5)	0.6809	
% variance explained	30.37	25.85
% cumulative variance explained	30.37	56.21
Cronbach's alpha	0.8173	0.7753

Table 2 presents the result from the principal axis factor analysis with varimax rotation for the items measuring the interactive and diagnostic use of MCS. The questions each correspond to one of the items used to construct the measures for interactive and diagnostic use of MCS. Factor 1 is labelled "MCS Diagnostic use" and Factor 2 is labelled "MCS Interactive use" in the table.

As shown in Table 2, the two first factors explain 56.21% of the variance in the items. This is a further indication that it is appropriate to retain two factors in the factor analysis (Hair et al., 2014). Hair et al. (2014) argue that factor loadings above 0.35 can be considered statistically significant with a sample size of 250 and 0.4 with a sample size of 200. Our sample is 240 and all factor loadings are above 0.5. Hence, all factor loadings are significant, which means that all items can be included in the instruments used to measure interactive and diagnostic use of

MCS (Bobe & Kober, 2018). Furthermore, all items have the greatest loading on the expected factor; the questions related to interactive use of MCS load on factor two and the questions related to diagnostic use load on factor one. Based on the conclusion that all items should be retained, Cronbach's alpha was calculated to judge the reliability of the summated scale (Hair et al., 2014). Hair et al. (2014) argue that values above 0.7 are acceptable and as can be seen in Table 2, both instruments have a Cronbach's alpha above this threshold. Based on this analysis, we conclude that all items comprising interactive and diagnostic use of MCS should be retained in the analysis and that all questions can be used to construct the instruments for interactive and diagnostic use of MCS respectively.

4.5 Empirical Model

In this section, we first present the empirical model used to test the hypotheses. This is followed by a presentation of the construction of the variables included in the model. The equation used to test the hypotheses is:

$$Y = \beta_0 + \beta_1 Gender + \beta_2 BusinessEducation + \beta_3 MaritalStatus + \text{Controls} + \varepsilon \quad \text{(1a-1b)}$$

where

Y is interactive use of MCS in Eq. 1a and diagnostic use of MCS in Eq. 1b

and

Controls are $\beta_4 Age + \beta_5 TenurePos + \beta_6 TenureComp + \beta_7 ExpFin + \beta_8 FirmSize + \beta_9 Return + \beta_{10} SalesGrowth + \beta_{11} EquityRatio + \beta_{12} FirmAge + \beta_n Industry$

Eq. 1a is used to test H1a, H2a and H3 and Eq. 1b is used to test H1b and H2b.

4.5.1 Dependent Variables

The dependent variables *Interactive* and *Diagnostic* were constructed based on the responses from the questionnaire. Relying on the results from the factor analysis, we constructed the variable *Interactive* as the average score on the five questions related to interactive use of MCS. Consequently, we constructed the variable *Diagnostic* as the average score on the five questions related to diagnostic use of MCS. In line with Bobe and Kober (2018), we use these variables as the dependent variables in Eq. 1a and 1b.

4.5.2 Variables of Interest

Data for the variables *Gender, BusinessEducation* and *MaritalStatus* were collected through the questionnaire. *Gender* is measured as a dummy variable coded 1 if the CFO is female and 0 otherwise. *BusinessEducation* is measured as the number of years of business education the

CFO has at university or equivalent level. Finally, *MaritalStatus* is measured as a dummy coded 1 if the CFO is married or in a domestic partnership and 0 otherwise.

4.5.3 Control Variables

Chatterjee and Simonoff (2013) argue that control variables can be included in a regression model to statistically account for their effects. The purpose of this is to separate the effect of the variables of interest and reduce the noise in the measurement of the effects on the independent variables (ibid.). We therefore include several control variables, both company specific and CFO specific, which have been found to have effects on the design and use of MCS in previous research. Since previous studies on the use of MCS in the field of upper echelons theory have been based on samples of universities (Bobe & Kober, 2018, 2020) and hospitals (Naranjo-Gil & Hartmann, 2006, 2007), we adapt the use of control variables to our cross-industrial sample. The control variables included in the regression model are presented below.

One managerial characteristic with consistent findings related to the effects on MCS is age (e.g. Firk et al., 2019; Naranjo-Gil et al., 2009; Young et al., 2001), which we included as a control variable (*Age*). The number of years that a CFO has held its position in the organisation has been found to have effects on MCS as well (e.g. Burkert & Lueg, 2013; Naranjo-Gil et al., 2009; Firk et al., 2019). We therefore included *TenurePos*, which is measured as the total number of years the respondent has held its position as a CFO in the company. Furthermore, we argue that in addition to the effect of tenure at the position, tenure in the organisation should have an effect on the use of MCS since it increases the familiarity with the organisation. Hence, we included *TenureComp*, which is measured as the number of years in the company in addition to the years at the current position. Naranjo-Gil and Hartmann (2006) find that CFOs with administrative (management) and clinical (operational) background use MCS differently. However, they do not distinguish between educational and professional experience and we argue that the effects could be different. Consequently, we controlled for this by analysing the effect of business education (*BusinessEducation*) and experience from finance functions (*ExpFin*) separately. *ExpFin* is coded 1 if the CFO mainly has experience from finance functions (business control, accounting or finance) and 0 otherwise.

In line with previous studies in the field of upper echelons and management control, we also included company-specific variables in the regression model. Firm size has been included as a control variable in many studies since it has been found to have effects on MCS. In line with Henri (2006) and Reheul and Jorissen (2014) we controlled for firm size using the natural logarithm of the number of employees (*FirmSize*). Different accounting measures and the historical development are other factors which have been found to affect MCS. Several variables were included in the regression model to control for these effects. For example, profitability may affect the use of MCS in a company and in line with Burkert and Lueg (2013)

and Firk et al. (2019), we controlled for this through the return on assets in the last full-year financial report (*Return*). Furthermore, stability of the company both in terms of sales growth and leverage could have an effect on the use of MCS. Following Firk et al. (2019), we included a measure of the historical sales growth, which is the yearly average sales growth for the last five-year period (*SalesGrowth*). To control for leverage effects, the equity ratio based on the last full-year financial report is included (*EquityRatio*). We argue that young companies may use MCS differently compared to older companies. In line with Sandino (2007), we controlled for this effect by including a dummy variable which is coded 1 if the company is older than 20 years and 0 otherwise (*FirmAge*). Finally, companies in different industries will likely use their MCS in different ways. Hence, we use nine dummy variables to capture industry effects related to the ten industries discussed in *4.2.2. Archival Data*. The exact definitions and calculations of the control variables can be found in Appendix C.

4.6 Non-Response Bias

To evaluate whether the dataset could suffer from non-response bias, we ran independent sample t-tests and chi-square independence tests for the variables in the model. T-tests were executed for the variables which are continuous and chi-square tests were executed for the categorical variables. According to Armstrong and Overton (1977), late respondents often share characteristics with non-respondents and hence, early and late respondents can be compared to evaluate whether the data suffers from non-response bias. Following Bedford (2015), the 20% of the respondents who responded first were compared to the 20% who responded last. Consequently, we ran chi-square or t-tests for all variables included in Eq. 1a and 1b. The results from these tests suggest that none of the differences are significant at a 5% significance level. However, *Return* and *Age* are statistically significant at a 10% significance level, which suggests that respondents differ from non-respondents on these variables. Considering that the differences are only weakly significant and that the tests only indicate differences on two of the variables of which neither is a variable of interest, we do not consider this a severe issue. As an additional test for non-response bias, respondents were compared to non-respondents on the variables that we had access to data for (*Firm size* and *Gender*), which is in line with Henri (2006). The tests did not suggest any differences in sample characteristics between respondents and non-respondents for *FirmSize* or *Gender*. Hence, our tests indicate that non-response bias is unlikely to bias the results.

4.7 Common Method Bias

A potential problem when both dependent and independent variables are measured based on the same respondents is common method bias (Heinicke, Guenther & Widener, 2016). Considerable care must be taken to mitigate this problem and we use several procedural measures proposed by Podsakoff, MacKenzie, Lee and Podsakoff (2003) to reduce the

likelihood of this problem. *First,* while the respondents were aware that the questions concern MCS and use, we did not mention the LOC framework or the specific relationships we examine in the study. This should reduce the likelihood of common method bias (Podsakoff et al., 2003). *Second,* by collecting data from archival sources when possible, we were able to reduce the number of variables obtained from the respondents. *Third,* the respondents were guaranteed anonymity, which should increase the reliability of the responses. *Finally,* other advantages of the construction of the questionnaire are that there should be no answers which are considered more appropriate and that the judgment the respondents have to apply in relation to the independent variables is very limited.

In line with Heinicke et al. (2003), we also used a statistical technique to test whether common method bias may be a problem, more specifically Harman's single factor test. If a majority of the variation in the data set can be explained by one factor, it is an indication that the method introduces common method bias. The result from Harman's single factor test shows that one factor explains 40.59% of the variance, which suggests that the likelihood of common method bias is low (Podsakoff et al., 2003).

5. Results

In this chapter, we first present the descriptive statistics. This is followed by a presentation of empirical results in relation to the hypotheses. The results suggest that H1a, H2a, and H2b hold, while we do not find support for H1b and H3. We conclude the chapter with a presentation of the robustness tests which have been conducted.

5.1 Descriptive Statistics

In this section, we present descriptive statistics for the data set and highlight patterns which emerge. Table 3 presents CFO characteristics and Table 4 presents descriptive statistics of the companies and the use of MCS.

Table 3
Descriptive statistics of CFO characteristics (n = 240)

Variable	Mean	Median	Std Dev.	Min.	Max.
Gender	0.275	0.000	0.447	0	1
BusinessEducation	3.952	4.000	0.900	0	9
MaritalStatus	0.913	1.000	0.283	0	1
Age	50.504	51.000	6.512	29	65
TenurePos	4.829	3.000	4.844	1	32
TenureComp	2.569	0.000	5.206	0	25
ExpFin	0.921	1.000	0.271	0	1

Table 3 presents the descriptive statistics for the CFOs in the sample.

Table 4
Descriptive statistics (n = 240)

Panel A: MCS use	**Mean**	**Median**	**Std Dev.**	**Min.**	**Max.**
Interactive	4.543	4.800	1.253	1.000	7.000
Diagnostic	5.717	6.000	0.969	2.400	7.000
Panel B: Company characteristics	**Mean**	**Median**	**Std Dev.**	**Min.**	**Max.**
Number of employees	2 400.333	657.000	5238.102	255	48 992
FirmSize	6.881	6.488	1.147	5.541	10.799
Return	0.075	0.065	0.101	-0.320	0.561
SalesGrowth	0.114	0.074	0.163	-0.188	1.716
EquityRatio	0.354	0.362	0.220	-0.945	0.912
FirmAge	0.754	1.000	0.431	0	1
Panel C: Industry	***n (%)***				
CommunicationServices	5 (2.08%)				
ConsumerDiscretionary	43 (17.92%)				
ConsumerStaples	24 (10.00%)				
Energy	1 (0.42%)				
Financials	13 (5.42%)				
HealthCare	17 (7.08%)				
Industrials	100 (41.76%)				
InformationTechnology	16 (6.67%)				
Materials	15 (6.25%)				
Utilities	6 (2.50%)				

Table 4 presents the descriptive statistics for the use of MCS and the companies in the sample.

In Table 3, it can be seen that a majority (72.5%) of the CFOs in the sample are male. This means that we have 66 females and 174 males in the sample. The average CFO in the sample has 3.95 years of business education with a minimum of 0 years and a maximum of 9 years. This average is not unexpected since we believe that most CFOs have a 3-5 year university degree in business. Another expected result is that most CFOs (92.1%) have their main work experience from financial positions such as accounting, business control and finance functions. The average age (50.5) and CFO tenure (4.83) in our sample are in line with Firk et al. (2019) who have a sample of CFOs in the largest European companies and report an average age of 50.04 and an average tenure of 4.30. A majority of the CFOs in our sample are married or in a domestic partnership (91.3%). This means that only 21 of the CFOs in the sample are not married or in a domestic partnership, which might be too few to identify statistically significant differences.

As shown in Panel A in Table 4, the average on *Interactive* is lower than the average on *Diagnostic.* Hence, our results show that on average, MCS are used more diagnostically than interactively in the sample, which corresponds with what has been reported in previous empirical research on the use of MCS (e.g. Bedford, 2015; Naranjo-Gil & Hartmann, 2007; Henri, 2006). Consistent with Bedford (2015), the standard deviation of interactive use of MCS is greater than standard deviation of diagnostic use of MCS. These results show that interactive use of MCS has a greater variability than diagnostic use of MCS for the companies in our sample.

Panel B and Panel C in Table 4 displays the characteristics of the companies in our sample. The average company in the sample has 2400 employees; the largest company has 48 992 employees and the smallest 255 employees. This means that our sample consists of a broad range of companies of different sizes, which increases the generalisability of the results. The variability of the companies in the sample is further strengthened by the range in *Return, SalesGrowth* and *EquityRatio.* Consistent with Sweden being a country with a strong industrial tradition, most of the companies in the sample (41.67%) are classified as industrial companies according to the GICS.

The pairwise correlations for all variables except the industry dummies are presented in Table 5.

Table 5
Pearson correlation matrix

Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**
(1) *Interactive*	1.000													
(2) *Diagnostic*	**0.446***	1.000												
(3) *Gender*	0.076	-0.024	1.000											
(4) *BusinessEducation*	0.077	0.057	-0.029	1.000										
(5) *MaritalStatus*	-0.005	-0.039	-0.040	0.049	1.000									
(6) *Age*	0.063	0.103	0.023	**-0.141***	-0.015	1.000								
(7) *TenurePos*	-0.105	0.035	-0.103	-0.051	-0.008	**0.368***	1.000							
(8) *TenureComp*	0.043	0.030	0.122	**-0.133***	-0.071	0.064	0.066	1.000						
(9) *ExpFin*	-0.073	-0.044	0.111	-0.050	0.073	0.046	0.025	**-0.158***	1.000					
(10) *FirmSize*	**0.152***	**0.182***	-0.083	0.002	-0.005	0.033	-0.082	**0.135***	-0.073	1.000				
(11) *Return*	0.043	0.009	-0.082	-0.056	-0.077	0.016	0.119	0.091	-0.062	-0.066	1.000			
(12) *SalesGrowth*	-0.049	0.007	-0.074	0.080	0.058	**-0.139***	0.004	-0.118	-0.004	-0.028	0.021	1.000		
(13) *EquityRatio*	0.010	-0.036	-0.061	-0.070	0.073	0.043	0.055	-0.011	0.022	-0.041	**0.303***	0.021	1.000	
(14) *FirmAge*	0.095	-0.045	-0.060	-0.095	0.063	0.047	0.080	0.107	-0.024	-0.044	**0.169***	**-0.262***	**0.209***	1.000

Table 5 presents Pearson's correlation coefficients for the variables in Eq. 1 except the industry dummies. * $p < 0.05$.

Table 5 shows that *Interactive* and *Diagnostic* have a correlation of 0.446, which is statistically significant on a 5% level. The strong positive correlation is in line with Bedford (2015) and Bobe and Kober (2018) who report statistically significant correlations of 0.645 and 0.587. We argue that the positive correlation is reasonable considering that both interactive and diagnostic use are aspects of MCS use. Some of the correlations in Table 5 are statistically significant but we argue that neither of them is at a level that could be problematic when interpreting the results[5]. Interestingly, *Interactive* is positively correlated with *Gender*, which indicates that females use MCS interactively to a greater extent than males. *Diagnostic* on the other hand is negatively correlated with *Gender*. These two correlations indicate that hypotheses H1a and H1b might be true. *BusinessEducation* is, as hypothesised in H2a and H2b, positively correlated with both *Interactive* and *Diagnostic*. Lastly, contrary to H3, *MaritalStatus* is negatively correlated with *Interactive.* However, neither of the correlations between the variables of interest (*Gender, BusinessEducation* and *MaritalStatus*) and the dependent variables (*Interactive* and *Diagnostic*) are statistically significant ($p < 0.05$).

5.2 Hypothesis Tests

In this section we present the empirical findings related to the hypothesis tests. Table 6 presents the results from the estimation of our regression models in Eq. 1a and 1b. To control for heteroscedastic error terms, we run the regression models with robust standard errors. We chose this particular procedure because tests suggest that the OLS regression suffers from heteroscedasticity[6]. We use OLS regression with robust standard errors to generate the results in the software application Stata.

[5] Multicollinearity is examined through calculation of variance inflation factors (VIFs). The highest VIF is 1.27, which suggests that multicollinearity is not a major concern as it is far below the threshold of 10 proposed by Hair et al. (2014).

[6] Breusch-Pagan tests suggest that the regression model estimating diagnostic use suffers from heteroscedasticity in the error terms ($p = 0.0000$).

Table 6
Regression results for interactive and diagnostic use of MCS

Variable	**Interactive**	**Diagnostic**
Gender	0.291*	-0.00212
	(1.507)	(-0.0135)
BusinessEducation	0.168**	0.0905*
	(1.728)	(1.492)
MaritalStatus	-0.0579	-0.142
	(-0.198)	(-0.643)
Age	0.0227	0.0179
	(1.619)	(1.497)
TenurePos	-0.0376**	0.000553
	(-2.000)	(0.0380)
TenureComp	-0.00771	-0.00127
	(-0.481)	(-0.101)
ExpFin	-0.293	-0.151
	(-0.921)	(-0.753)
FirmSize	0.207**	0.175***
	(2.590)	(3.300)
Return	0.684	0.263
	(0.784)	(0.396)
SalesGrowth	0.0185	-0.0648
	(0.0440)	(-0.152)
EquityRatio	-0.0170	-0.136
	(-0.0443)	(-0.408)
FirmAge	0.327*	-0.0705
	(1.657)	(-0.476)
Energy	-2.038***	-0.839***
	(-9.217)	(-4.423)
Materials	0.406	0.310
	(1.185)	(1.208)
ConsumerDiscretionary	0.328	0.435***
	(1.401)	(2.622)
ConsumerStaples	-0.202	0.0644
	(-0.879)	(0.295)
HealthCare	-0.698	-0.0378
	(-1.640)	(-0.110)
Financials	0.239	-0.216
	(0.543)	(-0.763)
InformationTechnology	0.0984	0.404**
	(0.368)	(2.023)
CommunicationServices	0.185	-0.206
	(0.283)	(-0.571)
Utilities	0.0710	0.342
	(0.148)	(0.727)
Constant	1.424	3.492***
	(1.390)	(4.356)
Observations	240	240
R-squared	0.130	0.101

Table 6 presents regression results for both interactive and diagnostic use of MCS. The numbers without parentheses display the coefficients for each variable and the numbers in parentheses display the t-statistics. Reported significance for *Gender, BusinessEducation* and *MaritalStatus* is for one-tailed tests. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$.

The results for the variable *Gender* suggest that companies with female CFOs use MCS more interactively than companies with male CFOs. In Eq. 1a estimating interactive use of MCS, the coefficient on *Gender* is 0.2912; this result is significant at a 10% level ($p = 0.0665$) in weak support for H1a. The analysis did not show any significant gender differences in the diagnostic use of MCS. The coefficient on *Gender* in Eq. 1b is -0.0021 ($p = 0.5055$), which gives no support for H1b. Hence, we found no support for the hypothesised negative relationship between female CFOs and diagnostic use of MCS.

As hypothesised, the coefficients on the variable *BusinessEducation* are positive in both Eq. 1a and 1b. The coefficient on *BusinessEducation* in Eq. 1a which estimates the use of MCS interactively is 0.1679 ($p = 0.0425$). Hence, *BusinessEducation* has a statistically significant positive effect on the interactive use of MCS on a 5% significance level, which supports H2a. This means that CFOs with more business education use MCS more interactively than those with less business education. The test related to diagnostic use of MCS revealed that *BusinessEducation* has a coefficient of 0.0905 ($p = 0.0685$), which weakly supports H1b as the coefficient is significant at a 10% level. Hence, *BusinessEducation* has a positive effect on both the interactive and diagnostic use of MCS.

No significant results were observed regarding *MaritalStatus,* for which it was hypothesised that CFOs who are married or in a domestic partnership use MCS more interactively than other CFOs. The coefficient for *MaritalStatus* in Eq. 1a is -0.0579 ($p = 0.5785$), which does not give any support for H3a. Hence, the analysis did not reveal any significant differences in interactive use of MCS between CFOs who are married or in a domestic partnership and CFOs who are not.

Among the control variables, *TenurePos* ($p < 0.05$), *FirmSize* ($p < 0.05$), *FirmAge* ($p < 0.05$) and *Energy* ($p < 0.01$) are statistically significant in Eq. 1a and *FirmSize* ($p < 0.01$), *Energy* ($p < 0.01$), *ConsumerDiscretionary* ($p < 0.01$), *InformationTechnology* ($p < 0.05$) and the constant ($p < 0.01$) are statistically significant in Eq. 1b.

5.3 Robustness of the Results

To further test the robustness of our results, additional analyses with alternative variables were conducted. The regression results can be found in Table 7.

Table 7
Regression results for alternative model specifications

	Main Model		**Model 1**		**Model 2**		**Model 3**		**Model 4**	
Variable	**Interactive**	**Diagnostic**	**Interactive**	**Diagnostic**	**Interactive**	**Diagnostic**	**Interactive**	**Diagnostic**	**Interactive**	**Diagnostic**
Gender	0.291*	-0.00212	0.290*	-0.00115	0.291*	-0.00191	0.261*	-0.0260	0.260	-0.0305
	(1.507)	(-0.0135)	(1.505)	(-0.00729)	(1.503)	(-0.0122)	(1.300)	(-0.162)	(1.281)	(-0.189)
BusinessEducation	0.168**	0.0905*	0.169**	0.0892*	0.165**	0.0929*	0.163**	0.0857*	0.164**	0.0872*
	(1.728)	(1.492)	(1.735)	(1.456)	(1.727)	(1.520)	(1.693)	(1.456)	(1.706)	(1.480)
MaritalStatus	-0.0579	-0.142	-0.0578	-0.142	-0.0511	-0.148	-0.0648	-0.150	-0.0538	-0.137
	(-0.198)	(-0.643)	(-0.197)	(-0.646)	(-0.174)	(-0.667)	(-0.223)	(-0.687)	(-0.187)	(-0.645)
Age	0.0227	0.0179	0.0230	0.0176	0.0227	0.0179	0.0240*	0.0189	0.0240*	0.0191
	(1.619)	(1.497)	(1.624)	(1.470)	(1.616)	(1.494)	(1.694)	(1.524)	(1.690)	(1.548)
TenurePos	-0.0376**	0.000553	-0.0377**	0.000620	-0.0378**	0.000718	-0.0403**	-0.00155	-0.0399**	-0.00157
	(-2.000)	(0.0380)	(-1.995)	(0.0426)	(-2.001)	(0.0490)	(-2.185)	(-0.105)	(-2.156)	(-0.104)
TenureComp	-0.00771	-0.00127	-0.00781	-0.00114	-0.00781	-0.00118	-0.00451	0.00112	-0.00413	0.00207
	(-0.481)	(-0.101)	(-0.487)	(-0.0895)	(-0.486)	(-0.0933)	(-0.286)	(0.0896)	(-0.263)	(0.167)
ExpFin	-0.293	-0.151	-0.287	-0.158	-0.305	-0.140	-0.286	-0.143	-0.278	-0.141
	(-0.921)	(-0.753)	(-0.899)	(-0.781)	(-0.924)	(-0.687)	(-0.937)	(-0.735)	(-0.892)	(-0.716)
FirmSize	0.207**	0.175***	0.197**	0.187***	0.210**	0.172***				
	(2.590)	(3.300)	(2.255)	(3.178)	(2.593)	(3.251)				
Listed			0.0563	-0.0662						
			(0.276)	(-0.473)						
Return	0.684	0.263	0.687	0.260	0.686	0.262	0.586	0.183	0.682	0.252
	(0.784)	(0.396)	(0.786)	(0.390)	(0.784)	(0.392)	(0.661)	(0.274)	(0.784)	(0.382)
SalesGrowth	0.0185	-0.0648	0.0133	-0.0586	0.0202	-0.0663	0.0183	-0.0634	-0.0324	-0.106
	(0.0440)	(-0.152)	(0.0314)	(-0.139)	(0.0479)	(-0.155)	(0.0435)	(-0.149)	(-0.0761)	(-0.248)
EquityRatio	-0.0170	-0.136	-0.0383	-0.111	-0.0132	-0.139	-0.0770	-0.188	-0.142	-0.236
	(-0.0443)	(-0.408)	(-0.0974)	(-0.337)	(-0.0344)	(-0.418)	(-0.194)	(-0.556)	(-0.355)	(-0.708)
FirmAge	0.327*	-0.0705	0.324	-0.0663	0.329*	-0.0719	0.310	-0.0845	0.301	-0.0927
	(1.657)	(-0.476)	(1.642)	(-0.445)	(1.657)	(-0.484)	(1.542)	(-0.564)	(1.502)	(-0.617)
Energy	-2.038***	-0.839***	-2.021***	-0.859***	-2.045***	-0.833***	-2.337***	-1.112***	-2.172***	-0.941***
	(-9.217)	(-4.423)	(-9.047)	(-4.414)	(-9.188)	(-4.372)	(-7.151)	(-4.814)	(-8.006)	(-4.520)
Materials	0.406	0.310	0.408	0.308	0.411	0.306	0.295	0.211	0.282	0.212
	(1.185)	(1.208)	(1.191)	(1.191)	(1.213)	(1.183)	(0.881)	(0.782)	(0.850)	(0.774)
ConsumerDiscretionary	0.328	0.435***	0.327	0.436***	0.330	0.433***	0.280	0.396**	0.270	0.385**
	(1.401)	(2.622)	(1.396)	(2.632)	(1.403)	(2.612)	(1.215)	(2.473)	(1.163)	(2.411)
ConsumerStaples	-0.202	0.0644	-0.203	0.0646	-0.202	0.0638	-0.306	-0.0279	-0.274	0.00686
	(-0.879)	(0.295)	(-0.879)	(0.295)	(-0.872)	(0.292)	(-1.266)	(-0.128)	(-1.167)	(0.0316)
HealthCare	-0.698	-0.0378	-0.704*	-0.0312	-0.700	-0.0367	-0.615	0.0313	-0.643	0.0118
	(-1.640)	(-0.110)	(-1.655)	(-0.0907)	(-1.638)	(-0.106)	(-1.421)	(0.0897)	(-1.480)	(0.0335)
Financials	0.239	-0.216	0.241	-0.218	0.242	-0.218	0.143	-0.297	-0.0270	-0.431
	(0.543)	(-0.763)	(0.546)	(-0.762)	(0.544)	(-0.766)	(0.335)	(-1.056)	(-0.0637)	(-1.429)
InformationTechnology	0.0984	0.404**	0.0720	0.435**	0.0951	0.407**	0.0539	0.371*	0.0232	0.338*
	(0.368)	(2.023)	(0.259)	(2.128)	(0.354)	(2.022)	(0.210)	(1.880)	(0.0905)	(1.722)
CommunicationServices	0.185	-0.206	0.191	-0.214	0.191	-0.211	0.165	-0.221	0.115	-0.263
	(0.283)	(-0.571)	(0.291)	(-0.590)	(0.294)	(-0.580)	(0.256)	(-0.605)	(0.179)	(-0.717)
Utilities	0.0710	0.342	0.0760	0.336	0.0680	0.345	-0.172	0.135	-0.285	0.0510
	(0.148)	(0.727)	(0.158)	(0.712)	(0.142)	(0.730)	(-0.364)	(0.285)	(-0.568)	(0.109)
OtherEducation					-0.0154	0.0133				
					(-0.287)	(0.329)				
Revenue							0.122	0.110**		
							(1.478)	(2.054)		
TotalAssets									0.0879	0.0685*
									(1.299)	(1.678)
Constant	1.424	3.492***	1.468	3.441***	1.423	3.493***	1.091	3.112***	1.637	3.747***
	(1.390)	(4.356)	(1.425)	(4.260)	(1.381)	(4.365)	(0.773)	(3.319)	(1.312)	(4.360)
Observations	240	240	240	240	240	240	240	240	240	240
R-squared	0.130	0.101	0.130	0.101	0.130	0.101	0.110	0.078	0.107	0.072

Table 7 presents regression results from five different regression models. "Main Model" is the model presented in *4.5 Empirical Model*, while Model 1-4 are the alternative model specifications presented in *5.3 Robustness of the Results*. Reported significance for *Gender, BusinessEducation* and *MaritalStatus* is for one-tailed tests. T-statistics in parentheses. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.10$

First, because of regulations and demands from stakeholders on listed companies, MCS may need to fulfil certain requirements to meet these expectations; this could have effects on the use of the systems. However, we argue that listing on a stock exchange should be strongly related to the size of the company, which is included in our main model. Hence, we decided not to include a control variable for listing in Eq. 1a and 1b. To evaluate whether the results are robust when we control for this effect, we added the variable *Listed*, which is coded 1 if the company is listed on a stock exchange and 0 otherwise, to Eq. 1a and 1b. As shown in Table 7, the regression results when including *Listed* in Model 1 are similar to those in the main model. *Second*, since previous studies have found that total amount of education has effects on MCS (Reheul & Jorissen, 2014; Young et al., 2001), we wanted to ensure that the results hold when controlling for other types of education. Therefore, we add a measure for the number of years of education in other fields than business (*OtherEducation*). *Third*, in line with Holm and Ax (2020), we substitute *FirmSize* with the natural logarithms of net sales and total assets as size measures (*Revenue* and *TotalAssets*) since previous studies have used these as alternative proxies for size. Three of these four alternative regressions yield qualitatively similar results to those reported in *5.2 Hypothesis tests*. When substituting *FirmSize* with *Revenue* in Eq. 1a, *Gender* is not statistically significant ($p = 0.1005$). That the results are not robust to the use of *Revenue* as a proxy for size is a limitation of the results connected to gender differences. However, we argue that since interactive use of MCS concerns relationships and collaboration among organisational members (Simons, 1995), the most appropriate proxy for firm size in relation to interactive use of MCS is number of employees. Considering that the results only differ on one variable in one of the alternative models, we still believe that our results are robust to alternative model specifications.

6. Discussion and Conclusion

This study increases the understanding of the relationship between CFO characteristics and the use of MCS by drawing on previous findings in the field of upper echelons and management control. In addition, we draw on research in other fields such as leadership and behavioural studies to contribute to an increased understanding of how CFO characteristics affect MCS use. Taken together, our study substantiates the importance of managerial characteristics as we show that both gender and business education of the CFO has effects on the use of MCS.

As stated in the introduction, our aim is to extend the existing knowledge of how organisations use MCS. Given the empirical results presented in this thesis, it is now possible to state that CFO characteristics have effects on the use of MCS. More specifically, we find support for three of our five hypotheses; H1a, H2a and H2b are supported while we do not find support for H1b and H3. The results lend support to the findings from Bobe and Kober (2018), which suggest that female heads of schools use MCS more interactively. We extend their results as we find that female CFOs use MCS more interactively than male CFOs in support for H1a. Similar to Bobe and Kober (2018, 2020), we do not find support for less diagnostic use of MCS in firms with female CFOs, as hypothesised in H1b. We find support for H2a and H2b, which suggests that companies with CFOs with more years of business education use MCS more interactively and diagnostically. These findings enhance and complement the understanding of the effects of education from previous research (e.g. Reheul & Jorissen, 2014; Naranjo-Gil, 2006, 2007). The analysis did not identify any significant differences in the interactive use of MCS between CFOs who are married or in a domestic partnership and CFOs who are not. This means that we cannot support H3 and we are unable to confirm that results from behavioural studies focused on risk-taking (e.g. Roussanov & Savor, 2014; Hegde & Mishra, 2019) are transferable to and have the hypothesised effect on the use of MCS.

The additional tests conducted generally reinforce our results; we conducted tests for non-response bias, common method bias and tested the robustness with alternative regression model specifications. The tests indicate that common method bias and non-response bias do not introduce bias into the measurement of the effects. Overall, the alternative model specifications yield similar results, with one exception. Gender does not have a statistically significant effect on the interactive use of MCS in the model where total assets is used as a proxy for firm size. Despite this limitation, the results from our main regression model and the other alternative models suggest that female CFOs use MCS more interactively than male CFOs.

Our study makes four main contributions by adding to the growing body of literature which highlights the importance of managerial characteristics for organisational outcomes in the field of upper echelons theory. *First*, we contribute to this field by finding that CFO characteristics are associated with the use of MCS. Prior MCS research has investigated how CEOs (Naranjo-Gil & Hartmann, 2006, 2007) and other heads of organisations (Bobe & Kober, 2018, 2020)

affect the use of MCS. However, in spite of the findings which suggest that CFOs have greater impact on the design and use of MCS than CEOs (Burkert & Lueg, 2013; Hiebl, 2014), no previous studies have to our knowledge studied how CFO characteristics affect the use of MCS. *Second*, our findings contribute to an increased generalisability of previous findings which highlight the importance of managerial characteristics for the use of MCS. Previous studies have tended to focus on one industry rather than conducting cross-industrial studies (Naranjo-Gil & Hartmann, 2006, 2007; Bobe & Kober, 2018, 2020) and we respond to Bobe and Kober's (2018) call to conduct similar studies across industries. *Third*, we respond to calls from both Reheul and Jorissen (2014) and Bobe and Kober (2018) with the finding that an increased amount of business education has a positive effect on the use of MCS both interactively and diagnostically. Reheul and Jorissen (2014) encourages future researchers to focus on different types of education while Bobe and Kober (2018) calls for research on the level of education. To our knowledge, no previous studies have investigated the effects of additional years of business education. Furthermore, Naranjo-Gil and Hartmann (2006, 2007) study how experience in administrative and clinical functions affects the use of MCS. While they define experience as both educational and work experience, we have separated these by including the variables *BusinessEducation* and *ExpFin*. Interestingly, the coefficients on *BusinessEducation* and *ExpFin* have opposite signs in Eq. 1a and 1b. Hence, we believe that our method isolates the effect of business education by explicitly controlling for experience in finance functions. *Fourth*, we add to the literature with our finding that gender of the CFO has an effect on the use of MCS in an interactive manner. The relation between gender and MCS has to our knowledge only been studied in the university sector (Bobe & Kober, 2018, 2020) why we add to the knowledge about gender effects.

While we find support for H1a, H2a and H2b, there are some possible explanations for why we fail to support H1b and H3. Our results share similarities with Bobe and Kober (2018, 2020) as neither us, nor them can support that females use MCS less diagnostically than males. Bobe and Kober (2018) argue that an explanation for this could be that executives in top positions have reached this position by sharing several traits connected to their leadership style, which has effects on the use of MCS. It is further proposed that females who reach top positions share transactional leadership characteristics with their male counterparts (Bobe & Kober, 2018), which may explain why we do not observe any difference in the diagnostic use of MCS. The analysis did not reveal any significant differences in the interactive use of MCS based on marital status, which might have different explanations. One explanation could be that our sample mainly consists of CFOs who are married or in a domestic partnership, which makes it difficult to observe any significant differences in the use of MCS. Also, the cultural setting in Sweden could differ from other countries where studies have suggested differences in risk preferences (e.g. Roussanov & Savor, 2014; Hegde & Mishra, 2019). Hence, further research in other countries may find other results for the effects of marital status.

The present study has several implications for both research and practice. Our findings have further highlighted the importance of managerial characteristics for the use of MCS. We believe that our results increase the knowledge about the relation between CFO characteristics and the use of MCS. Based on this, we argue that there is room for researchers to further increase the understanding of this relation by accounting for other CFO characteristics and studying the use of MCS in other settings, for example across cultures. Overall, our findings and prior studies (e.g. Firk et al., 2019; Bobe & Kober, 2018, 2020) suggest that managerial characteristics have important effects on the design and use of MCS. We hope that our research will be helpful in increasing the attention to managerial characteristics and encourage further research in the field of MCS design and use.

The findings of our research also have considerable managerial implications. As we find that CFO characteristics such as gender and business education affect the use of MCS, our research could be a useful aid for decision-makers in recruitment processes and organisational processes. The evidence from this study suggests that the amount of business education is positively associated with both interactive and diagnostic use of MCS. A consequence of this is the possibility that if a company is using formal MCS less than they intend to, one explanation could be that the CFO does not have extensive education in business. The awareness of this possibility could help the company take balancing measures to increase the use of MCS if necessary. Similarly, our findings suggest that gender could help explain the interactive use of MCS. Furthermore, our findings highlight the importance of taking managerial characteristics such as gender and business education into consideration to achieve the desired outcomes when hiring CFOs.

Our study is subject to several limitations. We use data obtained from a survey instrument, which may introduce common method bias. One aspect of this is that the measurement of interactive and diagnostic use of MCS is based on perceptions of the respondents, which may introduce measurement bias into the results. However, our survey instrument was adopted from Bedford (2015) and the respondents were not aware of the concepts that were used to measure the use of MCS. Also, we gathered data from alternative sources when possible and these measures should mitigate the risk of common method bias. In addition to these procedural measures, the result from Harman's single-factor test indicates that common method bias is unlikely to be a concern. Another possible limitation is that the results may suffer from omitted variable bias. This would introduce a bias to the measurement of the effects if relevant variables are excluded in the regression models. One example of this could be that characteristics of other members of the TMT could affect the use of MCS, which we have not controlled for. However, since our empirical model is based on findings in the field of upper echelons and management control research, we argue that this is unlikely to be a major concern. Finally, the present study has only examined Swedish companies and therefore the results may be country

specific. Despite these limitations, we believe that our study generates considerable knowledge about the use of MCS.

Considering that we have not identified any prior studies with the specific focus on CFO characteristics and MCS use, numerous possible paths for future research exist of which we highlight four. *First*, further work should be done to establish whether there are other CFO characteristics than gender and business education which explain the use of MCS. For example, age and tenure have been found to affect the design of MCS (e.g. Naranjo-Gil et al., 2009; Hiebl, 2014) and future research could clarify if and how these characteristics affect the use of MCS. Bobe and Kober (2018) call for research on the effects of cultural backgrounds of managers and we argue that this need remains. *Second*, future research could extend our research and the findings from Bobe and Kober (2018, 2020) by studying how CFO characteristics affect the use of non-financial and financial performance measures in other industries than the university sector. *Third*, interview studies could be conducted to increase the understanding of the underlying drivers of the effects of managerial characteristics. For example, we build our hypotheses on studies of leadership styles and risk attitudes; future research could examine the connection between these and the use of MCS further. *Fourth*, future studies should aim at establishing whether our results hold across countries. Such studies could also examine whether the effects of managerial characteristics differ across countries, for example if marital status may have different effects across different cultures.

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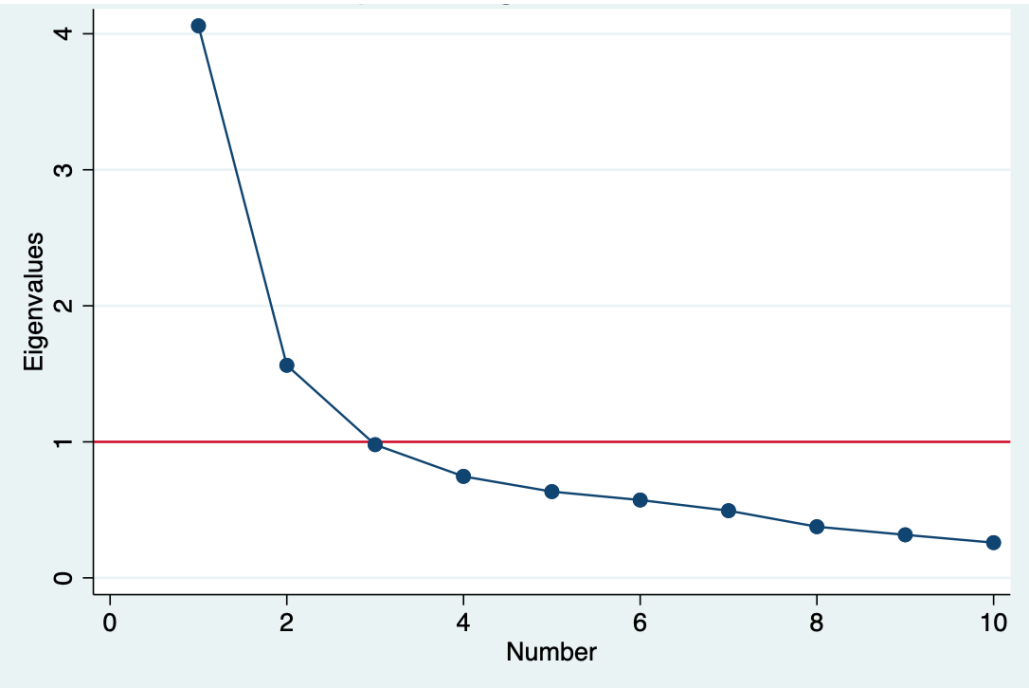
Appendix

Appendix A

Scree plot for eigenvalues in *4.4 Factor Analysis*



Appendix A presents eigenvalues for the factor analysis conducted in *4.4 Factor Analysis.*

Appendix B
Description of questionnaire

English	Swedish	Related to variable	Purpose
What company/group do you work as a CFO (or equivalent) for?	Vilket företag eller koncern jobbar du som CFO (eller liknande roll) för?	*FirmSize, Return, SalesGrowth, EquityRatio, FirmAge, Listed, Industry*	Connect the company to control variables
What is your title in the company/group?	Vilken är din formella befattning i företaget eller koncernen?		Control that the respondent has an intended title
How many years have you held your current position in the company/group?	Hur många år har du haft din nuvarande position i företaget eller koncernen?	*TenurePos*	Control variable
How many years have you worked for the company/ group in total?	Hur många år har du jobbat för ditt nuvarande företag eller koncern totalt?	*TenureFirm*	Control variable
To what extent does your top management team use Management Control Systems for the following purposes:	I vilken utsträckning använder er ledningsgrupp sig av ekonomistyrningssystem för följande syften:		
Provide a recurring and frequent agenda for top management activities	Tillhandahålla en återkommande och frekvent dagordning för ledningsgruppsaktiviteter	*Interactive*	Construct the measure for interactive use of MCS
Provide a recurring and frequent agenda for subordinate activities	Tillhandahålla en återkommande och frekvent agenda för anställdas aktiviteter	*Interactive*	Construct the measure for interactive use of MCS
Enable continual challenge and debate of underlying data, assumptions and action plans with subordinates and peers	Möjliggöra att underliggande data, antaganden och åtgärdsplaner ständigt ifrågasätts och debatteras med anställda och medarbetare	*Interactive*	Construct the measure for interactive use of MCS
Focus attention on strategic uncertainties (i.e. factors that may invalidate current strategy or provide opportunities for new strategic initiatives)	Rikta uppmärksamhet mot strategiska osäkerheter (dvs. faktorer som kan omkullkasta den nuvarande strategin eller skapa möjligheter för nya strategiska initiativ)	*Interactive*	Construct the measure for interactive use of MCS
Encourage and facilitate dialog and information sharing with subordinates	Uppmuntra och främja dialog och informationsdelning med anställda	*Interactive*	Construct the measure for interactive use of MCS
Identify critical performance variables (i.e. factors that indicate achievement of current strategy)	Identifiera KPIer	*Diagnostic*	Construct the measure for diagnostic use of MCS
Set targets for critical performance variables	Sätta mål för KPIer	*Diagnostic*	Construct the measure for diagnostic use of MCS
Monitor progress toward critical performance targets	Följa utvecklingen gällande uppsatta prestationsmål	*Diagnostic*	Construct the measure for diagnostic use of MCS
Provide information to correct deviations from pre-set performance targets	Tillhandahålla information för att korrigera avvikelser från uppsatta prestationsmål	*Diagnostic*	Construct the measure for diagnostic use of MCS
Review key areas of performance	Granska prestation inom viktiga områden	*Diagnostic*	Construct the measure for diagnostic use of MCS
What is your year of birth?	Vilket år är du född?	*Age*	Control variable
What is your gender?	Vilket är ditt kön?	*Gender*	Variable of interest
Are you married or in a domestic partnership?	Är du gift eller sambo?	*MaritalStatus*	Variable of interest
How many years of business education do you have at the university or equivalent type of education (University, Professional University, College)?	Hur många års universitetsutbildning eller liknande har du inom ekonomi? (Utbildning på universitet, högskola eller yrkeshögskola)	*BusinessEducation*	Variable of interest
How many years of education do you have at the university or equivalent type of education in total (University, Professional University, College)?	Hur många års universitetsutbildning eller liknande har du totalt? (Utbildning på universitet, högskola eller yrkeshögskola)	*OtherEducation*	Control variable
In your career, have you mainly worked within the finance function (Accounting, Business Control, Finance, etc.) or in operational positions?	Har du i din karriär i huvudsak jobbat inom ekonomifunktioner (redovisning, ekonomistyrning, finansiellt stöd, etc.) eller operationella funktioner?	*ExpFin*	Control variable

Appendix B presents the questions from the questionnaire and describes what variable they are connected to as well as their purpose.

Appendix C
Calculation and description of variables

Variable	Type of variable	Calculation
Interactive	Continuous	$\frac{Interactive\ 1 + Interactive\ 2 + Interactive\ 3 + Interactive\ 4 + Interactive\ 5}{5}$
Diagnostic	Continuous	$\frac{Diagnostic\ 1 + Diagnostic\ 2 + Diagnostic\ 3 + Diagnostic\ 4 + Diagnostic\ 5}{5}$
Gender	Dummy	1 if female, 0 otherwise
BusinessEducation	Continuous	Total number of years of business education at university (university, professional university or college)
MaritalStatus	Dummy	1 if married or in a domestic partnership, 0 otherwise
Age	Ordinal	$2020 - year\ of\ birth$
TenurePos	Discrete	Number of years on the current position as CFO or equivalent
TenureComp	Continuous	$Number\ of\ years\ in\ the\ company - TenurePos$
ExpFin	Dummy	1 if the respondent has mainly worked within the finance function, 0 otherwise
FirmSize	Continuous	ln $Number\ of\ employees$
Return	Continuous	$\frac{EBIT}{(Total\ assets\ year\ opening + Total\ assets\ year\ closing)/2}$
SalesGrowth	Continuous	$\left(\frac{Net\ sales_0}{Net\ sales_{0-4}}\right)^{1/4} - 1$, where 0 corresponds to the last full-year financial report
EquityRatio	Continuous	$\frac{Equity + Untaxed\ reserves * (1-t)}{TotalAssets}$, where t = 0.214
FirmAge	Dummy	1 if the registration date of the company is earlier than 20 years ago, 0 otherwise
Energy	Dummy	1 if the company is classified as an Energy company, 0 otherwise
Materials	Dummy	1 if the company is classified as a Materials company, 0 otherwise
ConsumerDiscretionary	Dummy	1 if the company is classified as a ConsumerDiscretionary company, 0 otherwise
ConsumerStaples	Dummy	1 if the company is classified as a ConsumerStaples company, 0 otherwise
HealthCare	Dummy	1 if the company is classified as a HealthCare company, 0 otherwise
Financials	Dummy	1 if the company is classified as a Financials company, 0 otherwise
InformationTechnology	Dummy	1 if the company is classified as an InformationTechnology company, 0 otherwise
CommunicationServices	Dummy	1 if the company is classified as a CommunicationServices company, 0 otherwise
Utilities	Dummy	1 if the company is classified as a Utilities company, 0 otherwise
*Industrials**	Dummy	1 if the company is classified as an Industrials company, 0 otherwise
Listed	Dummy	1 if the company is listed on a stock exchange or multilateral trading facility, 0 otherwise
OtherEducation	Continuous	$Total\ number\ of\ years\ of\ education - BusinessEducation$
Revenue	Continuous	ln $Net\ sales$
TotalAssets	Continuous	ln $Total\ assets$

Appendix C presents the variables and how they are measured and calculated. *Industrials is not included in the regression model since it is the industry benchmark.