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An exploratory study of the reciprocal relationship between interactive use of management control systems and perception of negative external crisis effects

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ABSTRACT

The use of management control systems (MCS) is shaped by perceptions of the environment. Next to this traditional view, some studies suggest that MCS use simultaneously shapes environmental perceptions. In other words, there is a reciprocal relationship between MCS use and environmental perceptions. We investigate this relationship in the 2008–2010 economic crisis. This study examines whether the perception of negative external crisis effects affects the interactive use of MCS on the organizational level. It also explores whether an interactive use of MCS during an economic crisis influences the perception of negative external crisis effects. The direction of causality is difficult to assess from cross-sectional data. Thus, we apply a cross-lagged panel design using data from two (time-lagged) surveys. The results show that perception of negative external crisis effects leads to more interactive use of MCS. Moreover, our findings support a positive effect of the interactive use of MCS on senior managers' perception of negative external crisis effects. Furthermore, we provide practitioner statements that illustrate the interactive use of MCS in times of economic crisis.

1. Introduction

A crisis is usually associated with a substantial threat to an organization (Weick, 1988), a lack of resources to respond to it (Khandwalla, 1978), little time for response (Hermann, 1963), a high degree of uncertainty (Pearson and Clair, 1998) and an ill-structured situation (Turner, 1976). Organizations encounter such challenges during crises like the worldwide economic downturn of 2008–2010 (Magnan and Markarian, 2011; Mangena et al., 2012; Van der Stede, 2011). The 2008–2010 economic crisis led to unexpected drops in demand within a few months, posing a threat to many organizations (Federal Statistical Office, 2011; Guillen, 2009; James et al., 2011; *The Economist*, February 19, 2009). Moreover, the extremely volatile business conditions also created an ill-structured and uncertain situation (Guillen, 2009; Muurlink et al., 2012; Parnell et al., 2012; Van der Stede, 2011; Zona, 2012). The crisis enveloped economies on a global scale and was not confined to a single industry or organization in contrast to, for instance, failed strategies, succession issues, shifts in technology or catastrophes (Grewal and Tansuhaj, 2001).

In the literature, external crises are typically defined by originating outside an organization – such as economic downturns, cash flow problems or political turmoil (James et al., 2011; Mitroff et al., 1988). The 2008–2010 economic crisis allows analysis of simultaneous responses to an external crisis for a large number of organizations.

Scarce knowledge exists on the changes that management control systems (MCS) undergo as a result of externally induced organizational crisis situations, particularly for economic crises (Collins et al., 1995; Ezzamel

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and Bourn, 1990; Hopwood, 2009).[1] In a qualitative study of a Swedish organization, Olofsson and Svalander (1975) find that the reporting of internal financial information broadens as a consequence of an external crisis associated with an economic downturn. Further, a single case study of a UK university facing threatening prospects caused by drops in external financing indicates that the use of the accounting information system (AIS) shifts from an "answering machine" to an "idea generating machine" in a crisis (Ezzamel and Bourn, 1990). Results of quantitative studies suggest that firms following a prospector strategy use their budgeting to a greater extent in times of perceived external crisis (Collins et al., 1997). Moreover, in young firms, the experience of externally caused cash flow crises is correlated with the introduction of cost management methods (Reid and Smith, 2000). Both of these quantitative studies consider potential reciprocal causal effects, hinting that the MCS may affect the perception of negative external crisis effects. Collins et al. (1997) find evidence of such a reciprocal relationship between crisis perceptions and strategy. Furthermore, using correlation analysis, Reid and Smith (2000) mention that their study design cannot determine whether implementing cost management methods followed a cash flow crisis or if it simply brought the crisis to light. Reciprocal relationships are similarly identified by Khandwalla (1978, p. 170): "In the absence of longitudinal data, the issue of whether crisis generates certain organizational responses or vice versa remains open and invites further research." Hence, on the one hand prior research provides evidence that organizations might change their MCS use in the wake of an external crisis and corresponding crisis perceptions (e.g. Ezzamel and Bourn, 1990). On the other hand, MCS use might have implications for the perception of negative external crisis effects (e.g. Collins et al., 1997; Reid and Smith, 2000).

We investigated this reciprocal role of MCS during the 2008–2010 economic crisis (Magnan and Markarian, 2011) by considering two questions:

(1) How does the perception of negative external crisis effects in terms of sales declines affect the interactive use of MCS on the organizational level?
(2) What are the consequences of interactively used MCS in terms of senior managers' perception of negative external crisis effects?

We chose the 2008–2010 economic crisis because it offers opportunities for research that are not present in times of "normal" change (Van der Stede, 2011). In addition, the interactive use of MCS is an important and frequently analyzed variable in management accounting research (e.g. Abernethy et al., 2010; Davila et al., 2009; Marginson, 2002; Mundy, 2010; Schäffer et al., forthcoming). The interactive use of MCS is recognized to foster organizational capabilities like market orientation, innovativeness, entrepreneurship and organizational learning (Henri, 2006; Widener, 2007). However, it is also associated with the cost of consuming managerial attention (Widener, 2007), and its importance is driven by crisis and by uncertain contexts (e.g. Simons, 1991; Widener, 2007). So far, quantitative studies have not analyzed the reciprocal effects between interactively used MCS and related variables (Luft and Shields, 2007). One potential explanation is that most management accounting survey studies are cross-sectional (Luft and Shields, 2007), whereas analysis of reciprocal causal relationships necessitates longitudinal study designs (Van der Stede et al., 2007). However, assuming merely unidirectional causal effects is often overly simplistic (Berry, 1984). Kober et al. (2007) support this view in their qualitative study describing a reciprocal relationship between interactively used MCS and strategy as a related variable.

To test the reciprocal role of interactively used MCS, we analyzed panel data from two time-lagged surveys, an approach that allowed estimating cross-lagged effect models (CLEM). These models provide simultaneous tests of reciprocal causal relations (Zapf et al., 1996). Thus, they compensate for some of the drawbacks of cross-sectional studies which cannot demonstrate cause-and-effect relationships (Khandwalla, 1978; Widener, 2007).

The contributions of this study are threefold. First, our quantitative analysis supports anecdotal evidence from prior research on a time-delayed increase in interactive use of MCS in times of externally induced crises. Thus, the limited knowledge about the change of MCS in organizations facing an economic crisis is expanded. We can answer Hopwood's (2009) question of whether uniform patterns of MCS change can be observed in such times. Second, by applying CLEM we simultaneously test a reciprocal relationship between interactively used MCS and perceptions of the environment; in this case, the perception of negative external crisis effects. Our findings provide support for a causal effect of interactively used MCS on the perception of negative external crisis effects. Hence, MCS use is not only shaped by perceptions of the environment, but it also shapes environmental perceptions. Many studies hold the traditional view that environmental perceptions are given; however, several other studies indicate that this view is too limited (Collins et al., 1997; Reid and Smith, 2000). Our results support the idea that the perceived environment is shaped by human actions and cognitive efforts to make sense of the available information (Smircich and Stubbart, 1985). Moreover, this finding underlines the risk inherent in drawing conclusions about causal directions from cross-sectional data. Third, this study is a response to calls for longitudinal research in quantitative management studies (e.g. Pierce and Aguinis, 2013; Ployhart and Vandenberg, 2010; Van der Stede et al., 2007). To the best of our knowledge, CLEM represent a new method for survey panel data analysis in management accounting research, and this method enables stronger causal interference (Zapf et al., 1996).

The remainder of this paper is organized as follows. In the next section we present the theory and derive our hypotheses. Section 3 gives an overview of the study design and the methodology. Our study's results are shown and

[1] MCS are formalized procedures and systems that use information to maintain or change patterns in an organizational activity (Henri, 2006; Tuomela, 2005) and which are used by managers and other organizational participants (Bisbe and Otley, 2004).

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discussed in Sections 4 and 5. The final section offers conclusions.

2. Theory and hypotheses

2.1. Perception of negative external crisis effects influences the interactive use of MCS

As suggested by the contingency framework, environmental variables influence decisions on the design and use of MCS (Burkert et al., 2014; Chenhall, 2003). One type of environmental variable is uncertainty (Widener, 2007), which is the discrepancy between the amount of information necessary to perform a task and the amount already possessed (Chapman, 1998; Galbraith, 1974). The necessary amount of information is a function of the desired performance level or the difficulty of achieving the goal (Galbraith, 1973). The quantity of available information depends on an organization's prior experience with, for instance, certain customers, products and technologies (Galbraith, 1973).

Due to extremely volatile business conditions, the 2008–2010 economic crisis created a high uncertainty situation. Its main characteristic was a sudden decline in demand which led to a severe drop in sales (Federal Statistical Office, 2011; *The Economist*, February 19, 2009). Senior managers' perception of negative external crisis effects due to sales declines can be considered a proxy for the degree of uncertainty organizations were facing at this time.[2] The uncertainty stems from two factors. First, a perceived decline in available financial resources due to strong sales declines increases the level of performance required of managers when making decisions. They must carefully decide how and where to invest scarce resources (Lin et al., 2006). Thus, the amount of information necessary for task performance rises (Galbraith, 1973). However, the second factor is that the amount of information possessed decreases. For example, management loses the ability to predict customer wishes or order volumes based on past experiences.

According to Galbraith's organizational information processing theory, uncertainty determines the level of information processing that an organization needs to perform a task (Galbraith, 1973). If there is little uncertainty, all of the information necessary for task performance is presumably available before it begins; thus, tasks can be preplanned. In highly uncertain situations, however, tasks presumably cannot be preplanned because most of the necessary information has to be acquired and processed while the task is being done. Thus, the need for information processing is higher when there is greater uncertainty.

High information processing needs result in adaptation of procedures to enhance processing capacity. The main assumption of the organizational information processing theory is that only a limited amount of information can be processed via an organization's standard information channels (Galbraith, 1974). Such channels include hierarchy of authority, rules and procedures as well as planning and goal setting (Galbraith, 1973). If uncertainty is high, these channels are overtaxed (Widener, 2007). Therefore, other strategies are needed to handle the increased demand for information processing. Galbraith (1974) suggests different strategies either to reduce the information processing demand or to increase the organization's information processing capacity. Strategies to augment the information processing capability between senior managers and subordinates as well as among senior managers entail the application of vertical information systems and lateral relations.

An interactive use of MCS facilitates increased information flows because it tears down hierarchical and functional obstacles (Abernethy and Brownell, 1999; Henri, 2006). Via interactively used MCS, senior managers regularly and personally participate in subordinates' decisions (Simons, 1987, 2000), which allows them to challenge and debate data, assumptions and action plans (Simons, 1987, 1995, 2000). The purpose of an interactive use of MCS is to stimulate dialog and organizational learning (Simons, 1987, 1995). It also fuels a creative search for new initiatives (Simons, 2000) to cope with possible opportunities and risks (Simons, 1995). Interactive MCS encompass both present and future time frames, thus leading to reestimation of targets (Simons, 1995). Moreover, by using MCS interactively, senior managers aim to motivate subordinates (Simons, 1995), ensure that system-generated data compose an important and recurring agenda item in discussions with them (Simons, 1995, 2000), and ensure that subordinates and peers throughout the organization regularly focus attention on the system (Simons, 1995, 2000). Widener (2007, p. 764) calls this use "similar" to that of vertical information systems, which collect information at the point of origin and direct it to the appropriate places in the hierarchy (Galbraith, 1973). Thus, these systems create links between members of different hierarchical levels (Widener, 2007). Similarly, an interactive use of MCS means that senior managers apply formal MCS to engage in their subordinates' decision activities (Simons, 2000). Interactive MCS have also been associated with lateral relations because they span cross-functional liaisons (Abernethy and Brownell, 1999). Hence, in addition to exchanges among levels of the hierarchy, this use leads to continual exchange among senior managers, lower level managers and other organizational members (Bisbe and Otley, 2004; Tani, 1995).

This reasoning suggests that the use of interactive MCS represents a way to cope with the increased demand for information processing during an externally induced economic crisis. In other words, the stronger an organization's senior managers perceive negative external crisis effects to be, the more interactively the MCS are used. Two case studies provide anecdotal evidence in support of these arguments. Simons' (1991) field study shows that senior managers tend to use multiple or all MCS interactively during periods of crisis; however, Simons does not mention external crises. Nevertheless, his findings are of value for the current study since the examined organizations faced great uncertainty when undergoing revolutionary changes

[2] Perception is understood as a result of information processing, or an outcome of "comprehension, encoding, storage and retention, information retrieval, and judgment" (Lord, 1985, p. 87).

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threatening their survival (Simons, 1991). Ezzamel and Bourn (1990) provide more evidence for interactive use of MCS in an organization facing an external crisis. They find that a university experiencing a crisis caused by cuts in external funding first uses its AIS as a dialog and then later as an idea machine in the rescue and salvage phase of the crisis.[3]

As indicated by Ezzamel and Bourn (1990), MCS are not necessarily used more interactively as an immediate response to an external crisis; there is a delay. A time-lag between the onset of a crisis and the interactive use of MCS is also stressed in the conceptual crisis frameworks of Fink et al. (1971) and Milburn et al. (1983). In both frameworks, the impetus for adaptation only builds in later stages of a crisis or in the middle and long term. In the later stages of a crisis, communication is guided by a search for understanding; leadership and decision making become more participative, regardless of an individual's status; problems are explored; and intergroup relations improve (Fink et al., 1971). Milburn et al. (1983) state that in the intermediate and long term, assumptions and goals are changed, management information is augmented and the number of staff advising senior management increases. In contrast to these time-lagged adaptations, the first phases or short-term responses to crises are shaped by, among other factors, less communication, the search for mechanistic responses and stronger centralization of decision making (Fink et al., 1971; Milburn et al., 1983). Hence, the features which are characteristic of an interactive use – search for understanding, exploration of problems, participative decision making and intergroup relations – occur only after some time has passed.

Based on Galbraith's organizational information processing theory, the anecdotal evidence of the two case studies and the extant crisis frameworks, the following hypothesis is tested:

H1. There is a positive time-lagged effect of perception of negative external crisis effects on the interactive use of MCS.

2.2. Interactive use of MCS influences the perception of negative external crisis effects

MCS are not only influenced by senior managers' perceptions. They can also affect perceptions of the organizational environment (Gray, 1990; Smircich and Stubbart, 1985; Weick, 1969), an idea that some quantitative management accounting studies support. For example, Reid and Smith (2000) acknowledge that their study design cannot distinguish whether the implementation of cost management methods followed an externally caused cash flow crises or simply exposed it. Hence, they consider the perception of negative external crisis effects as a possible result of the MCS use. Hall's (2008) results support the idea that MCS, and performance measurement systems in particular, can influence managers' cognition. Findings from the information system literature also support an effect of MCS use on senior managers' perceptions. Vandenbosch and Higgins (1995, 1996) show that executive support systems (ESS) are capable of changing senior managers' mental models, which are "all forms of mental representation(s)" (Vandenbosch and Higgins, 1995, p. 104). ESS can provide information and analysis capability to support senior managers' decision making, and Vandenbosch and Higgins (1995, 1996) provide quantitative evidence that the way ESS are used facilitates senior managers' learning in terms of augmenting mental models and building new mental models.

We suggest that MCS which are used interactively by senior managers show characteristics similar to ESS and can shape senior managers' perceptions. Senior managers use both types of systems. Moreover, interactive MCS are used as learning tools, to challenge new ideas and ways of doing tasks and to encourage the creation of new goals and priorities. Thus, like ESS they are used to gather information and to support decision making. Therefore, based on these findings, we argue that interactively used MCS shape mental models – that is, the perceptions of senior managers.

To shape senior managers' crisis perceptions, we must assume that an interactive use of MCS deals with the organizational consequences of the 2008–2010 economic downturn. There are two reasons supporting this assumption. First, Kiesler and Sproull (1982) argue that due to limited information-processing capacities, people attend events that are deviant, intense, sudden and unusual. In organizations, an example of such an event would be unanticipated drops in cash flow (Kiesler and Sproull, 1982) as occurred in the 2008–2010 economic crisis. Hence, senior managers might use MCS to learn about the consequences of the 2008–2010 crisis for their organizations and to design measures to counter this threat. Second, Simons (2000) states that interactively used MCS draw attention to emerging threats which are caused by unexpected changes. Given the strong and threatening impact of the 2008–2010 economic crisis, in organizations which used their MCS interactively as the economic crisis began, the organizational consequences were likely to have been at the focus of the interactive use. Consequently, the related debates and discussions might have influenced the crisis perceptions of senior management.

An attendant question is how the perceptions were influenced. The use of MCS might convey the impression that appropriate measures to resolve the crisis are being taken (Weick, 1988). This impression probably lessens the extent to which the organization is perceived to be threatened; consequently, the perception of negative effects from the external crisis declines. However, there are several reasons which predict that an interactive use augments the perception of negative effects from an external crisis. First, only when MCS are used interactively might senior

[3] If the AIS operates as a "dialog machine", it provides relevant information processing which encompasses information centers and consultative processes. The AIS as an "idea machine" refers to it providing multiple streams of thought and experience sharing to encourage creativity (Ezzamel and Bourn, 1990). As an idea machine, the AIS promotes problem sharing and encourages constructive dialog (Burchell et al., 1980). The operations as dialog and idea machines both include characteristics which are similar to those of interactively used MCS (Abernethy and Brownell, 1999; Hartmann and Maas, 2011). This is why we consider these operational modes as similar to an interactive use.

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managers become aware of all the ways in which the economic crisis threatens the organization and of all the issues it poses to the organization (Barnes, 1984; Weick, 1988). Further, the positive correlation between the introduction of cost management methods and externally caused cash flow crises suggests that management only becomes aware of the external crises because of the introduction of cost management methods (Reid and Smith, 2000). Second, cognition research argues that individuals construct reality by performing cognitive operations on evidence derived from the environment (Kiesler and Sproull, 1982). The concept of automatic scanning suggests that individuals consciously or unconsciously assign information to cognitive categories (Bargh and Pietromonaco, 1982; Higgins et al., 1977). The more frequently a category is activated, the more accessible it becomes, requiring decreasing amounts of stimulus energy to detect congruent information. The effect of automatically scanned information influencing perceptions is best illustrated by Bargh and Pietromonaco (1982). In the first step of their experiment, each test subject was shown a list of 100 words with hostile, positive or neutral connotations, with the proportion of hostile words varying between subjects (0%, 20% and 80%). In a second step, the test subjects had to assess the behavior of a person described in a 12-sentence paragraph that was ambiguous with regard to the trait of hostility. The results of the experiment showed that subjects exposed to more hostile words consistently rated the person's behavior as being more negative. In an organizational context, a more interactive use suggests that senior managers might more intensely debate the threats posed to their organization by the economic crisis (cf. arguments above), and this debate would activate their crisis threat category. Therefore, when asked about negative crisis consequences afterwards, their cognition would reflect a stronger perception of negative external crisis effects. Taken together, this reasoning supports the view that interactive MCS use increases the perception of negative external crisis effects.

An interactive use of MCS can immediately augment the extent to which negative external crisis effects are perceived. However, it might also take some time for the interactive use to have an impact on senior managers' crisis perceptions.[4] Therefore, the time aspect is not considered in our second hypothesis:

H2. An interactive use of MCS has a positive effect on the perception of negative external crisis effects.

3. Study design and method

3.1. Data source and sample construction

To test these hypotheses, we used data from the WHU Controller Panel which was founded in 2007. The panel's goals are to identify the best practices and benchmarks in management accounting and to support research in this area. Therefore, each year in spring, summer and fall, surveys are sent out to the panel population. These surveys are designed and administered online, and they consist of questions concerning the company (e.g. number of employees and industry) and the respondent (e.g. his or her position in the company). Moreover, each survey has a focus theme or themes (e.g. budgeting, reporting or cost accounting). The surveys also encompass scientific variable measures such as the ones used in this study (cf. Section 3.2). In order to administer the surveys, all measures are translated into German.

In 2007, the initial panel population was compiled from a random sampling of organizations from the Hoppenstedt database, which contains data from approximately 29,000 medium to large companies in Germany, Austria and Switzerland. From 2007 to 2010 the panel population increased through the acquisition of new members. For instance, all members of the International Controller Association received periodic invitations to join the panel (comparable to the respondents of the study by Maas and Matějka, 2009). Starting with a population of 672 in 2007, the number of panel members grew to 722 by spring 2009 and to 850 members by fall 2010. The majority of the panel members are heads of controlling.[5] Panel members work for companies of various sizes, ranging from small and medium enterprises to strategic business units of listed companies. Since each panel member is assigned an identification number, we are able to match each respondent's answers across different studies.

The data used for our study were gathered in two surveys sent out to all panel members. The first point of measurement was in spring 2009, which was when the financial crisis had expanded to an economic crisis (Zoellick, 2009 as cited in Giles and Barber, 2009). In June 2009, the World Bank projected that the global trade for 2009 would fall by 10%, an "unprecedented decline" (World Bank, 2009). The spillover of the financial crisis to the real economy was also indicated by severe drops in sales levels from the end of 2008 to the beginning of 2009 (Federal Statistical Office, 2011). The second point of measurement was in fall 2010, by which time the global economic crisis had recently passed its peak as indicated by sales levels (Federal Statistical Office, 2011). The 18-month time lag was long enough to allow intraorganizational changes in the interactive use of MCS. Hence, the timing of the data collections was adequate for our research questions and in line with the recommendations of Cohen et al. (2003) who emphasize that the period between the data collection has to be long enough to allow the "causal influences to take effect" (p. 477).[6]

Participation of 361 respondents in the spring 2009 survey yielded a response rate of 50%, while participation of 277 respondents in fall 2010 gave a response rate of 33%. Combining both surveys resulted in a sample of 447 cases which included missing values. First, only 191 of the 361

[4] We will test both possibilities in the latter specified model.

[5] For explanations regarding German Controlling vs. management accounting see Ahrens and Chapman (2000), Becker and Messner (2005), Goretzki et al. (2013) and Messner et al. (2008).

[6] If the time lag is too short or too long, this will lead to an underestimation of the true causal impact or even to the conclusion that there is no effect (Zapf et al., 1996). However, given that we find significant results, this does not seem to be an issue for our study.

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respondents in spring 2009 also participated in fall 2010. Hence, the other 170 cases from the spring 2009 survey showed missing values for the fall 2010 survey. Second, the inclusion of the respondents of the fall 2010 study introduced 86 cases with missing values in spring 2009.

Missing data are commonplace in longitudinal settings (Bollen and Curran, 2006). Raykov (2005) notes, "In view of recent advances in statistical methods for dealing with missing data, earlier ad hoc approaches such as listwise and pairwise deletion cannot in general be recommended due to loss in efficiency as well as possible estimator bias and distortion of variable interrelations" (p. 494). Instead, the psychometric literature recommends using the direct maximum likelihood (also called the full information maximum likelihood) method (Arbuckle, 1996; Bollen and Curran, 2006; Raykov, 2005; Schafer and Graham, 2002). This method uses all available information (but does not impute values, see Bollen and Curran, 2006). We followed these suggestions and used the direct maximum likelihood method for our main analyses. The resulting covariance coverage of our data ranged from 44% to 83% and thus was higher than the minimum default value of 10% set in MPlus (Muthén and Muthén, 1998–2012). In an alternative specification, we also applied the traditional approach of listwise deletion and found that our results were robust (see Section 4.4 for details).

The final sample used to test the hypotheses consisted of only 332 cases, for two reasons. First, nine respondents participated in both studies, but did not answer any questions about key variables, such as interactive use of MCS or perception of negative external crisis effects; these respondents were excluded. Second, since employees lower in a hierarchy might not be able to judge the use of MCS in an organization, 106 cases in which the respondent was two levels or more below the CFO were excluded as well.[7] The characteristics of the final sample are displayed in Table 1.

Table 1
Respondents by role, company size and industry.

Characteristics of sample	Final sample	
	N	%
Panel A: Respondent profile		
Role		
CEO/Head of operations	38	11.4
CFO/Head of finance	128	38.6
Head of controlling and other financial executives	166	50.0
Panel B: Company size		
Number of employees		
0–200	71	21.4
201–500	99	29.8
501–2000	90	27.1
2001+	71	21.4
n/a	1	0.3
Panel C: Industry		
Category		
Automotive	17	5.1
Metals	21	6.4
Consumer goods	16	4.8
Chemicals and plastics	17	5.2
Electrical engineering	23	6.9
Mechanical engineering	29	8.7
Financial services	24	7.3
Other services	53	16.0
Construction	8	2.5
Media/information technology	25	7.5
Transportation and logistics	18	5.4
Other	81	24.2
Total	**332**	**100**

3.2. Variable measurement

We derived a self-developed four-item construct to reflect the perception of negative effects of an external crisis. These indicators were included in the spring 2009 and fall 2010 surveys. One item addressed the impact of the perceived crisis on the respondent's company. The other items focused on more specific aspects such as perceived negative repercussions of the crisis on sales, orders and customer payment behavior. We stressed sales-related crisis perceptions with these three indicators since the defining feature of the crisis was decreased demand causing severe drops in organizational sales (Correa and Iootty, 2010; Federal Statistical Office, 2011; *The Economist*, February 19, 2009).[8] All items used a 7-point Likert scale ranging from "not at all" to "to great extent." These items captured two characteristics of an external economic crisis. First, the extent to which current and future sales were perceived to decline reflects the threat which the crisis posed to the organization. Second, as previously explained, the degree of perceived sales drops represented the uncertainty which senior management was facing.

Both surveys measured interactive use of MCS by using a reflective construct adapted from Naranjo-Gil and Hartmann (2006, 2007) that asks for the overall use of MCS, not the use of a specific MCS. Simons (1991) observed that several MCS are used interactively in times of crisis. Hence, rather than describing the degree of interactive use of a specific MCS, the current study investigated the degree to which interactivity was present, regardless of the specific MCS being used. The construct encompassed six items, including the extent to which MCS were used to set and negotiate goals and targets, encourage new goals and priorities, signal key strategic areas, challenge new ideas and

[7] CEOs and CFOs are part of the top management team. Heads of controlling might be part of the top management team. We consider top management team members or heads of controlling to be able to respond to questions regarding the use of MCS since they are either the organizational members deciding how they use MCS or they are organizational members responsible for the MCS. In contrast management accountants might not be able to assess the overall use of MCS. Furthermore, we believe that crisis perceptions of those respondents who are not part of the top management team, but are heads of controlling, can be seen as a proxy for the perceptions of the top management team since they are in close contact with the top management team under uncertain conditions (Chapman, 1998) and are highly aware of problems like a sales crisis due to their managerial position in the finance function. Thus, with senior managers we refer to CEOs, CFOs and heads of controlling.

[8] The overall crisis impact item is conceptually on a higher level than the rest of the crisis items. All four items were retained because based on the statement that the predominant feature of this crisis were the sales and customer related problems, all four items reflect the crisis importance as perceived by the respondents.

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ways of doing things, permanently involve subordinates and learn. A 5-point Likert scale ranging from "not at all" to "to great extent" was applied to measure these items. Two items – the extent to which MCS were used to permanently involve subordinates and to set and negotiate goals – had to be dropped from the construct since their inclusion resulted in insufficient reliability, fit and validity statistics (results not shown). Nevertheless, the applied items still captured the main characteristics mentioned in Simons' studies. We note that the construct of Naranjo-Gil and Hartmann (2006, 2007) is not the only operationalization of interactive use in the accounting literature (cp. Henri, 2006; Widener, 2007). Moreover, Bisbe et al. (2007) provide an in-depth discussion of the dimensions of interactive use. Naranjo-Gil and Hartmann (2006, 2007) as well as Bisbe et al. (2007) draw on the works of Simons (1987, 1995, 2000). To facilitate a clearer understanding of whether the measures capture the same underlying concepts, we briefly outline how the five features described by Bisbe et al. (2007) are related to the items from Naranjo-Gil and Hartmann (2006, 2007):

(1) Intensive use by senior managers: This feature was indirectly captured by our application of the Naranjo-Gil and Hartmann (2007) construct, because we asked senior managers about the extent to which the MCS is used.
(2) Intensive use by operating managers: Naranjo-Gil and Hartmann (2007) do not capture this item directly with their measure. However, if senior management uses an MCS interactively and is thus involved in the decision making of subordinates, we can assume that operating managers are obliged to pay attention to and to use this system (Abernethy and Brownell, 1999).
(3) Senior managers and operating managers have to meet in order to challenge and debate assumptions and action plans: This feature was indirectly captured by the three items of Naranjo-Gil and Hartmann (2007) asking about the extent to which MCS are used to challenge new ideas and ways of doing tasks, encourage new goals and priorities and serve as a learning tool. The challenging aspect was measured directly by the first item. If MCS are used for the three purposes, debates are also highly likely.
(4) MCS have to focus on strategic uncertainties: Naranjo-Gil and Hartmann (2007) partially capture this aspect by the item "MCS are used to signal key strategic areas" and by the other three items – MCS use to challenge new ideas and ways of doing tasks, encourage new goals and priorities and serve as a learning tool – all of which are forward looking.
(5) MCS have to encourage, facilitate and inspire: The encouragement was reflected by the item "encourage new goals and priorities" and the inspiration by the item "learning tool".

We used several control variables in this study. As already mentioned, the economic crisis represented a high uncertainty situation related to severe drops in sales. However, the uncertainty facing an organization and its senior managers can stem from other factors such as the unpredictability of the technological environment. To control for effects of a generally more uncertain environment – apart from the uncertainty caused by the perceived negative effects of the external crisis due to sales declines – we used items from the operationalization of the uncertainty construct introduced by Gordon and Narayanan (1984). This construct originally comprised ten items and was measured by a 7-point Likert scale in the second survey in fall 2010. Based on the results of a confirmatory factor analysis as well as theoretical considerations about which items capture uncertainty that was unrelated to the economic crisis, we applied a 4-item construct in the later specified model.[9] These items encompassed the intensity of competition for manpower, the unpredictability of the technological environment, the amount of new products and services marketed in the past five years and the frequency of new scientific discoveries in the industry. Conceptually, we did not expect these items to be related to the perceived crisis effects of the 2008–2010 economic crisis. To test this assumption, we calculated the correlations of these four items with the perception of negative external crisis effects, and no significant relationships were found. Thus, our proposition to control for different sources of uncertainty with this variable was supported. The limited availability of the construct items – only in fall 2010 – was not a drawback because Little et al. (2007) suggest controlling for covariate effects in CLEM at the final occasion of measurement.

Moreover, we controlled for the effect of company size by using the natural logarithm of the number of employees. In general, large firms show a greater degree of inertia (Greve, 2010). Hence, size might influence the extent to which we observed a change in the interactive use of MCS.

Competitive strategy is an important factor for MCS design and use (e.g. Langfield-Smith, 1997, 2007). This control variable was measured in fall 2010 following Porter's classification (Porter, 1980). A single-item, 7-point Likert scale as in Govindarajan (1988), ranging from "cost-leadership" to "differentiation", was applied for this instrument.

Design and use of MCS vary over the lifecycle of companies (Davila and Foster, 2007; Moores and Yuen, 2001). Thus, we added company lifecycle as a covariate. Panel members were asked to assess the lifecycle stage (e.g. foundation/birth, growth) on a 5-point Likert scale in fall 2010. Higher values on this scale equal more mature companies.

Furthermore, the applied CLEM controls for all constant background variables (cf. Section 3.3). The survey questions for the different variables are presented in Appendix A, and Table 2 provides an overview of the characteristics of the survey items used.

[9] In an untabulated robustness check, we used the average of the 10 items as a control variable for perceived environmental uncertainty. The results using this variable for the later specified models do not significantly defer from the results which we encounter for the model controlling for perceived environmental uncertainty measured as a 4-item construct.

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Table 2
Item characteristics (number of responses, mean, standard deviation, minimum, maximum).

	N[a]	Mean	SD	Min	Max
Crisis perception (spring 2009)					
To what extent is your company impacted by the current economic crisis?	271	4.36	1.58	1	7
Have orders declined?	269	4.27	1.98	1	7
Have sales declined?	269	4.09	1.94	1	7
Have customers increasingly failed to pay?	270	3.68	1.59	1	7
Crisis perception (fall 2010)					
To what extent is your company impacted by the current economic crisis?	207	3.56	1.67	1	7
Have orders declined?	205	3.44	2.01	1	7
Have sales declined?	205	3.57	2.00	1	7
Have customers increasingly failed to pay?	207	3.40	1.60	1	7
Interactive use of MCS (spring 2009)					
Set and negotiate goals and targets	273	3.41	1.03	1	5
Encourage new goals and priorities	274	3.51	0.84	1	5
Signaling key strategic areas	273	3.25	1.01	1	5
Challenge new ideas and ways for doing tasks	272	3.50	0.83	1	5
Permanently involve subordinates (e.g. by discussion)	272	3.11	0.95	1	5
Learning tool	274	2.72	0.90	1	5
Interactive use of MCS (fall 2010)					
Set and negotiate goals and targets	205	3.09	1.07	1	5
Encourage new goals and priorities	207	3.36	1.01	1	5
Signaling key strategic areas	206	3.27	1.06	1	5
Challenge new ideas and ways for doing tasks	205	3.30	0.97	1	5
Permanently involve subordinates (e.g. by discussion)	207	2.90	1.03	1	5
Learning tool	206	2.52	0.98	1	5
Perceived environmental uncertainty (fall 2010)					
Bidding for products or raw material	206	3.65	1.89	1	7
Competing for manpower	206	4.70	1.40	1	7
Price competition	206	5.37	1.37	1	7
Economic environment	208	4.16	1.56	1	7
Technological environment	207	4.05	1.60	1	7
Predictability of market competitors' activities	205	4.06	1.20	1	7
Predictability of customers' preferences	208	4.67	1.15	2	7
Products/services marketed in industry	204	4.44	1.60	1	7
Political and economic constraints	206	4.84	1.49	1	7
Scientific discoveries	205	3.80	1.61	1	7
Single item controls					
Size (natural logarithm of employee number)	206	6.49	1.60	2.48	11.51
Strategy	207	5.20	1.42	1	7
Lifecycle	208	3.12	0.91	2	5

SD: standard deviation; Min: minimum; Max: maximum
[a] The difference between 332 cases in the final sample and the number of cases for each item presented in this table results from missing values.

3.3. Cross-lagged effect models

Cross-lagged effect models were applied to test the suggested hypotheses. These longitudinal design models have several benefits over cross-sectional study designs. First, they control for initial levels of outcome variables (Hellgren and Sverke, 2003; Zapf et al., 1996). Second, they directly contrast the direction of causality among variables (Hellgren and Sverke, 2003). Third, they test the effect of a variable on the change in a second variable (Finkel, 1995). Fourth, CLEM rule out that constant background variables such as gender, functional background or industry influence the cross-lagged effect estimates (Lang et al., 2011; Zapf et al., 1996).

A CLEM for the available setting (shown in Fig. 1) included four types of relationships: the correlation between the two factors in spring 2009 (predictor correlation), the stability of the crisis perception and interactive use constructs across time (autoregressive effects), two cross-lagged effects and the correlation between the disturbance terms of the two latent variables in fall 2010 (disturbance correlation) (Lang et al., 2011). Error terms for the latent variable indicators are allowed to correlate in CLEM (Bollen, 1989; Hellgren and Sverke, 2003; Little et al., 2007). Based on recommendations in the literature (Finkel, 1995; Lang et al., 2011; Little et al., 2007; Zapf et al., 1996) we applied structural equation modeling techniques to analyze the cross-lagged panel design. All analyses were conducted using MPlus (Version 6).

Drawing conclusions from CLEM focuses on the interpretation of cross-lagged effects (Lang et al., 2011). For example, the impact of the perception of negative external crisis effects in spring 2009 on interactive use of MCS in fall 2010 represents the perceived crisis effect on the change in interactive use of MCS over time. Similarly, the impact of the interactive use of MCS in spring 2009 on the perception of negative external crisis effects in 2010 indicates an effect of interactively used MCS on the change in the crisis perception (Finkel, 1995).

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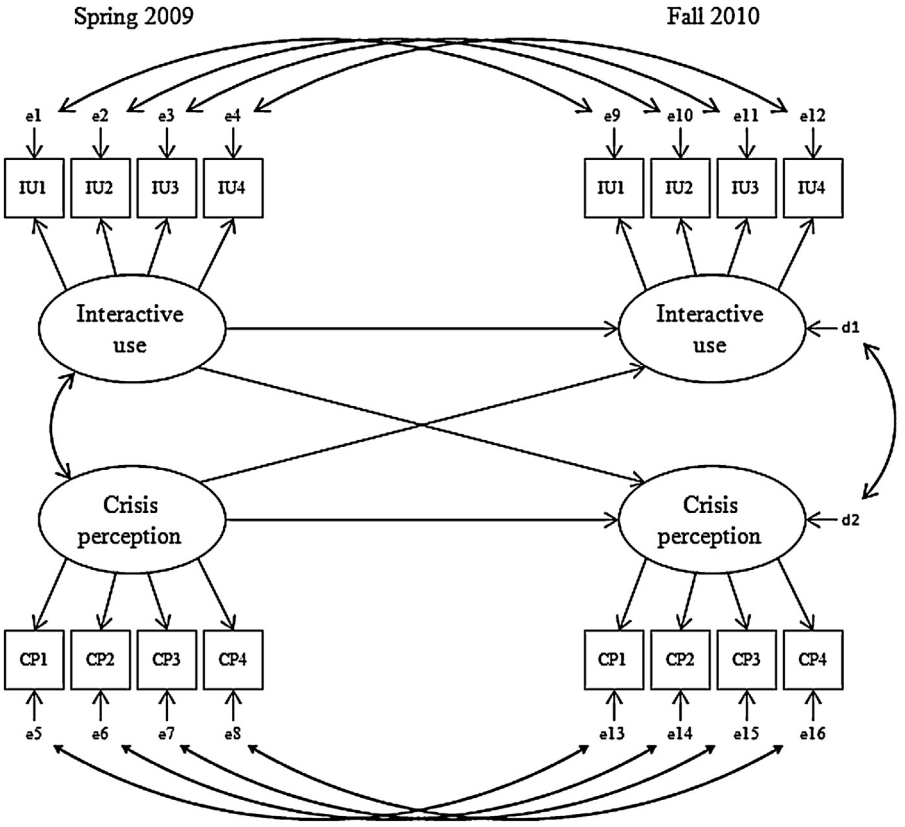

Fig. 1. Cross-lagged structural equation model. IU1, IU2, IU3 and IU4 = items of the interactive use of MCS construct; CP1, CP2, CP3 and CP4 = items of the perception of negative external crisis effects construct; e1–e16 = error variances of the items; d1 = error disturbance for interactive use construct in fall 2010; d2 = error disturbance for the crisis perception construct in fall 2010.

The prerequisite for the application of CLEM is measurement invariance of the examined constructs (Finkel, 1995). Configural (or form invariance) and metric invariance (or loading invariance) are considered to be requirements for the analysis of CLEM.[10] Configural invariance means that the pattern of indicator-to-construct relations is the same at each measurement occasion (Little et al., 2007; Steenkamp and Baumgartner, 1998). Metric invariance indicates that the relationship between the latent variables and the items remains constant over time (Steenkamp and Baumgartner, 1998), and it is tested by constraining the factor loadings of like indicators to be equal over time (Vandenberg and Lance, 2000). Hence, the following analysis included assessments of measurement invariance.

4. Results

4.1. Measurement models

Before the assessment of the CLEM estimates, the quality of the measurement models of the latent variables has to be evaluated (Anderson and Gerbing, 1988). To validate the measurement models of the constructs, reliability, fit and validity tests were undertaken. Reliability and fit statistics of the measurement models are displayed in Table 3. Validity statistics as well as correlations are shown in Table 4.

With Cronbach's alphas ranging from .65 to .88 and composite reliability values ranging from .69 to .91, all latent variables showed sufficient reliability statistics (Bagozzi and Yi, 1988). Indicator reliability was deemed acceptable with all indicator loadings being significant at the $p < .001$ level.[11] Confirmatory factor analyses showed that

[10] Further types of measurement invariance are only of theoretical importance or relevant as a precondition when the aim is to test assumptions on latent mean change (Lang et al., 2011; Little et al., 2007; Vandenberg and Lance, 2000). These invariance types are not important for testing relationships between variables or for guaranteeing that the meaning of the constructs stays the same over time – as in CLEM (Finkel, 1995; Lang et al., 2011).

[11] For one indicator of the interactive use factor in spring 2009 the standardized factor loading lies below the minimal level of .30 (Hair et al., 2009). Nevertheless, it was decided not to eliminate the item because the threshold value is conservative (Hair et al., 2009) and because thereby configural measurement invariance can be established. To test if this inclusion leads to a bias in model estimates, subsequent tests of the different models (presented later) were also conducted with 3-item interactive use constructs. The results, however, do not differ substantially from the results for the later specified models with four interactive use items and are therefore not tabulated.

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Table 3
Reliability and fit of measurement models.

Variables	CFA loadings[a] (standardized)	Cronbach's alpha	Composite reliability	χ^2	*df*	*p*-Value	CFI	TLI	RMSEA	SRMR
Crisis perception (spring 2009)	.38–.95	.84	.88	3.46	2	.18	1.00	.99	.05	.02
Crisis perception (fall 2010)	.44–.99	.88	.91	1.23	2	.54	1.00	1.00	.00	.01
Interactive use (spring 2009)	.21–.81	.65	.69	1.16	2	.56	1.00	1.01	.00	.01
Interactive use (fall 2010)	.40–.73	.71	.72	3.25	2	.19	.99	.98	.06	.02
Control variable										
PEU[b] (fall 2010)	.32–.72	.68	.70	1.03	2	.60	1.00	1.02	.00	.01

CFA: confirmatory factor analysis; *df*: degrees of freedom; CFI: comparative fit index; TLI: Tucker-Lewis index; RMSEA: root mean square error of approximation; SRMR: standardized root mean square residual; PEU: perceived environmental uncertainty.

[a] All items load on the respective factors at a significance level of $p < .001$.

[b] PEU construct with 4 items.

Table 4
Mean, standard deviation, average variance extracted and standardized factor correlations.

		Mean	SD	1	2	3	4	5	6	7	8
1	Crisis perception (spring 2009)	4.27	1.92	.67							
2	Crisis perception (fall 2010)	3.57	1.86	.49***	.74						
3	Interactive use (spring 2009)	3.51	.53	−.09	.11	.39					
4	Interactive use (fall 2010)	3.38	.75	.26***	.18**	.50***	.41				
5	PEU[a] (fall 2010)	4.70	.44	.13	.05	.21**	.33***	.39			
6	Size_ln (fall 2010)	6.49	1.60	.13	−.11	−.05	−.07	.05	–		
7	Strategy (fall 2010)	5.20	1.42	.13*	.01	.07	−.01	.28***	.02	–	
8	Lifecycle (fall 2010)	3.12	.91	.14*	.28***	−.08	.06	−.19**	.00	.00	–

SD: standard deviation; PEU: perceived environmental uncertainty.
The average variance extracted for each factor is represented by the values on the diagonal of the correlation matrix.

[a] PEU construct measured with 4 items

Significance (two tailed *t*-test):

* $p < .1$.
** $p < .05$.
*** $p < .01$.

all measurement models reached satisfactory model fit criteria (Bollen and Long, 1993; Hu and Bentler, 1999): comparative fit index (CFI) ≥ .95, Tucker-Lewis index (TLI) ≥ .95, root mean square error of approximation (RMSEA) ≤ .08 and standardized root mean square residual (SRMR) ≤ .08.

Furthermore, discriminant and convergent validity was analyzed. Discriminant validity of the constructs was assessed by considering the average variance extracted (AVE), which represents the average variance shared between a construct and its indicators (Fornell and Larcker, 1981). Discriminant validity is warranted if the AVE of each factor is greater than the squared correlations with other latent variables. This indicates that more variance is shared between each factor and its block of indicators than with any other factor (Fornell and Larcker, 1981). Table 4 gives the AVE values and latent variable correlations, showing that all AVE values exceeded all respective squared correlations. Convergent validity was supported because all composite reliability values exceeded the required threshold of .60 (Bagozzi and Yi, 1988), indicator loadings were significant (cf. Table 3) and all AVE values were at least close to or above the required threshold of .40 (Bagozzi and Baumgartner, 1994) (cf. Table 4).

If common method variance strongly affects all measures, one might assume that a single factor accounts for a large proportion of the variance in the data. In order to test this hypothesis, a Harman's single factor test was applied (Podsakoff et al., 2003). Therefore, we conducted a confirmatory factor analysis allowing all items used in model 1 to load on a single factor. The fit statistics of the resulting model showed a poor fit to the data ($\chi^2 = 969.804$, $df = 104$, $p = .000$, CFI = .510, TLI = .435, RMSEA = .158, SRMR = .159). Hence, these results did not support the assumption that there is a single factor which all items load on. Accordingly, common method variance did not seem to affect our results. Moreover, we conducted an exploratory factor analyses for all multi-item variables. The analysis for the items collected in spring 2009, which consisted of the two constructs crisis and interactive use of MCS, revealed the presence of two factors with eigenvalues exceeding 1. The analysis for the items collected in fall 2010, which in addition to crisis and interactive use also contained perceived environmental change, revealed the presence of three factors with eigenvalues exceeding 1. The item loadings are presented in Table 5 and indicate that each item loads strongest on the factor it conceptually belongs to.[12] The cross-loadings were small.

[12] Similar to the results of the confirmatory factor analysis discussed previously, the factor loading of the item "Learning tool" in the exploratory factor analysis was below the minimum cutoff point of .30 for *practical* significance (Hair et al., 2009) in spring 2009. We kept the item because the factor loading was statistically significant ($p < .05$) and, as previously stated, to preserve configural measurement invariance with the fall 2010 construct. As mentioned, the results were robust even if this item was dropped.

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Table 5
Exploratory factor analyses.

Panel A

	Factor 1	Factor2
Crisis perception (spring 2009)		
To what extent is your company impacted by the current economic crisis?	**.736**	.053
Have orders declined?	**.947**	.000
Have sales declined?	**.937**	−.014
Have customers increasingly failed to pay?	**.387**	.115
Interactive use of MCS (spring 2009)		
Encourage new goals and priorities	.067	**.628**
Signaling key strategic areas	−.073	**.685**
Challenge new ideas and ways for doing tasks	.000	**.794**
Learning tool	.140	**.220**

Panel B

	Factor 1	Factor2	Factor 3
Crisis perception (fall 2010)			
To what extent is your company impacted by the current economic crisis?	**.846**	.017	.036
Have orders declined?	**.933**	−.008	−.031
Have sales declined?	**.988**	−.020	−.002
Have customers increasingly failed to pay?	**.431**	.034	.114
Interactive use of MCS (fall 2010)			
Encourage new goals and priorities	.088	**.728**	−.005
Signaling key strategic areas	−.034	**.645**	.016
Challenge new ideas and ways for doing tasks	.027	**.694**	−.012
Learning tool	−.056	**.388**	.103
Perceived environmental uncertainty (fall 2010)			
Competing for manpower	−.013	−.042	**.341**
Technological environment	.005	−.086	**.729**
Products/services marketed in industry	−.002	.098	**.585**
Scientific discoveries	.003	.012	**.725**

The exploratory factor analyses include all items of latent variables that were used in the main model specification.
$N = 277$ for spring 2009; $N = 209$ for fall 2010.
Rotation method: Geomin.
All bold values are significant at 5% level.

4.2. Measurement invariance

As previously mentioned (cf. Section 3.3), analyses of measurement invariance had to be carried out. As shown in Table 6, models specifying the same factor structure with freed loadings in spring 2009 and fall 2010 provided a satisfactory fit to the data. Thus, evidence of configural invariance was provided. Setting loadings of all like items equal over time to demonstrate metric invariance changed model fit statistics only slightly. Next, the fit of the model for both constructs of the perception of negative external crisis effects with invariant factor loadings was compared to the fit of the model with free loadings. This comparison indicated that fit between both models was marginally different ($\Delta\chi^2 = 7.415$, $\Delta df = 3$, $p < .10$) (Bollen and Curran, 2006; Chan, 1998; Finkel, 1995; Vandenberg and Lance, 2000). According to the recommendations in the literature, one factor loading was freed from the equality constraint. In this way we tested if partial measurement invariance was given (Steenkamp and Baumgartner, 1998; Vandenberg and Lance, 2000) which was sufficient for the analysis of CLEM (Little et al., 2007). The χ^2 difference test comparing this model with the free loadings model indicated no significant difference in fit ($\Delta\chi^2 = 3.366$, $\Delta df = 2$, $p > .10$). Thus, partial measurement invariance was supported. Moreover, the CFI difference was less than the cutoff value of .01 which was in line with suggestions in the literature (Cheung and Rensvold, 2002).

The comparison of the interactive use model including one freed factor loading with the model in which all factor loadings are freed showed a marginal difference in fit ($\Delta\chi^2 = 5.461$, $\Delta df = 2$, $p < .10$).[13] However, the CFI difference was less than .01 which supported partial measurement invariance (Cheung and Rensvold, 2002).

Taken together, the results indicate that CLEM presented in the following can be analyzed, although future studies might aim at identifying measures with improved invariance over time.

4.3. Hypotheses testing

We tested our hypotheses using the CLEM presented in Fig. 1 assuming metric measurement invariance. As

[13] Setting all factor loadings for the model of the interactive use constructs in 2009 and 2010 invariant over time significantly decreased model fit compared with the model with free loadings ($\Delta\chi^2 = 9.993$, $\Delta df = 3$, $p < .05$), indicating that metric measurement invariance was not supported for this specification. Therefore, in line with footnote 11 and 12, we also assessed measurement invariance for the 3-item version of interactive use. This specification showed no significant difference between the model with the free loadings and the model with the equality constraints ($\Delta\chi^2 = 3.149$, $\Delta df = 2$, $p > .10$), indicating metric measurement invariance.

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Table 6
Measurement invariance analysis.

	χ^2	*df*	$\Delta\chi^2$	CFI	TLI	RMSEA	SRMR
Crisis perception (spring 2009, fall 2010)							
Free loadings[a]	20.671	15		.996	.992	.034	.040
Loadings invariant[b]	28.086	18	7.415	.993	.989	.041	.050
Partial invariance[c]	24.037	17	3.366	.995	.992	.035	.042
Interactive use (spring 2009, fall 2010)							
Free loadings[a]	16.142	15		.997	.994	.015	.038
Loadings invariant[b]	26.135	18	9.993	.979	.967	.037	.062
Partial invariance[c]	21.603	17	5.461	.988	.980	.029	.052

χ^2: chi square; *df*: degrees of freedom; CFI: comparative fit index; TLI: Tucker-Lewis index; RMSEA: root mean square error of approximation; SRMR: standardized root mean square residual.

[a] Free loadings refers to the fact that no constraints are imposed except the same pattern of indicator-to-construct relations.

[b] Loadings invariant means that factor loadings of like items are set equal over time.

[c] The loadings of the item with the largest deviation between the two points of measurement are freed from the equality constraint, all other factor loadings of identical items are set equal over time.

Table 7
Structural model fit.

	χ^2	*df*	*p*-Value	CFI	TLI	RMSEA	SRMR	N
Model 1	103.301	96	.287	.996	.995	.015	.060	332
Model 2	116.357	98	.099	.990	.987	.024	.084	332
Model 3	267.653	209	.004	.971	.965	.029	.066	332
Model 4	249.468	209	.029	.969	.963	.038	.072	136

df: degrees of freedom; CFI: comparative fit index; TLI: Tucker-Lewis index; RMSEA: root mean square error of approximation; SRMR: standardized root mean square residual.

indicated by Table 7, this CLEM (model 1) provided a reasonable fit to the data. We consequently proceeded by examining the cross-lagged effect estimates.

As shown in Table 8, model 1 showed a significant lagged effect from the perception of negative external crisis effects to the interactive use of MCS as suggested by Hypothesis 1. Moreover, Hypothesis 2 was supported by a significant cross-lagged effect from the interactive use of MCS to the perception of negative external crisis effects. As can be seen from the correlation between the interactive use of MCS and the perception of negative external crisis effects in spring 2009, the respective effect estimate was not significantly distinct from zero. Thus, an immediate effect between the interactive use of MCS and the perception of negative external crisis effects was not supported.

4.4. Robustness checks

To confirm the robustness of our results, we tested several additional models. Model 2 tested if the observed cross-lagged effects in model 1 were significantly different from zero. Therefore, we compared the fit of model 2, in which the cross-lagged effects were set to zero, to the fit of model 1, in which the effect estimates were freely estimated (cf. Table 8). This comparison, based on a χ^2 difference test (cf. Table 7), showed that model 2 fit the data significantly worse than model 1 ($\Delta\chi^2 = 13.056$, $\Delta df = 2$, $p < .005$). This result fits the proposition that there were causal effects between the two focal constructs over time rather than the variables having been unrelated to each other over time (Hellgren and Sverke, 2003).

The inclusion of control variables underscored the inference drawn from model 1. In model 3 control variables (perceived environmental uncertainty, size, strategy and lifecycle) were added to model 1. Again, both hypotheses were supported. The cross-lagged effects for both causal directions were significant and positive (cf. Table 8).

Our hypotheses also received support if only those cases for which full information on the two focal constructs was available at both points of measurement were considered. In model 4, effect estimates were calculated using only data from respondents who answered every item of the two focal constructs measured with four items at both points of measurement. This reduced the sample size from 332 to 136 respondents. Hypothesis 1 received support from model 4, since the effect estimate for an effect of the perception of negative external crisis effects on the interactive use was marginally significant. Our second hypothesis was also supported by this model. However, the fourth model did not use all of the available information and therefore only served as a robustness check (cf. Section 3.1). The direct maximum likelihood approach which was used in the other models was considered superior to the approach chosen in model 4 (Bollen and Curran, 2006).

In summary, the robustness checks supported Hypotheses 1 and 2. The cross-lagged effects of the perception of negative external crisis effects on the interactive use of MCS were significant and positive in each of the tested models. Moreover, all cross-lagged effects of interactively used MCS on the perception of negative external crisis effects were significant.

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Table 8
Model estimates.

Effect	Model 1	Model 2	Model 3	Model 4[b]
Stabilities (autoregressive effects)				
Crisis perception	.49*** (.06)	.47*** (.07)	.49*** (.06)	.45*** (.07)
Interactive use	.43*** (.10)	.39*** (.10)	.39*** (.10)	.44*** (.11)
Cross-lagged effects				
Crisis perception → interactive use	.27*** (.09)	–[c]	.27*** (.09)	.19* (.10)
Interactive use → crisis perception	.16** (.08)	–[c]	.16** (.08)	.17** (.08)
Predictor correlations (spring 2009)				
Crisis perception ↔ interactive use	–.08 (.07)	–.07 (.07)	–.08 (.07)	–.07 (.10)
Disturbance correlations (fall 2010)				
Crisis perception ↔ interactive use	–.03 (.10)	.06 (.09)	–.10 (.10)	–.16 (.12)
Control variables (fall 2010)				
PEU[a] → interactive use			.27*** (.10)	.25** (.12)
PEU[a] → crisis perception			.02 (.08)	–.01 (.09)
Size_ln → interactive use			–.11 (.07)	–.14 (.10)
Size_ln → crisis perception			–.15** (.06)	–.19** (.07)
Strategy → interactive use			–.14* (.08)	–.15 (.10)
Strategy → crisis perception			–.05 (.07)	–.07 (.08)
Lifecycle → interactive use			.10 (.08)	.11 (.10)
Lifecycle → crisis perception			.24*** (.06)	.16** (.08)
N	332	332	332	136

All values are standardized coefficients with standard errors in parentheses.
[a] PEU (perceived environmental uncertainty) measured as a 4-item construct.
[b] Model 4 equals model 3 for the sample with complete information on the 2 focal constructs at both points of measurement.
[c] Effect estimate was set to zero.
Significance (two tailed *t*-test):
* $p < .1$.
** $p < .05$.
*** $p < .01$.

4.5. Additional quantitative analyses

The interactive use of MCS is a broad concept which encompasses several features (Bisbe et al., 2007; Naranjo-Gil and Hartmann, 2007). Therefore, we tested additional models to provide more specific results as to which aspects represented by the interactive use of MCS changed more and which changed less due to the perception of negative external crisis effects. Overall, we calculated six additional models which examined the interrelationship between each single interactive use item of the Naranjo-Gil and Hartmann (2007) construct and the perception of negative external crisis effects. All models showed sufficiently good fits to the data (not tabulated). The effect estimates are presented in Table B.1 in Appendix B. They supported the conclusions drawn from model 1. The results show that the perception of negative external crisis effects had a significant time-lagged impact on the extent to which MCS were used to encourage new goals and priorities and to generate new ideas and ways of doing tasks. Moreover, there were marginal effects of the crisis perception on the extent to which MCS were used to set and negotiate goals and to permanently involve subordinates. The other estimates for the impact of the perception of negative external crisis effects on the use of MCS to signal key strategic areas and as a learning tool were also positive, although not significantly distinct from zero.[14] In summary, the additional analysis showed that all facets of interactive use as measured by the six individual items were related in a similar way to the perception of negative external crisis effects. In addition, the results for the reversed cross-lagged effects underlined that the encouragement of new goals and priorities in particular increased the perception of negative external crisis effects (see fourth line and second column in Table B.1).

4.6. Additional qualitative evidence

To further illustrate the interactive use of MCS in times of economic crisis, we analyzed free text comments from the surveys. Moreover, we conducted six additional interviews with heads of controlling and other financial managers in different industries. Table 9 presents quotes from the free text comments and from the interviews that provided anecdotal evidence regarding the use of MCS during the crisis. We categorized the quotes according to the six items of the construct that was used in the quantitative analysis earlier in the paper.

Taken together, the quotes support a more interactive use of MCS in crisis times. Furthermore, they give some evidence on which MCS were used more interactively. The

[14] In an additional analysis (not tabulated) we calculated a model which included all six tested cross-lagged effects, meaning a cross-lagged effect from perception of negative external crisis effects on every single interactive use item. We tested two alternatives of this model. In the first one the cross-lagged effects were freely estimated. In the second alternative the cross-lagged effects were constrained to be of equal magnitude. Model comparison by a χ^2 difference test showed no significant impairment in model fit for the second alternative. Therefore, the analysis underlined that the perception of negative external crisis effects had similar consequences for the different interactive use characteristics.

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Table 9
Practitioner statements regarding the interactive use of MCS in times of economic crisis.

Conceptual aspect of interactive use	Practitioner statements
1. Set and negotiate goals and targets	"Targets were negotiated [more intensely] during the budgeting talks. . .[especially] quantities, costs, investments and projects"
2. Encourage new goals and priorities	"We had more information events where the directors showed up to get people on board – this was also about goals" "[Regarding what was discussed more during the crisis:] what the senior managers did was focusing stronger on market data. . .and we included this data in the KPIs [key performance indicators]"
3. Signaling key strategic areas	"As a result of the strategic discussions [of the top management] cash flow became more important" "[Management control] got more involved in strategic processes"
4. Challenge new ideas and ways for doing tasks	"Detailed information is challenged – medium-term targets are backed up with detailed key performance indicators" "During the crisis it was required to check the assumptions [of the MCS]"
5. Permanently involve subordinates (e.g. in discussions)	"Permanent in-depth questions from the board of directors to the controlling department – the board recognized that it has to pay more attention to risks" "More intense discussions about market conditions in shorter cycles" "More intense use of discussion groups instead of providing standardized evaluations per mail" "During the crisis it was required to talk to the budget holders to understand the reasons for budget deviations" "In the crisis . . . to reduce the uncertainty of the employees . . . once a week a member of the board of directors sat at a certain table in the canteen . . . and was available for face-to-face talks" "[The CEO] visited our [i.e. the financial managers'] offices more often and said 'Have a quick look. Is this possible? This can't be right! Why do we have four million less here?'"
6. Learning tool	"During the crisis, the CEO put emphasis on using action plans with a 'traffic light' monitoring system [problems were discussed in] more frequent meetings" "Understanding the reasons for deviations from the plan became much more important during the crisis" "Budget deviations were more intensely discussed during the crisis to identify necessary actions . . . a learning process occurred"

We would like to note that some statements are related to more than one of the six conceptual aspects, hence the classification is to a certain extend a judgment call. The original quotes were in German.

most prominently mentioned MCS was a more interactive use of cash flow information and forecasts. Several interview partners explained that at the height of the crisis, top management frequently required cash and sales forecasts, was closely involved in discussing options to ensure financial liquidity, and made decisions based on the MCS. For example, one financial manager from a large glass-producing company explained that the cash flow accounting information was used more intensely during the crisis by senior managers and operational managers to debate about tough decisions to preserve liquidity and to signal "new priorities in the crisis – clearly: cash flow instead of income". For example, turning off the glass production units to reduce operating costs was discussed even if it meant that the glass hardened and the tub (worth three million euros) had to be written off. Related to this point, the budgeting system was used more interactively in some companies, to discuss deviations and to learn about necessary actions to reduce those deviations.

In addition, in line with the theory on interactive use of MCS, the anecdotal evidence suggested that vertical information flow increased and senior managers engaged more often in personal meetings with subordinates to discuss the recent developments of the key performance indicators and other information from the MCS.

Moreover, some anecdotal evidence for delayed causal effects was encountered. For example, a senior manager, working at an automobile supplier during the 2008–2010 economic crisis, hinted at a time-lag between crisis perceptions and the interactive use of MCS: "When your house is burning, the first step to take before rebuilding it is to extinguish the fire." This statement was further explained with two mechanisms. First, in this organization, in the early phase of the crisis, the focus was on the implementation of cost-cutting programs. According to the interviewee, decisions about cost cutting were made at the top without involvement of subordinates. Second, a discussion with subordinates and among senior managers about the changes in the environment and the implications for the company by using MCS interactively did not start until later.

5. Discussion

5.1. Perception of negative external crisis effects influences the interactive use of MCS

When a firm was perceived to be hit by the economic crisis, an interactive use of MCS was able to support necessary adjustments. The results of the CLEM suggested a positive effect of the perception of negative external crisis effects on the change in the interactive use of MCS. These findings add to the anecdotal evidence found by Simons (1991). In his field study, he observed intensification in the interactive use of MCS when firms were facing crisis situations and were "undergoing revolutionary changes

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which threatened their survival" (Simons, 1991, p. 58).[15] If we consider an interactive use as a forward-looking use of MCS (Naranjo-Gil and Hartmann, 2007), these findings also correspond to the observations of D'Aveni and MacMillan (1990) and Hopwood (2009). They state that an externally induced output crisis like declining demand has long-term effects. These must be responded to with long-term solutions, such as changing long-term assumptions (D'Aveni and MacMillan, 1990), and shifts in the external environment beyond internal economizing (Hopwood, 2009).

A change in the interactive use of MCS due to the perception of negative external crisis effects only occurs with a time delay since the correlation between interactively used MCS and crisis perceptions in spring 2009 was not significantly distinct from zero. This result hints at a time lag between an intensified interactive use of MCS and the perception of negative external crisis effects.[16] Such a time-lag is also supported by Ezzamel and Bourn (1990) who observe that the AIS was used as a dialog and then as an idea machine in later phases of the crisis. Directly after the onset of the crisis the AIS was applied as an answer machine which provided simple investment appraisal methods, stock control systems and credit control routines. The conceptual frameworks of Fink et al. (1971) and Milburn et al. (1983) also support a possible time-lag between the onset of a crisis and the interactive use of MCS. Both frameworks state that the impetus for adaptation only builds in later stages of a crisis or in the medium and long term. The first phases or short-term responses to crises are – among other things – shaped by less communication, the search for mechanistic responses and more centralized decision making. In these early shock phases, when organizational members become aware of the threat, interpersonal relationships are fragmented, the organizational members do not work effectively as a group, planning and goal setting are neglected and the structure of the organization seems chaotic (Fink et al., 1971).

Time delay might also be considered an explanation for non-findings in prior cross-sectional management accounting studies. For instance, Verbeeten (2006) hypothesizes an effect of different uncertainty dimensions (financial, social, market and input) on the application of sophisticated capital budgeting practices (SCBP). However, in his cross-sectional analysis he merely finds an effect of financial uncertainty on SCBP. The other uncertainty dimensions are not significantly related to SCBP. An explanation might be that organizations require time to install SCBP, and a longitudinal study which is capable of examining time-lagged effects might identify effects that are not visible in a cross-sectional study.

The additional quantitative analyses confirmed that time-delayed effects occur for different features of the interactive use of MCS. These results support the propositions made by the crisis frameworks that were explained in Section 2. Both crisis frameworks support a stronger involvement of subordinates as medium- and long-term responses to a crisis (Fink et al., 1971; Milburn et al., 1983). These frameworks also emphasize a forward-looking reframing of an organization's goals and an exploration and search for understanding on how to handle existing problems in this phase (Fink et al., 1971; Milburn et al., 1983).

5.2. Interactive use of MCS influences perception of negative external crisis effects

The tested CLEM also supported a positive time-lagged effect of interactively used MCS on the perception of negative external crisis effects. An explanation for this positive effect might be the increased awareness of all aspects for which the organization is concerned by the crisis (Weick, 1988). Our research design was, however, restricted in its ability to determine exactly how perceptions are shaped. The observed effect of an interactive use of MCS on crisis perceptions can mean that the extent to which the organization is hit by the crisis is assessed more appropriately by senior managers, or that they overestimate the negative impact of the economic crisis.

Furthermore, our additional analyses showed that the use of MCS in particular to encourage new goals and priorities increased the perception of negative external crisis effects. Hence, it was not necessarily intense debate about organizational crisis issues which caused a stronger perception of negative external crisis effects. The deviations from pre-established goals and priorities also caused negative crisis perceptions.

Kober et al. (2007) find support for a reciprocal relationship between an interactive use and organizational strategy. We found further evidence that the traditional view of a passive relationship suggesting MCS use to be an outcome of the perceived environment and other contextual factors is too limited (Chenhall, 2003). MCS use seems to proactively influence environmental perceptions. Thus, our results illustrate the risk of drawing conclusions about causal directions in cross-sectional studies (Lang et al., 2011). It is important to develop theories about the processes underlying the observed relationships in cross-sections. However, these hypotheses need to be tested and modified using longitudinal data.

6. Conclusions and directions for future research

This study makes three contributions. First, this study adds to the limited knowledge of organizational responses to externally induced economic crises in management accounting research. By finding a time-lagged increase

[15] As stated above, Simons (1991) does not explicitly refer to external crises.

[16] We found a significant effect between crisis perceptions and interactively used MCS with a delay of approximately 18 months. Simons (1991) says nothing about when an intensified use of interactive MCS starts. He merely mentions an increased interactive use of MCS in companies facing crisis for a period of 8 to 12 months. In combination with the observation of a delayed reaction of the interactive use of MCS this might indicate that our second point of measurement was rather late. However, simulation studies show that time lags which are too long merely underestimate true causal effects (Luft and Shields, 2007; Zapf et al., 1996).

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in the interactive use of MCS, qualitative evidence is supported by a quantitative study. Second, the inverse causal effect of interactively used MCS on the perception of negative external crisis effects is also supported by this study design. Thus, this study contributes to the debate about the causal effect direction between the use of MCS and environmental perceptions (Collins et al., 1997). It confirms that MCS have an effect on managerial perceptions and illustrates the risk of drawing conclusions about causal directions from cross-sectional data. Third, this study responds to calls for longitudinal research in quantitative management studies (Pierce and Aguinis, 2013; Ployhart and Vandenberg, 2010; Van der Stede et al., 2007). In doing so, it introduces CLEM as a method to analyze longitudinal data that has rarely, if at all, been used in survey-based management accounting research.

As with most studies, this research has limitations. Most importantly, the theories available in the literature and applied in this study to explain the effects of economic crises on management control systems are somewhat vague. For future research, the development of stronger and more detailed theories seems desirable given the widely acknowledged importance of economic crises for management accounting (Hopwood, 2009). Next, while we used an established construct to measure interactive use of MCS (Naranjo-Gil and Hartmann, 2006, 2007), more detailed alternative approaches are available (e.g. Bisbe et al., 2007). Moreover, our measure does not address which specific control systems are used interactively. Our qualitative evidence suggests, for example, that cash flow information, forecasts and budgeting were used more interactively during the economic crisis. Depending on the research question, for future quantitative studies, use of empirical measures that are more specific might be better than the construct used in our study. This would advance management accounting research by helping to understand exactly which MCS become more important in times of economic crises.

Another limitation are potential threats from endogeneity. While our cross-lagged panel approach has important advantages compared to cross-sectional designs, it cannot completely rule out all alternative explanations for the statistical results shown in this study (Finkel, 1995).

Moreover, this study relied on a single respondent for each company. Since our measures of the focal constructs might be noisy, an approach with several respondents per company is preferable. Furthermore, the low sampling frequency – data for this study were gathered at only two points of measurement – results in two limitations. First, a closer examination of the form of change, linear or quadratic, in the focal variables is not feasible. In order to describe the exact form of change, more measurement points are necessary (e.g. Bollen and Curran, 2006; Ployhart and Vandenberg, 2010). Second, it is not possible to determine the exact time lag between cause and effect in the cross-lagged relationships. Future research could overcome this limitation by collecting data at more time points.

In addition, existing management accounting research provides little theoretical guidance regarding the question of how long it takes until changes in the environment lead to changes in accounting practices. Therefore, the development of further theoretical arguments regarding time-lagged effects seems desirable. More attention should be paid to the exact timing of cause-and-effect relationships between the investigated variables and to possible mediating variables which can help to explain the time-lags.

Notwithstanding these important limitations, the present study provides new insights on management accounting and economic crisis that are relevant for theory as well as practice by hypothesizing and empirically testing a time-lagged reciprocal relation between crisis perceptions and interactive use of MCS.

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Appendix A. Survey questions

Crisis impact
Please indicate the extent to which you agree with the following:

1. To what extent is your company impacted by the current economic crisis?	1 = Not at all 7 = To great extent
2. Please indicate the extent to which your company faces the following impacts of the current financial and economic crisis (a) Have orders declined? (b) Have sales declined? (c) Have customers increasingly failed to pay?	1 = Not at all 7 = To great extent

Use of management accounting system
Please indicate the extent to which you use the management accounting system, considering it as the whole of management accounting and control techniques.

1. Set and negotiate goals and targets 2. Encourage new goals and priorities[a] 3. Signaling key strategic areas[a] 4. Challenge new ideas and ways for doing tasks[a] 5. Permanently involve subordinates (e.g. in discussions) 6. Learning tool[a]	1 = Not at all 5 = To great extent

[a] Items used to measure the 4-item interactive use construct in the later specified models.

Perceived environmental uncertainty Please indicate the extent to which you agree with the following:	
Intensity of competition	
1. How intense is each of the following in your industry? (a) Bidding for products or raw materials (b) Competition for manpower[a] (c) Price competition	1 = Of negligible intensity 7 = Extremely intense
Unpredictability of environment	
2. How stable/dynamic is the external environment (economic and technological) facing your firm? (a) Economic (b) Technological[a]	1 = Very stable, changing slowly 7 = Very dynamic, changing rapidly
3. In the past five years, the market activities of your competitors have become:	1 = More predictable 7 = Less predictable
4. In the past five years, the tastes and preferences of your customers have become:	1 = Much easier to predict 7 = Much harder to predict
Elements of environmental change	
5. How many new products and/or services have been marketed in the past five years by your industry?[a]	1 = None 7 = Many
6. In the past five years, political and economic constraints surrounding your firm:	1 = Remained about the same 7 = Have proliferated greatly
7. How often do new scientific discoveries emerge in your industry?[a]	1 = Seldom 7 = Frequently

[a] Items used to measure the 4-item perceived environmental uncertainty construct in the later specified models

Competitive strategy	
How would you best describe your business unit's strategic emphasis?	1 = Cost-leadership (lowest price/cost in the industry) 7 = Differentiation (superior product features, e.g. quality, image, etc.)

Please name the lifecycle stage of your company
1 = Foundation/Birth
2 = Growth
3 = Maturity
4 = Realignment/Revival
5 = Decline

Appendix B. Additional analyses

See Table B.1.

Table B.1
Model estimates for each item of interactive use of MCS.

Effect	MCS use 1	MCS use 2	MCS use 3	MCS use 4	MCS use 5	MCS use 6
Stabilities (autoregressive effects)						
Crisis perception	.48*** (.07)	.45*** (.07)	.47*** (.07)	.47*** (.07)	.46*** (.07)	.46*** (.07)
Use of MCS	.24*** (.08)	.37*** (.07)	.32*** (.07)	.23*** (.08)	.26*** (.08)	.26*** (.07)
Cross-lagged effects						
Crisis perception → use of MCS	.16* (.08)	.16** (.08)	.12 (.08)	.17** (.08)	.16* (.08)	.05 (.08)
Use of MCS → crisis perception	.08 (.07)	.15** (.07)	.10 (.07)	.11 (.07)	.02 (.08)	−.08 (.07)
Predictor correlations (spring 2009)						
Crisis perception ↔ use of MCS	.05 (.06)	.00 (.06)	−.14** (.06)	−.08 (.06)	−.03 (.06)	.12* (.06)
Disturbance correlations (fall 2010)						
Crisis perception ↔ use of MCS	.09 (.08)	.04 (.08)	−.07 (.08)	−.04 (.09)	.01 (.08)	−.03 (.08)
N	332	332	332	332	332	332

Interactive MCS . . .
. . . use 1: to set and negotiate goals and targets; . . . use 2: to encourage new goals and priorities; . . . use 3: to signal key strategic areas; . . . use 4: to challenge new ideas and ways for doing tasks; . . . use 5: to permanently involve subordinates; . . . use 6: as a learning tool.
Significance (two tailed *t*-test):
* $p < .1$.
** $p < .05$.
*** $p < .01$.

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References

Abernethy, M.A., Bouwens, J., van Lent, L., 2010. Leadership and control system design. Management Accounting Research 21 (1), 2–16.
Abernethy, M.A., Brownell, P., 1999. The role of budgets in organizations facing strategic change: an exploratory study. Accounting, Organizations and Society 24 (3), 189–204.
Ahrens, T., Chapman, C.S., 2000. Occupational identity of management accountants in Britain and Germany. European Accounting Review 9 (4), 477–498.
Anderson, J.C., Gerbing, D.W., 1988. Structural equation modeling in practice: a review and recommended two-step approach. Psychological Bulletin 103 (3), 411–423.
Arbuckle, J.L., 1996. Full information estimation in the presence of incomplete data. In: Marcoulides, G.A., Schumacker, R.E. (Eds.), Advanced Structural Equation Modeling – Issues and Techniques. Lawrence Earlbaum, Mahwah, NJ.
Bagozzi, R., Baumgartner, H., 1994. The Evaluation of Structural Equation Models and Hypothesis Testing: Principles of Marketing Research. Blackwell Publishers, Oxford, England.
Bagozzi, R., Yi, Y., 1988. On the evaluation of structural equation models. Journal of the Academy of Marketing Science 16 (1), 74–94.
Bargh, J.A., Pietromonaco, P., 1982. Automatic information processing and social perception: the influence of trait information presented outside of conscious awareness on impression formation. Journal of Personality and Social Psychology 43 (3), 437–449.
Barnes, J.H., 1984. Cognitive biases and their impact on strategic planning. Strategic Management Journal 5 (2), 129–137.
Becker, A., Messner, M., 2005. After the scandals: a German-speaking perspective on management accounting research and education. European Accounting Review 14 (2), 417–427.
Berry, W.D., 1984. Nonrecursive Causal Models. Sage, Beverly Hills, CA.
Bisbe, J., Batista-Foguet, J.-M., Chenhall, R., 2007. Defining management accounting constructs: a methodological note on the risks of conceptual misspecification. Accounting, Organizations and Society 32 (7-8), 789–820.
Bisbe, J., Otley, D., 2004. The effects of the interactive use of management control systems on product innovation. Accounting, Organizations and Society 29 (8), 709–737.
Bollen, K.A., 1989. Structural Equations with Latent Variables. John Wiley & Sons, New York.
Bollen, K.A., Curran, P.J., 2006. Latent Curve Models: A Structural Equation Perspective. John Wiley & Sons, New Jersey.
Bollen, K.A., Long, J.S., 1993. Testing Structural Equation Models: Alternative Ways of Assessing Model Fit. Sage, Newbury Park, CA.
Burchell, S., Clubb, C., Hopwood, A., Hughes, J., Nahapiet, J., 1980. The roles of accounting in organizations and society. Accounting, Organizations and Society 5 (1), 5–27.
Burkert, M., Davila, A., Metha, K., Oyon, D., 2014. Relating alternative forms of contingency fit to the appropriate methods to test them. Management Accounting Research 25 (1), 6–29.
Chan, D., 1998. The conceptualization and analysis of change over time: an integrative approach incorporating longitudinal mean and covariance structures analysis (LMACS) and multiple indicator latent growth modeling (MLGM). Organizational Research Methods 1 (4), 421–483.
Chapman, C.S., 1998. Accountants in organisational networks. Accounting, Organizations and Society 23 (8), 737–766.
Chenhall, R.H., 2003. Management control systems design within its organizational context: findings from contingency-based research and directions for the future. Accounting, Organizations and Society 28 (2-3), 127–168.
Cheung, G.W., Rensvold, R.B., 2002. Evaluating goodness-of-fit indexes for testing measurement invariance. Structural Equation Modeling 9 (2), 233–255.
Cohen, J., Cohen, P., West, S.G., Aiken, L.S., 2003. Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences, 3rd ed. Lawrence Erlbaum, Mahwah, NJ.
Collins, F., Holzmann, O., Mendoza, R., 1997. Strategy, budgeting, and crisis in Latin America. Accounting, Organizations and Society 22 (7), 669–689.
Collins, F., Lowensohn, S.H., McCallum, M.H., Newmark, R.I., 1995. The relationship between budgetary management style and organizational commitment in a not-for-profit organization. Behavioral Research in Accounting 7, 65–79.
Correa, P., Iootty, M., 2010. The impact of the global economic crisis on the corporate sector in Europe and Central Asia: evidence from a firm-level survey. The World Bank.
D'Aveni, R.A., MacMillan, I.C., 1990. Crisis and the content of managerial communications: a study of the focus of attention of top managers in surviving and failing firms. Administrative Science Quarterly 35 (4), 634–657.
Davila, A., Foster, G., 2007. Management control systems in early-stage startup companies. The Accounting Review 82 (4), 907–937.
Davila, A., Foster, G., Oyon, D., 2009. Accounting and control, entrepreneurship and innovation: venturing into new research opportunities. European Accounting Review 18 (2), 281–311.
Ezzamel, M., Bourn, M., 1990. The roles of accounting information systems in an organization experiencing financial crisis. Accounting, Organizations and Society 15 (5), 399–424.
Federal Statistical Office, 2011. Konjunkturindikatoren: Umsatz im verarbeitenden Gewerbe [Economic data: Sales in the manufacturing industry], Retrieved from http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Statistiken/Zeitreihen/WirtschaftAktuell/Schluesselindikatoren/UmsatzVerarbeitendesGewerbe/liste_verums,templateId=renderPrint.psml, 20 December 2011.
Fink, S.L., Beak, J., Taddeo, K., 1971. Organizational crisis and change. The Journal of Applied Behavioral Science 7 (1), 15–37.
Finkel, S.E., 1995. Causal Analysis with Panel Data. Sage University Paper series on Quantitative Applications in the Social Sciences, Thousand Oaks, CA.
Fornell, C., Larcker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research 18 (1), 39–50.
Galbraith, J.R., 1973. Designing Complex Organizations. Addison-Wesley Publishing Company, Reading, MA.
Galbraith, J.R., 1974. Organization design: an information processing view. Interfaces 4 (3), 28–36.
Giles, C., Barber, L., 2009. Zoellick calls for global response to crisis. Financial Times, Retrieved from http://www.ft.com/intl/cms/s/0/42f9802c-fe25-11dd-932e-000077b07658.html#axzz2dB9REueU, 28 August 2013.
Gordon, L.A., Narayanan, V.K., 1984. Management accounting systems, perceived environmental uncertainty and organization structure: an empirical investigation. Accounting, Organizations and Society 9 (1), 33–47.
Govindarajan, V., 1988. A contingency approach to strategy implementation at the business-unit level: integrating administrative mechanisms with strategy. Academy of Management Journal 31 (4), 828–853.
Goretzki, L., Strauss, E., Weber, J., 2013. An institutional perspective on the changes in management accountants' professional role. Management Accounting Research 24 (1), 41–63.
Gray, B., 1990. The enactment of management control systems: a critique of Simons. Accounting, Organizations and Society 15 (1-2), 145–148.
Greve, H.R., 2010. Positional rigidity: low performance and resource acquisition in large and small firms. Strategic Management Journal 32 (1), 103–114.
Grewal, R., Tansuhaj, P., 2001. Building organizational capabilities for managing economic crisis: the role of market orientation and strategic flexibility. Journal of Marketing 65 (2), 67–80.
Guillen, M.F., 2009. The Global Economic and Financial Crisis: A Timeline. The Lauder Institute, Wharton Art and Science University of Pennsylvania, Retrieved from http://www-management.wharton.upenn.edu/guillen/2009_docs/crisis_financiera_formato_nuevo.pdf, 12 February 2013.
Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., 2009. Multivariate Data Analysis: A Global Perspective. Pearson Education, Inc., Boston.
Hall, M., 2008. The effect of comprehensive performance measurement systems of role clarity, psychological empowerment and managerial performance. Accounting, Organizations and Society 33 (2-3), 141–163.
Hartmann, F.G.H., Maas, V.S., 2011. The effects of uncertainty on the roles of controllers and budgets: an exploratory study. Accounting & Business Research 41 (5), 439–458.
Hellgren, J., Sverke, M., 2003. Does job insecurity lead to impaired well-being or vice versa? Estimation of cross-lagged effects using latent variable modeling. Journal of Organizational Behavior 24 (2), 215–236.
Henri, J.-F., 2006. Management control systems and strategy: a resource-based perspective. Accounting, Organizations and Society 31 (6), 529–558.
Hermann, C.F., 1963. Some consequences of crisis which limit the viability of organizations. Administrative Science Quarterly 8 (1), 61–82.
Higgins, E.T., Rholes, W.S., Jones, C.R., 1977. Category accessibility and impression formation. Journal of Experimental Social Psychology 13, 141–154.

Please cite this article in press as: Janke, R., et al., An exploratory study of the reciprocal relationship between interactive use of management control systems and perception of negative external crisis effects. Manage. Account. Res. (2014), http://dx.doi.org/10.1016/j.mar.2014.01.001

Hopwood, A.G., 2009. The economic crisis and accounting: implications for the research community. Accounting, Organizations and Society 34 (6–7), 797–802.
Hu, L., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal 6 (1), 1–55.
James, E.H., Wooten, L.P., Dushek, K., 2011. Crisis management: informing a new leadership research agenda. The Academy of Management Annals 5 (1), 455–493.
Khandwalla, P.N., 1978. Crisis responses of competing versus noncompeting organizations. Journal of Business Administration 9 (2), 151–178.
Kiesler, S., Sproull, L., 1982. Managerial response to changing environments: perspectives on problem sensing from social cognition. Administrative Science Quarterly 27 (4), 548–570.
Kober, R., Ng, J., Paul, B.J., 2007. The interrelationship between management control mechanisms and strategy. Management Accounting Research 18 (4), 425–452.
Lang, J., Bliese, P.D., Lang, J.W.B., Adler, A.B., 2011. Work gets unfair for the depressed: cross-lagged relations between organizational justice perceptions and depressive symptoms. Journal of Applied Psychology 96 (3), 602–618.
Langfield-Smith, K., 1997. Management control systems and strategy: a critical review. Accounting, Organizations and Society 22 (2), 207–232.
Langfield-Smith, K., 2007. A review of quantitative research in management control systems and strategy. In: Chapman, C.S., Hopwood, A.G., Shields, M.D. (Eds.), Handbook of Management Accounting Research, vol. 2. Elsevier, Amsterdam, pp. 753–783.
Lin, Z., Xia, Z., Ismail, K.M., Carley, K.M., 2006. Organizational design and restructuring in response to crises: lessons from computational modeling and real-world cases. Organization Science 17 (5), 598–618.
Little, T.D., Preacher, K.J., Selig, J.P., Card, N.A., 2007. New developments in latent variable panel analyses of longitudinal data. International Journal of Behavioral Development 31 (4), 357–365.
Lord, R.G., 1985. An information processing approach to social perceptions. In: Cummings, L.L., Staw, B.M. (Eds.), Research in Organizational Behavior, vol. 7. JAI Press, Greenwich, CT, pp. 87–128.
Luft, J., Shields, M.D., 2007. Mapping management accounting: graphics and guidelines for theory-consistent empirical research. In: Chapman, C.S., Hopwood, A.G., Shields, M.D. (Eds.), Handbooks of Management Accounting Research, vol. 1. Elsevier, Amsterdam, pp. 27–95.
Maas, V.S., Matějka, M., 2009. Balancing the dual responsibilities of business unit controllers: field and survey evidence. Accounting Review 84 (4), 1233–1253.
Magnan, M., Markarian, G., 2011. Accounting, governance and the crisis: is risk the missing link? European Accounting Review 20 (2), 215–231.
Mangena, M., Tauringa, V., Chamisa, E., 2012. Corporate boards, ownership structure and firm performance in an environment of severe political and economic crisis. British Journal of Management 23, S23–S41.
Marginson, D.E.W., 2002. Management control systems and their effects on strategy formation at middle-management levels: evidence from a U.K. organization. Strategic Management Journal 23 (11), 1019–1031.
Messner, M., Becker, A., Schäffer, U., Binder, C., 2008. Legitimacy and identity in Germanic management accounting research. European Accounting Review 17 (1), 129–159.
Milburn, T.W., Schuler, R.S., Watman, K.H., 1983. Organizational crisis. Part II: Strategies and responses. Human Relations 36 (12), 1161–1179.
Mitroff, I.I., Pauchant, T.C., Shrivastava, P., 1988. The structure of man-made organizational crises: conceptual and empirical issues in the development of a general theory of crisis management. Technological Forecasting and Social Change 33 (2), 83–107.
Moores, K., Yuen, S., 2001. Management accounting systems and organizational configuration: a life-cycle perspective. Accounting, Organizations and Society 26 (4–5), 351–389.
Mundy, J., 2010. Creating dynamic tensions through a balanced use of management control systems. Accounting, Organizations and Society 35 (5), 499–523.
Muthén, L.K., Muthén, B.O., 1998–2012. Mplus User's Guide, 7th ed. Muthén & Muthén, Los Angeles, CA.
Muurlink, O., Wilkinson, A., Peetz, D., Townsend, K., 2012. Managerial autism: threat-rigidity and rigidity's threat. British Journal of Management 23, S74–S87.
Naranjo-Gil, D., Hartmann, F., 2006. How top management teams use management accounting systems to implement strategy. Journal of Management Accounting Research 8 (1), 21–53.
Naranjo-Gil, D., Hartmann, F., 2007. Management accounting systems, top management team heterogeneity and strategic change. Accounting, Organizations and Society 32 (7–8), 735–756.
Olofsson, C., Svalander, P.A., 1975. The medical services change over to a poor environment. Working Paper.
Parnell, J.A., Dent, E.B., O'Regan, N., Hughes, T., 2012. Managing performance in a volatile environment: contrasting perspectives on luck and causality. British Journal of Management 23, S104–S118.
Pearson, C.M., Clair, J.A., 1998. Reframing crisis management. The Academy of Management Review 23 (1), 59–76.
Pierce, J.R., Aguinis, H., 2013. The too-much-of-a-good-thing effect in management. Journal of Management 39 (2), 313–338.
Ployhart, R.E., Vandenberg, R.J., 2010. Longitudinal research: the theory, design, and analysis of change. Journal of Management 36 (1), 94–120.
Podsakoff, P.M., MacKenzie, S.B., Jeong-Yeon Lee Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. Journal of Applied Psychology 88 (5), 879–903.
Porter, M.E., 1980. Competitive Strategy. The Free Press, New York.
Raykov, T., 2005. Analysis of longitudinal studies with missing data using covariance structure modeling with full-information maximum likelihood. Structural Equation Modeling 12 (3), 493–505.
Reid, G.C., Smith, J.A., 2000. The impact of contingencies on management accounting system development. Management Accounting Research 11 (4), 427–450.
Schafer, J.L., Graham, J.W., 2002. Missing data: our view of the state of the art. Psychological Methods 7 (2), 147–177.
Schäffer, U., Mahlendorf, M.D., Rehring, J., 2014. Does the interactive use of headquarter performance measurement systems in foreign subsidiaries endanger the potential to profit from local relationships? Australian Accounting Review (forthcoming).
Simons, R., 1987. Planning, control and uncertainty: a process view. In: Burns, W.J., Kaplan, R.S. (Eds.), Accounting and Management: Field Study Perspectives. Harvard Business School Press, Boston, MA.
Simons, R., 1991. Strategic orientation and top management attention to control systems. Strategic Management Journal 12 (1), 49–62.
Simons, R., 1995. Levers of Control – How Managers Use Innovative Control Systems to Drive Strategic Renewal. Harvard Business School Press, Boston.
Simons, R., 2000. Performance Measurement & Control Systems for Implementing Strategy. Prentice Hall, New Jersey.
Smircich, L., Stubbart, C., 1985. Strategic management in an enacted world. The Academy of Management Review 10 (4), 724–736.
Steenkamp, J.E.M., Baumgartner, H., 1998. Assessing measurement invariance in cross-national consumer research. Journal of Consumer Research 25 (1), 78–107.
Tani, T., 1995. Interactive control in target cost management. Management Accounting Research 6 (4), 399–414.
The Economist, 2009, February 19. The collapse of manufacturing.
Tuomela, T.-S., 2005. The interplay of different levers of control: a case study of introducing a new performance measurement system. Management Accounting Research 16 (3), 293–320.
Turner, B.A., 1976. The organizational and interorganizational development of disasters. Administrative Science Quarterly 21 (3), 378–397.
Van der Stede, W.A., 2011. Management accounting research in the wake of the crisis: some reflections. European Accounting Review 20 (4), 605–623.
Van der Stede, W.A., Young, S.M., Chen, C.X., 2007. Doing management accounting survey research. In: Chapman, C.S., Hopwood, A.G., Shields, M.D. (Eds.), Handbook of Management Accounting Research, vol. 1. Elsevier, Amsterdam, pp. 445–478.
Vandenberg, R.J., Lance, C.E., 2000. A review and synthesis of the measurement invariance literature: suggestions, practices, and recommendations for organizational research. Organizational Research Methods 3 (1), 4–70.
Vandenbosch, B., Higgins, C.A., 1995. Executive support systems and learning: a model and empirical test. Journal of Management Information Systems 12 (2), 99–130.
Vandenbosch, B., Higgins, C.A., 1996. Information acquisition and mental models: an investigation into the relationship between behavior and learning. Information System Research 7 (2), 198–214.
Verbeeten, F.H.M., 2006. Do organizations adopt sophisticated capital budgeting practices to deal with uncertainty in the investment decision? A research note. Management Accounting Research 17 (1), 106–120.
Weick, K.E., 1969. The Social Psychology of Organizing. Addison-Wesley Publishing Company, Reading, MA.
Weick, K.E., 1988. Enacted sensemaking in crisis situations. Journal of Management Studies 25 (4), 305–317.
Widener, S.K., 2007. An empirical analysis of the levers of control framework. Accounting, Organizations and Society 32 (7-8), 757–788.

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World Bank, 2009. The Financial Crisis: Charting a Global Recovery, Retrieved from http://go.worldbank.org/XNOU707YR0, 28 August 2013.

Zapf, D., Dormann, C., Frese, M., 1996. Longitudinal studies in organizational stress research: a review of the literature with reference to methodological issues. Journal of Occupational Health Psychology 1 (2), 145–169.

Zona, F., 2012. Corporate Investing as a response to economic downturn: prospect theory, the behavioral agency model and the role of financial slack. British Journal of Management 23, S42–S57.

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