The design and effects of control systems: tests of direct- and indirect-effects models

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Abstract

Two models are developed on the effects of a control system that include participative standard setting, standard-based incentives, and standard tightness. The direct model proposes that the control system directly affects performance, whereas the indirect model proposes that the effects of the control system on performance are indirect through the mediating influence of job-related stress. Hypothesis tests and a models-comparison test using structural equation modeling indicate that the indirect model has a significantly better fit to the data than does the direct model. © 2000 Elsevier Science Ltd. All rights reserved.

Control systems as researched in the accounting literature are usually based on a cybernetic model in which performance standards (e.g. budget, goal, target)\textsuperscript{1} and performance measures are compared as the basis for corrective action and performance evaluation. Three important components of performance-based control systems are the standard setting process (e.g. participation, imposition), standard tightness (e.g. goal difficulty, budgetary slack), and standard-based incentives (e.g. a bonus for each unit of measured performance in excess of the performance standard). These three components are interrelated (Demski & Feltham, 1978). The process used to set a performance standard is likely to affect its tightness which, in turn, may affect the rewards received for performance relative to the standard.

Many studies have investigated the direct effects of one or more components of control systems (e.g. budget participation, standard tightness, performance-based incentives) on performance or other variables (e.g. job-related stress) (Birnberg, Shields & Young, 1990; Kren & Liao, 1988; Merchant, 1989; Shields & Young, 1998; Young, 2000).

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\textsuperscript{1} Hereafter, we use the terms standard and standard setting instead of budget and budgeting although they have similar meanings (Atkinson, 1978; Christensen, 1982; Horngren, Foster & Datar, 1997; Merchant, 1982). Results of prior research in accounting and organizational behavior and psychology in which job or task requirements are expressed as goals, budgets, standards, or targets are qualitatively similar (see the ensuing literature review and Locke and Latham (1990) and Shields and Shields (1998)). For the sample used in this study, task goals are stated as standards, but this should not be confused with standard costs (i.e. formulas for mapping resource costs to outputs). Instead, as used in this paper, standard means the level of performance expected by an organization.

\textsuperscript{2} A direct effect is the influence of one variable on another that is not mediated by any other variable. An indirect effect is a direct effect that is mediated by at least one other variable. See Bollen (1989).
These studies have investigated either the independent direct effects of a control-system component (e.g. bivariate correlation between participative standard setting and performance) or the interactive direct effects of a component (e.g. a component interacts with another independent or a moderator variable to affect performance). Few studies have investigated whether a control-system component has indirect effects on performance [e.g. a model with an intervening variable(s) that mediates the relationship between the component and performance].

While these prior studies have provided many insights into the effects of control-system components, most studies have one or more of the following three limitations. First, many studies have limited their investigation to one control-system component, while fewer studies have focused on multiple components. Since management accounting and controls usually have more than one component and are represented as a system, it is important for research to include multiple components in order to understand how they operate as a system and the system’s effects. There, however, is a practical limit to the number of control-system components that can be included in any one study due to the need to have theoretical and predictive clarity and an adequate sample size to test the predictions. In addition, including many components in an empirical study requires estimating the magnitude and direction of the numerous predicted cause-effect relations in the sample (i.e. relationships between components and relationships between components and other variables).

Second, while control systems and their components can have many effects (e.g. job-related stress, performance, conflict, cooperation, communication), most studies include only one dependent variable or, if multiple dependent variables are included, relationships among them are not investigated. Limiting a study to one dependent variable or including multiple dependent variables but suppressing relationships among them can lead to a distorted understanding of the effects of control systems. The predicted or estimated effects of a control-system component on a dependent variable can depend on which other variables that are affected by that component are included in the study. As will be shown in this study, for example, the reported results and implications of a study can depend on whether it includes as consequences of a control system performance, job-related stress, or both variables but either suppressing or incorporating the relationship between stress and performance.

Third, almost all of these studies investigate the direct (independent or interactive), but not indirect, effects of control systems. There can be important theoretical differences between direct and indirect models that have practical implications. For example, Bollen (1989, p. 376) suggests that,

The indirect and total effects can help to answer important questions that are not addressed by examining the direct effects. For instance, suppose that participation in a social welfare program has a positive direct effect on household income but a negative indirect effect because it reduces the number of hours of part-time work, which in turn reduces other sources of income. The direct effect provides a misleading impression of the influence of program participation on income.

There is a similar difference between the predictions of the direct- and indirect-effects models tested in this paper: they imply opposite management policies for the level at which performance standards should be set to increase or maximize performance.

The purpose of this paper is to develop and test two competing control system models. Each has three control-system components — participative standard setting, standard-based incentives, and standard tightness — and job performance as the dependent variable. The direct model, based on prior accounting research, assumes that the three control-system components directly affect job performance. The indirect model, based on organizational psychology literature that did not influence the prior accounting studies, assumes that the effects

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3 A dependent variable is directly caused by an independent variable. An intervening variable is caused by an independent variable and causes a dependent variable. A moderator variable affects the relationship between an independent and dependent variable but does not have a bi-variate relationship with either the dependent or independent variable.
of the control-system components on job performance are indirect, through the intervening variable of job-related stress. Structural equation modeling is used to test the proposed models and related hypotheses. The results indicate that the indirect model provides a better fit to the data than does the direct model; all of the hypotheses that constitute the indirect model are supported, but two of five hypotheses that comprise the direct model are not.

The remainder of this paper is organized in four sections. The next section provides a review of prior accounting and organizational psychology studies as the basis for developing two competing control-system models and the nine hypotheses that in total constitute the two models. The next two sections describe the hypothesis testing method and results. The last section discusses the results and their implications for future research.

1. Literature review and hypothesis development

An important determinant of the expected design and effects of a control system is the nature of the job or task being controlled. Appendix A provides a description of the job/task. The job is automobile design engineering and the task is designing a particular component(s) of an automobile. The design engineers are Japanese nationals who are employed by a large Japanese company that sells automobiles around the world. They work at this company’s facility in Japan where automobiles are designed. This company uses a target costing system which has tight performance standards. The performance measures used for these employees and their jobs are specific to each job and task (i.e. qualitative, quantitative, financial, nonfinancial). Three components of the control system used for this job are participative standard setting, standard tightness, and standard-based incentives. The effects of these control-system components are on job-related stress and job performance.

Numerous accounting studies have investigated the effects of participative standard setting, standard tightness, or standard-based incentives. Performance is the most frequently researched (and probably the most important) effect of these control-system components, and job-related stress has been a dependent variable in some studies. These studies have also investigated the relationship between participative standard setting and both standard tightness and standard-based incentives.

Two competing models of the effects of this three-component control system are proposed and tested. Each model in Fig. 1 includes H2 and H3, which describe the theoretical relationships between participative standard setting and both standard tightness and standard-based incentives. The models differ in their predictions about the effects of this control system. The direct model is based on the extant accounting research (to be reviewed later) and predicts that performance is directly caused by each control-system component (i.e. H1, 4, 5 in Fig. 1). In contrast, the indirect model predicts that the effects of the control system on performance are indirect through the mediating influence of job-related stress as the intervening variable (i.e. H6–9 in Fig. 1). These models have different implications for how to improve performance. The direct model implies that expected performance can be increased if the performance standard is tightened. In contrast, the indirect model predicts the opposite — loosening the performance standard decreases expected job-related stress which, in turn, increases expected performance.5 The remainder of this section first reviews literature to develop the hypotheses that constitute the direct model, and then those that make up the indirect model.

1.1. Participative standard setting

Subordinate participation in setting performance goals, standards, or budgets is one of the most researched topics in management and accounting.
(Locke & Latham, 1990; Shields & Shields, 1998). It can be used by superiors and subordinates to determine the level or tightness of the standard and the reward for performance relative to the standard. For example, Shields and Waller (1988) had a participative standard setting situation in which superiors designed menus of contracts to offer subordinates and then the subordinates selected the contracts under which they would work and be paid. The contracts differed in terms of the fixed salary, the bonus per unit that actual performance exceeds the standard performance, and the level of the performance standard. A commonly used expression of the relationship among the performance standard, standard-based incentives, and performance in the accounting literature is (Young & Lewis, 1995):

\[
r = \begin{cases} 
  b(a - s) & \text{if } a > s, \\
  0 & \text{if } a < s 
\end{cases}
\]

where,

- \( r \) = reward
- \( b \) = bonus per unit
- \( a \) = actual performance
- \( s \) = performance standard.

When the parameters of this formula are determined during participative budgeting, a subordinate and superior can have different preferences for them. When a subordinate participates, he or she is assumed to try to maximize \( r \) by negotiating for an optimized combination of \( b \) and \( s \) (e.g. large \( b \) and low \( s \)). The superior is assumed to use participative budgeting to learn more about the subordinate’s task in order to set a \( b - s \) pair that maximizes \( a - r \).

### 1.2. Participative standard setting and job performance

The direct effects of participative standard setting on job performance has been investigated in numerous studies (Shields & Shields, 1998). The earliest studies relied on organizational and psychological theories to structure their investigation of the independent direct effects of participation on performance.

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6 Many participation studies in the accounting literature are based on research in organizational behavior and psychology on participative goal setting, decision making, and management (Locke & Latham, 1990). The qualitative results of the accounting and non-accounting studies are similar although a higher percentage of the accounting studies report detecting statistically significant direct effects of participation on performance.
attitude, job-related stress, motivation, performance, and satisfaction (e.g. Hofstede, 1967; Kenis, 1979; Milani, 1975). The evidence from these studies is somewhat mixed and weak, but the majority supports a positive, direct relationship. Hopwood (1976) notes that these studies and related organizational studies usually report that participation has positive, independent, direct effects on attitude and satisfaction, but the evidence on performance is equivocal at best. In particular, some studies report positive, independent, direct effects of participation on performance under certain circumstances while other studies report negative, independent, direct effects for other situations.

In response to Hopwood's (1976) interpretation of the extant literature, studies began to try to sort out the mixed and weak results of the prior research by hypothesizing, based on a variety of organizational and psychological theories, that participation as an independent variable interacts with another independent or a moderator variable to directly affect performance and other variables (e.g. Govindarajan, 1986; Merchant, 1981). The majority of the evidence in these studies indicates that participation is part of an interaction (with another independent or a moderator variable) that has a positive, ordinal-interaction, direct effect on job performance (Shields & Shields, 1998). Almost all of the studies have investigated the independent or interactive direct effects of participation and very few have examined its indirect effects. In total, most studies investigating the independent or interaction direct effects of participative standard setting report a positive, direct relationship between it and job performance.

**H1.** There is a positive relationship between participative standard setting and job performance.

### 1.3. Participative standard setting and standard tightness

Theoretical analysis and field-study and experimental evidence indicates that a negative relationship between participative standard setting and standard tightness should be expected. This expected relationship stems from theoretical research in organizational behavior and economics which predicts that allowing subordinate participation in setting performance standards can result in slack. Slack arises during participative standard setting when a subordinate intentionally understates the expected revenues and/or productive capability, and/or overstates the expected costs and/or resources required to achieve a performance standard. A consequence of participative standard setting, therefore, is that performance standards may not be as tight as they would have been if there were no participation.

The initial research on participation and slack, based on Cyert and March (1963) and Williamson (1964), argued that building slack into a standard is in a subordinate’s best economic interest, and provided field-study evidence which showed that slack exists and identified factors that might be related to it (Lowe & Shaw, 1968; Schiff & Lewin, 1970). Subsequent studies suggested that participation reduces a subordinate’s need to build slack into the budget; but this negative relationship between participation and slack was only indirectly detected by Onsi (1973), not detected by Collins (1978), and very weakly detected by Merchant (1985).

More rigorous predictions were subsequently derived based on the economic theory of agency (Baiman, 1982; Baiman & Evans, 1983). The basic prediction is a positive relationship between participation and slack because, when a subordinate’s expected compensation is related to standard tightness, ceteris paribus, he or she is expected to use the opportunity to participate in standard setting to build slack into the standard in

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7 Two studies investigate indirect effects. Brownell and McInnes (1986) report, contrary to their prediction, that participative budgeting has a nonsignificant indirect effect on performance through motivation as the intervening variable (this indirect path was not significant because the participation-motivation linkage was not significant), and a significant independent, direct effect on performance. Nouri and Parker (1998) predict and find that the influence of participative budgeting on performance is indirect, with separate paths through organizational commitment and budget tightness as intervening variables. All of the linkages in these studies’ models are positive in sign which means that the indirect effects would be expected to affect the strength, but not the sign, of the expected direct effect of the independent variable on the dependent variable.

8 See Dunk and Nouri (1998) for similar definitions of slack and a review of research on slack.
order to increase expected compensation. Consistently, Lukka (1988) provides field-study evidence that when a subordinate participates in setting his or her budget and rewards are tied to performance relative to the budget, he or she tries to use participation to get an easier budget.

Several studies test the participation-tightness/slack relationship based on this agency-theory prediction. Nouri and Parker (1998) report survey evidence that participative budgeting is related to looser budgets. Experimental studies report that subordinates who participate by “self selecting” their own performance standard choose lower standards (Chow, Cooper & Haddad, 1991; Chow, Cooper & Waller, 1988; Waller, 1988; Young, 1985). Overall, the theoretical analysis and experimental, survey, and field-study evidence supports the hypothesis of a negative relationship between participative standard setting and standard tightness.

**H2.** There is a negative relationship between participative standard setting and standard tightness.

### 1.4. Participative standard setting and standard-based incentives

Prior research has predicted based on agency theory that, when participative standard setting is used, management will make greater use of incentives that reward performance relative to meeting or exceeding the standard (Baiman, 1982; Baiman & Evans, 1983). The assumption underpinning this relationship is that as the level of participation increases, a superior can learn how to develop a better performance standard, one that will motivate a subordinate to maximize performance (Shields & Shields, 1998). An important way to motivate the subordinate to maximize performance is to provide more incentive to achieve and surpass the performance standard, for example by increasing the unit bonus for performance in excess of the standard.

We also expect that a subordinate will use the opportunity to participate to increase standard-based incentives. The subordinate is assumed to be using participation to obtain the combination of standard-based incentives and standard tightness that maximize his or her expected reward — for example, a particular high level of unit bonus for performance over the standard and a particular low level of performance standard. That is, ceteris paribus, we would expect a subordinate to use participative standard setting to try to increase his or her expected reward for the excess of measured performance over the standard. Shields and Young (1993), the only evidence on this issue, report a positive relationship between participative budgeting and budget-based incentives.

**H3.** There is a positive relationship between participation and standard-based incentives.

### 1.5. Standard tightness and job performance

Standard tightness is defined as the amount of resources needed to perform at the level of a standard minus the amount of resources provided to perform. Several theories of motivation, including level of aspiration (Stedry, 1960), expectancy (Ronen & Livingstone, 1975), agency (Chow, 1983), and goal setting (Hirst & Lowy, 1990), have been used to predict that, assuming a standard is accepted as attainable, performance is an increasing function of standard difficulty. Consistent with these theoretical predictions and the results of many studies in organizational psychology (Locke & Latham, 1990), experimental and survey research in accounting report a positive relationship between standard tightness and individuals’ standard-related performance (Chow; Hirst & Lowy; Hofstede, 1967; Lindquist, 1995; Rockness, 1977; Stedry, 1960; Waller & Chow, 1985). In contrast, Kenis’ (1979) survey evidence is ambiguous with respect to the relationship between tightness and performance. He reports that while tightness is positively related to motivation, it is negatively related to performance. However, this latter result depends on the perceived tightness (performance decreases when standards are perceived to be tighter than “about right”). Simons (1988) extends the evidence from individual to organizational performance and reports, consistent with almost all of the individual-level evidence, that tighter budget goals are associated with higher levels of organizational performance. Overall, almost all of the evidence from the prior research supports the
hypothesis of a positive relationship between standard tightness and job performance.

H4. There is a positive relationship between standard tightness and job performance.

1.6. Standard-based incentives and job performance

Agency, expectancy, and goal-setting theories each predict that performance is an increasing function of performance-contingent incentives (Demski & Feltham, 1978; Locke & Latham, 1990; Ronen & Livingstone, 1975). The essence of this theoretical prediction is that individuals are motivated to expend more effort when they believe that the additional effort will increase performance which, in turn, results in receiving additional valued rewards. Specifically, incentives contingent on the excess of performance over a standard will motivate an individual to exert additional effort up to the point that the cost of the incremental effort equals the benefit received from that effort (e.g. increase in bonus). The accounting research that is based on predictions from these theories report evidence of a positive relationship between standard-based incentives and performance (Chow, 1983; Dillard & Fisher, 1990; Kren, 1990; Rockness, 1977; Waller & Chow, 1985).

H5. There is a positive relationship between standard-based incentives and job performance.

1.7. Job-related stress

Early research on job-related stress is based on the arousal model (a variant of the Yerkes-Dodson Law), which predicts that stress increases motivational arousal which, in turn, increases and focuses effort and hence performance. However, at some (moderate) stress level, additional arousal causes interference, anxiety, or disorganization which reduces and diffuses effort and hence performance. The arousal model predicts an inverted-U relationship between job-related stress and performance (Beehr, 1985; McGrath, 1976; Weick, 1983); however, in general the evidence did not support the prediction.

In response to the lack of predictive ability of this arousal model of stress, the task demand-performance capability model was developed based on the person-environment fit literature (Beehr 1985; Beehr & Bhagat, 1985; Edwards, 1996; Van Harrison, 1985). This model predicts that, ceteris paribus, job-related stress is a positive function of the difference between the performance demands of a task (i.e. the task goals and constraints) and the individual’s performance capability (e.g. skill, effort, external resources). As task demands increase over performance capability, job-related stress is assumed to increase due to either ambiguity about task demands or task demands exceeding performance capability (overload). As demand ambiguity or overload increase, an individual has more uncertainty about the possible outcomes of the job and/or how his or her effort affects job outcomes, resulting in feelings of role ambiguity and/or loss of control, which then causes a reduction and diffusion in effort and hence performance. Several studies provide evidence consistent with the predicted determinants and effects of job-related stress (Beehr; Beehr & Bhagat; Edwards; Motowidlo, Pacard & Manning, 1986; Van Harrison). The ensuing subsection elaborate on how the control-system components cause job-related stress and on the effects of stress.

1.8. Participative standard setting and job-related stress

The extant accounting research on the relationship between participation and job-related stress is weak on theory and has reported mixed results. Kenis (1979) did not explicitly predict, but reports finding, a significant negative relationship. Three studies predict that participative budgeting is part of a particular interaction that causes job-related stress, but their results are contrary to prediction: (1) Brownell and Hirst (1986) found a negative linear relation between participation and job-related stress; (2) Harrison (1992) reports that participation is part of a significant interaction that is associated with job-related stress but that interaction is not the predicted one, and the bivariate relationship is not significant; and (3) Lau, Low and Eggleton (1995) did not find their predicted interaction, nor is the linear bivariate relationship significant.

Consistent with the results of Brownell and Hirst (1986) and Kenis (1979), but not their predictions, the
primary prediction and result of research based on the task demands-performance capability model is that participation in decision making causes job-related stress to decrease (Beehr, 1985; Jex & Beehr, 1991). The root of this theoretical relationship is that participation increases individuals' feeling of control which thereby reduces their stress. Thus, we propose that job-related stress decreases as participation increases.

H6. There is a negative relationship between participative standard setting and job-related stress.

1.9. Standard tightness and job-related stress

Theoretical research based on the task demands–performance capability model predicts that, ceteris paribus, job-related stress is a positive function of the difference between the performance demands of a job and individuals’ performance capability, which we refer to as standard tightness (Beehr 1985; Beehr & Bhagat, 1985; Edwards, 1996; Van Harrison, 1985). This model of job-related stress proposes that stress increases as the demands of a job increasingly exceed a worker’s performance capability. Several studies provide evidence consistent with this prediction (Beehr; Beehr & Bhagat; Edwards; Motowidlo et al., 1986; Van Harrison). In a budgetary context, Jick’s (1984, 1985) analysis supports the prediction of a positive relationship between budget tightness and job-related stress. Similarly, Kenis (1979) reports evidence of a positive relationship between budget tightness and job-related stress. In the ensuing hypothesis, standard tightness refers to a standard that the subordinate believes is achievable for two reasons: (1) an unattainable standard would not likely result from participation; and (2) an unattainable standard is not effective in the long-term since the subordinate will not be motivated to achieve a standard that he or she consistently believes is unattainable.

H7. There is a positive relationship between standard tightness and job-related stress.

1.10. Standard-based incentives and job-related stress

Prior accounting research has not addressed the relationship between standard-based incentives and job-related stress. A negative relationship between standard-based incentives and job-related stress is predicted based on prior stress research that finds that when individuals expect higher rewards for achieving a goal, they will experience less stress because the expected rewards increase performance capability by arousing and focusing effort (Edwards, 1996; Van Harrison, 1985). This increased effort makes the task less difficult, thus reducing the excess of performance demands over performance capability which then reduces stress.9

H8. There is a negative relationship between standard-based incentives and job-related stress.

1.11. Job-related stress and job performance

As previously presented, the task demand-performance capability model predicts a negative relationship between job-related stress and job performance (Beehr, 1985; Beehr & Bhagat, 1985; Edwards, 1996; Van Harrison, 1985). This model assumes that stress results from either ambiguity about task demands or task overload. As task demand ambiguity or overload increase, an individual has more uncertainty about the possible outcomes of the job and/or how his or her effort affects job outcomes, resulting in feelings of role ambiguity and/or loss of control, which then causes a reduction and diffusion in effort and hence performance. The evidence outside accounting (Jamal, 1985; McGrath, 1976; Motowidlo et al., 1986) and in accounting (Dunk, 1993) is consistent with the prediction of a negative relationship.

H9. There is a negative relationship between job-related stress and job performance.

9 When there is a high level of incentives (in the extreme, “excess” incentives over those needed to motivate achieving the standard), the excess will not cause stress when it can be ignored or retained by the performer for other purposes (e.g. leisure, engaging in job-related behavior which is not implied by the performance standard). Only when these excess incentives hinder or interfere with the achievement of the current performance standard will they cause job stress (Edwards, 1996; Van Harrison, 1985). The negative effect of incentives is not applicable for our sample because the excess incentives can be ignored or used to motivate accomplishment of other valued goals.
2. Hypothesis-testing method

This section has three parts. The first part further describes the sample that is used to test the hypotheses, the second part describes how the questionnaire that was used for data collection was developed, and the last part describes how the variables were measured.

2.1. Sample

The sample was obtained by having a senior executive of the automobile division of a global Japanese company distribute the questionnaires to the automobile design engineers who work in this firm’s design facility in Japan. The completed questionnaires were mailed by these engineers directly to one of the authors. Of 480 questionnaires distributed, 415 (86%) were returned. However, only 358 were usable because 46 respondents’ self-reported job titles were not design engineers and 11 had missing data. These 358 usable subjects had a mean of 11.2 (SD = 7.3, range = 1–33) years of employment with this company and a mean of 7.8 (SD = 6.1, range = 0–32) years of experience in their current job assignment.10

2.2. Questionnaire

The questionnaire was initially developed in English, then translated into Japanese and back-translated into English by different individuals. The original and back-translated versions were compared. The Japanese version was revised based on the detected differences, then translated back into English and again compared to the original English version. Only a few remaining differences had to be resolved to finalize the Japanese version.

2.3. Measurement of variables

Each variable was measured using multiple indicators. Existing measures were used when possible, with modification to fit the present research context. To check on the relevance of these measures to the subjects, one of the authors who has had a consulting relationship with this company showed the questionnaire to representatives of the company and they indicated that they believed the items in the questionnaire were relevant to the design engineers. The items used to measure each variable are in Appendix B.

Participative standard setting was measured by eight items adapted from Shields and Young (1993). Each item was measured on a seven-point scale with higher values representing greater participation.

Standard tightness has been measured several ways in the prior research. We adopted a measurement approach that was consistent with our definition of standard tightness, which was also consistent with how the stress literature conceptualized sources of stress. It was measured as the difference between two constructs — resources needed (as perceived by a respondent to accomplish a job) and resources available (to accomplish the job as perceived by a respondent). The response to each of the two constructs for each type of resource was captured on a seven-point response scale. Then for each of four types of resources (your own time, design technology, support from other employees, support from outside sources), resources needed minus resources available was calculated. Each respondent’s four differences between resources needed and available were then summed. The summed score was re-scaled so that it ranged from one to 13, with higher values representing a tighter performance standard.

Standard-based incentives were measured with a modified version of the three-item instrument used by Shields and Young (1993). The scores of the three seven-point incentive measures were summed with higher values indicating more incentives.

Job-related stress was measured as the sum of responses to nine items from the 15-item instrument originally developed by Kahn, Wolfe, Quinn, Snoek and Rosenthal (1964) and has been used in several accounting studies [e.g. Brownell and Hirst (1986)]. This instrument was modified to fit the context of the present research, including

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10 The hypothesis testing results did not qualitatively differ when those design engineers with less than three years of experience were deleted from the sample.
Each item was measured on a five-point scale, with higher values indicating higher stress.

Job performance of a design engineer was not measured by a financial measure (e.g. profit, ROI). As discussed previously, financial performance measures captured only part of a design engineer’s measured performance. We could not use the company’s performance evaluation that would be applicable to each engineer because we were denied access to them. Moreover, these performance measures and evaluations tend to be job, task, and department specific, which reduced comparability across engineers. As an alternative approach to performance measurement, many control system studies have used the Mahoney, Jerdee and Carroll (1965) instrument in which each respondent subjectively rated his or her own performance on eight dimensions of managerial activity (e.g. planning, staffing, supervising) as well as on overall managerial performance. This approach to data collection was feasible, though the instrument was not appropriate for measuring the performance of design engineers since they do not primarily perform managerial activities. Thus, we developed a measure in which each respondent subjectively rated his or her performance on three items, each with a seven-point scale, with higher values indicating higher performance.

3. Results

This section has four parts. The first part reports descriptive statistics for the variables, the second part describes the structural equation model, and the other two parts present the results of the models-comparison tests and hypothesis tests.

3.1. Descriptive statistics

Table 1 reports the variables’ Cronbach alpha, means, standard deviations, and theoretical and actual ranges. Each variable’s Cronbach alpha was greater than 0.60 which indicated that they had at least a satisfactory level of univariate reliability. The variables’ actual ranges were almost as large as their theoretical ranges and their means were approximately in the middle of these ranges. The actual range of standard tightness, when compared to its theoretical range, appears skewed toward the direction of tight standards. The mean of job-related stress was in the middle of the theoretical range. We had expected that these design engineers would have stressful work settings, which would imply that the mean would be greater than the middle of the theoretical range. However, it could be that these engineers were providing relative, not absolute, assessments of their job-related stress. That is, if they had become accustomed to high levels of job-related stress, they could have responded that they had “average” job-related stress meaning that they had experienced a typical level of stress for the kind of job they have. The key, however, is not their reported level of job-related stress but how it is associated with the other variables. Table 2 reports Pearson correlations for the variables. The signs of the correlations were consistent with seven of the nine hypotheses ($p < 0.05$). The correlations between job performance and both standard-based incentives and standard tightness were not significant.

3.2. Structural equation model

A structural equation modeling technique (LISREL 8 for Windows) was used to estimate the parameters of the direct and indirect models.

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11 The items that were deleted related to stress that would be caused by non-job related sources or job-related sources that did not directly relate to standard-based control systems, such as home and family life, having to make decisions that may affect the lives of people you know, and feeling that you may not be liked or accepted by the people you work with.

12 The question can be raised about the degree to which such subjective self-ratings correspond to objective performance measures and/or superiors’ ratings. Results of a recent meta-analysis reveal a significant positive correlation between superiors’ subjective rating and objective measures of subordinate performance (Bommer, Johnson, Rich, Podsakoff & Mackenzie, 1995). Venkatraman and Ramanujam (1987) report a high degree of convergence between objective and subjective measures of financial performance. Several studies report positive correlations between superiors’ and subordinates’ subjective ratings of subordinate performance (Furnham & Stringfield, 1994; Heneman, 1974; Kirchner, 1965; Parker, Taylor, Barrett & Martens, 1959; Riggio & Cole, 1992). Thus, while objective measures or superiors’ ratings of performance would have been preferred, prior research has shown that subjective self-ratings of performance are highly correlated with them.
(Fig. 1) and to test the hypotheses embedded in each model. LISREL was used to simultaneously estimate a measurement model which related the observed variables to the latent variables and a structural model which related the latent variables to each other.13 In the measurement model, unobserved endogenous and exogenous latent variables and their observed indicators were associated together through factor loadings and measurement errors. The relationship between an exogenous and an endogenous variable was labeled as $g$ and the relationship between two endogenous variables was labeled as $b$. The structural error had an expected value of zero and was uncorrelated with the exogenous variable. The maximum-likelihood procedure was used to estimate all of the parameters and fit indices. All of the variances for the observed indicators and latent variables were estimated and all of the covariances of these variables were fixed at zero, with the exception of some of the covariances among the error terms for participative standard setting.14

The LISREL model for the indirect model had a satisfactory fit to the data as evidenced by a comparative fit index (Bentler, 1990) of 0.90 and an incremental fit index (Bollen, 1989) of 0.90. The LISREL model for the direct model provided a slightly less-good fit to the data as evidenced by a comparative fit index of 0.88 and an incremental fit index of 0.88. Fig. 2 presents the structural parameter estimates (i.e. $g$, $b$) for the hypothesis tests for each model. The factor loadings for each variable in each LISREL model had the expected sign, reasonably large standard estimates, statistical significance ($p < 0.05$), and most of the loadings were greater than 0.60, which provided evidence of at least a satisfactory level of convergent validity (Anderson & Gerbing, 1988).15

### 3.3. Models-comparison tests

The direct and indirect models were tested to identify which had a better fit to the data. The

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13 The notation used follows the convention established in the literature (Bagozzi, 1980; Joreskog & Sorbom, 1979).

14 For this variable, there were some semantic relationships among its indicators. We, therefore, allowed non-zero correlations among the error terms of the indicators that were semantically related. Specifically, the correlated error terms were items 1 and 2; 3 and 4; 5 and 6; 7 and 8; 1, 3, 5, and 7; and 2, 4, 6, and 8.

15 These statistics are available from the authors.
direct model was nested within the indirect model; all of its linkages involving job-related stress were constrained to be zero and the other linkages in the two models also differed as identified in Fig. 2 in terms of whether they were constrained to be zero or allowed to be estimated. The chi-square difference statistic between the direct and indirect models was 59.02 (d.f. = 1, \( p < 0.01 \)) with the indirect model having the better fit to the data.

### 3.4. Hypothesis tests

The indirect model was comprised of six hypotheses (Fig. 2). The signs and significance levels of the structural parameter estimates provided support for each of the six hypotheses. In particular, the results were a negative relationship between participation and standard tightness (H2: \( -0.27, p < 0.01 \)), a positive relationship between participation and incentives (H3: 0.37, \( p < 0.01 \)), a negative relationship between participation and stress (H6: \( -0.32, p < 0.01 \)), a positive relationship between standard tightness and stress (H7: 0.17, \( p < 0.05 \)), a negative relationship between incentives and stress (H8: \( -0.19, p < 0.01 \)), and a negative relationship between stress and performance (H9: \( -0.26, p < 0.01 \)). The direct model had five hypotheses, two of which were not supported by the tests (Fig. 2). Consistent with the results for the indirect model, the structural parameter estimates for H2 (0.28) and H3 (0.37) were significant (\( p < 0.01 \)). The relationship between participation and performance was significant (H1: 0.24, \( p < 0.01 \)). However, the structural parameter estimates for the relationships between performance and both standard tightness (H4: 0.03) and incentives (H5: 0.04) were not significant (\( p > 0.05 \)).

### 4. Discussion

The results of models-comparison tests indicated that the indirect model fit the data better than did the direct model (Figs. 1 and 2). This was evidenced in three ways: (1) the indirect model had the better overall fit to the data according to the two fit indices; (2) the indirect model provided a better fit to the data than did the direct model in the models-comparison test; and (3) tests of the hypotheses in the indirect model provided support for all of them, while two of five hypotheses in the direct model were not supported by the tests.
Overall, these test results indicate that standard-based incentives and standard tightness are influenced by the degree of subordinate participation in standard setting, and that the effects of these three control-system components are indirect on job performance through job-related stress as the intervening variable. These results clarify and modify the composite results implied by the prior accounting studies. They reveal additional insights that can be obtained from researching indirect effects of control systems, especially using an indirect model such as the one in this study because it supports a different prediction for how to improve performance than does the direct model. The difference in prediction arises because the direct model predicts a positive relationship between standard tightness and performance but the indirect model predicts a negative relationship (i.e. predicted positive relationship between tightness and stress multiplied by the predicted negative relationship between stress and performance). The magnitude of these conflicting predictions is heightened in a sample such as the one in this study because job-related stress (the intervening variable) is a salient feature of the organizational context.

These results also help sort out the conflicting recommendations in the literature concerning how tight performance standards should be. The literature has traditionally recommended that standards/budgets should be “tight, but achievable,” with a probability of less than 0.50 that they will be achieved [see Merchant and Manzoni (1989) for a review of this literature]. In contrast, Merchant and Manzoni report field-study evidence that profit budgets are achieved 80–90% of the time. Consistent with Merchant and Manzoni’s evidence, the indirect-effects model predicts that performance is higher when performance standards are lower. While there may be practical limits to how low a performance standard can be, our results indicate that Merchant and Manzoni’s evidence of, and recommendation for, highly-achievable budgets is consistent with the finding of a negative relationship between standard tightness and performance operating through job-related stress.

Merchant and Manzoni (1989) review the prior research which is used to support the recommendation in the literature for high performance standards and suggest that recommendation is valid when: (1) the subordinate is committed to achieving the standard (which may be less likely if the standard induces too much stress); (2) tasks have short duration, low uncertainty and complexity, ability does not explain most of the variance in performance, and there is immediate performance feedback; and (3) performance is not affected by exogenous factors. Merchant and Manzoni then conclude that since many work settings and performance (including that in our study) do not have these features, the prior research which is used to support the recommendation of tight performance standards does not provide a basis for any prescription. An implication is that future research could test whether these task and performance variables as well as commitment affect the standard tightness-performance relationship.

Limitations of this research study should be considered when interpreting its results. These include reliance on non-experimental data to test causal relationships and on correlations which are necessary but not sufficient to establish causal relations. The sample is a potential limitation in terms of direct comparability to the samples used in related research. However, since tests of predictions that are based on those studies yielded similar results, this should reduce concerns about generalizability or comparability. The measurement of the variables, while possessing satisfactory measurement reliability, could be improved.16 For example, job performance could be measured by reference to objective measures (e.g. audited financial-statement data) or, if subjective measurement is relied on, then multiple raters of individual performance could be used (e.g. superior, peers).

These results have implications for future research beyond those already mentioned. The direct and indirect models were developed by piecing together the results of prior accounting studies that individually typically investigated one or two of the nine hypotheses embedded in the direct and indirect models. Future research could expand the indirect model in order to develop a more complete understanding of the design and effects of control systems. Expanded models can include,

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16 See footnote 12.
for example, antecedents to control systems (e.g. uncertainty, information asymmetry, prior performance), additional control-system components and their interrelationships (e.g. controllability of performance measures, audits, intra-period and end-of-period revisions of standards, formula vs. subjective performance evaluation), other intervening variables (e.g. goal acceptance, goal commitment, motivation\textsuperscript{17}), other dependent variables (e.g. innovation, risk taking, gaming behavior), and consequent variables (i.e. factors affected by dependent variables such as promotions, future participation strategy). Future research also could continue to use structural equation models because they facilitate testing, for example, complex nomological networks that would result from including additional variables, as just suggested. Such models also provide simultaneous tests of measurement and structure and tests of competing models. Additional research that aims to expand and enrich our indirect model (Figs. 1 and 2) will provide management accounting researchers with a better basis to understand the antecedents, design, and effects of control systems.

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Appendix A. Description of the job/task

The sample in this study is automobile design engineers operating under a target costing strategy in which a control system has performance goals, and their performance measures are stated in financial and nonfinancial terms. The target costing system puts continuous pressure on the design engineers to improve their design process and designs. There is pressure to decrease the cost of and time to make designs and to increase the quality of their design process. There is also pressure to design automobile components that are of increasingly higher quality, functionality, and performance, and that have lower cost and less time to market. We expect that this performance pressure causes job-related stress.

All design engineers work in Japan at the site where this company does its automotive design engineering. The automobile division of this company has a matrix organizational design consisting of functional (e.g. mechanical engineering, electrical engineering) departmental managers and product managers. The functional managers have more impact than the product managers on the design engineers’ performance standards and performance evaluation. Each engineer typically works on a particular section of a car (e.g. chassis, engine). This company has had a long-term employment policy and design engineers spend most, if not all, of their careers in automobile design engineering. Consequences of this organizational design include engineers having a variety of job assignments within the design engineering departments and engineering managers frequently having had one or more of the jobs which they currently manage. Consequences of this employment context are that the engineering managers tend to be very familiar with their subordinates’ jobs and may know more about a particular job than does a subordinate who is new to it. In this context, a participatively-oriented control system is used to share information so that the superior can learn more about the subordinates’ jobs and the subordinates can learn how to do their jobs better, and to motivate the design engineers to achieve their performance standards.

Subordinate engineers have frequent communications with their functional and product engineering managers which are intended to identify ways to improve performance, to establish performance standards, and to monitor performance relative to the standards. Performance standards

\textsuperscript{17} See footnote 7 for discussion of two studies that examine the intervening effects of commitment and motivation.
(targets, goals) are set both for the design process, including design time (e.g. milestones) and design cost, and for the design object, including target cost, functionality, styling, performance, quality (e.g. defect rates), manufacturability, and serviceability. Since these standards are tailored to each design assignment and design object, a common set of performance goals and measures does not exist. These standards typically are participatively set and are applied to departments or teams of engineers. They are also an important part of the information set that is used to evaluate and reward individual design engineers. Although the setting of performance standards involves several parties (e.g. human resource management, top management) besides the subordinate engineers and their functional and product managers, these other parties have much less involvement with and influence on standard setting. The target cost system results in the setting of performance standards for the design engineers that are tight and challenging. Finally, while these design engineers receive bonuses that are determined by several factors (e.g. team and division performance) and by several employees (e.g. superiors, peers, human resource management), an increasingly important determinant of these bonuses is individual performance relative to the performance standards.

Appendix B. Variable measurement

B.1. Participative standard setting

(Anchor by 1 = Extremely low, and 7 = Extremely high.)

1. The extent to which your superiors sought your input into the setting of your performance standards.
2. The extent to which your superiors sought your input into determining the amount of resources needed for your design assignments.
3. The importance that your superiors placed on including changes you had suggested in your performance standards.
4. The importance that your superiors placed on including changes you had suggested into the determination of the amount of resources to be provided for your design assignments.
5. The importance that your superiors placed on not finalizing your performance standards until you were satisfied with them.
6. The importance that your superiors placed on not finalizing the amount of resources to be provided for your design assignments until you were satisfied with them.
7. Overall, the influence that you had in setting your performance standards.
8. Overall, the influence that you had in determining the amount of resources to be provided for your design assignments.

B.2. Standard-based incentives

(Anchor by 1 = Extremely low, and 7 = Extremely high.)

1. The degree to which valued rewards to design engineers increase with increases in their measured performance.
2. The degree to which design engineers’ valued rewards are totally determined by measured performance relative to performance standards.
3. Consider the design engineers whose performance relative to the performance standards are in the top 25% of all design engineers’ performance. The extent to which these engineers receive larger valued rewards than do those engineers whose performance in relation to the standards are not in the top 25%.

B.3. Standard tightness

1. Please indicate the total amounts of each of the following resources you believed typically were required for you to achieve your performance standards on design assignments; minus
2. Please indicate the total amounts of each of the following resources that typically were made available to you on design assignments.

(Each anchored by 1 = no resources, and 7 = an extremely large quantity of resources.)

Four resources:
a. Your time at work  
b. Design technology (e.g. CAD, CAM, CAE)  
c. Assistance from other employees of your company (e.g. time, skills, information)  
d. Assistance from external sources (e.g. consultants, suppliers, customers)

B.4. Job-related stress

For each statement, please circle the number which most closely represents your true beliefs about your work assignments.
(Anchored by 1 = Never; 2 = Rarely; 3 = Sometimes; 4 = Often; 5 = Almost always.)

1. Feeling that you have too little authority to carry out the responsibilities assigned to you.
2. Being unclear on just what the scope and responsibilities of your job are.
3. Feeling that you have too heavy a work load, one that you can’t possibly finish during an ordinary workday.
4. Thinking that you’ll not be able to satisfy the conflicting demands of various people over you.
5. Not knowing what your supervisor thinks of you, how he evaluates your performance.
6. The fact that you can’t get information needed to carry out your job.
7. Feeling unable to influence your immediate supervisor’s decisions and actions that affect you.
8. Not knowing just what the people you work with expect of you.
9. Thinking that the amount of work you have to do may interfere with how well it gets done.

B.5. Job performance

(Anchored by 1 = Extremely low, and 7 = Extremely high.)

1. The level of my measured performance relative to my performance standards.
2. The level of my measured performance relative to other design engineers’ measured performance.
3. The level of my measured performance.

References


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