Performance Measure Properties and Delegation

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ABSTRACT: In this paper, I extend the organizational design literature by examining how the delegation choice is affected by the ability to resolve the incentive problem caused by this delegation. Based on the seminal papers by Grossman and Hart (1986) and Holmstrom and Milgrom (1994), I argue that the ability to resolve the incentive problem depends on the contractibility of financial performance measures versus non-financial performance measures, where the contractibility depends on the performance measure properties sensitivity, precision, and verifiability. The empirical results show that, if financial performance measures are “good” (“poor”) incentive measures, i.e., high (low) on sensitivity, precision, and verifiability, then using these measures for incentive purposes increases (decreases) delegation. Overall, the results are consistent with the argument that firms design their decision-making process around the quality of contractible performance measures.

Keywords: delegation; performance measure properties; contractibility; financial vs. nonfinancial performance measures; simultaneity.

Data Availability: Contact the author.

I. INTRODUCTION

In this paper, I examine how the quality of contractible performance measures affects the delegation choice. There is a large stream of literature on the design of incentive systems and the design of these systems for lower-level managers has received increased attention in the empirical accounting literature. For example, Bushman et al. (1995) and Keating (1997) examine the factors associated with the importance of specific types of performance measures used to reward lower-level managers. Although these studies provide valuable insights into the incentives provided to lower-level managers, none of these studies incorporate the link between delegation and incentives. This omission is likely to be problematic given that the delegation choice is one of the crucial organizational design variables and affects the extent to which incentives need to be provided.

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Empirical studies that address the determinants of delegation are rare. Baiman et al. (1995) examine the impact of the relative expertise of the principal and the relative importance of the business unit on the decision rights allocated to the business unit manager, but they ignore the effect of incentives. Recent studies by Nagar (2002), Abernethy et al. (2004), and Demers et al. (2004) do address the effect of performance measurement and incentives on delegation, but generally fail to find such an effect. For example, Nagar (2002) finds that incentive-based pay, which in his setting is predominantly based on earnings, does not affect delegation, although delegation does increase incentive-based pay. Similarly, Abernethy et al. (2004) find that the relative use of financial performance measures for incentive purposes does not affect the extent of delegation, but delegation does increase the emphasis on these measures. These results seem to suggest that once we delegate, we resolve the incentive problem by emphasizing financial measures for incentive purposes, but being able to resolve the incentive problem by emphasizing financial measures does not allow us to delegate. From a theoretical perspective, this conclusion is problematic, since the argument for the former relationship assumes the existence of the latter.

In this paper, I extend the organizational design literature by examining how the delegation choice is affected by the ability to resolve the incentive problem caused by this delegation. Based on the seminal papers by Grossman and Hart (1986) and Holmstrom and Milgrom (1994), I argue that the ability to resolve the incentive problem depends on the quality of contractible performance measures and, more specifically, on the quality of performance measures that aggregate information about all actions. An aggregate performance measure can complement the delegation choice because it provides the agent with the required discretion and the principal with an instrument to constrain the extraction of private benefits (Prendergast 2002). Comprehensive financial (accounting) measures are the most aggregate performance measures because they ultimately reflect the consequences of all decisions. However, the degree to which this aggregation feature can be exploited depends on the costs of contracting on financial measures. The more sensitive, precise, and verifiable financial measures are relative to other (nonfinancial) measures, the less costly it is to contract on financial measures. As a result, the better the relative incentive properties (quality) of financial performance measures, the greater their relative incentive use can complement the delegation choice, and thus the greater the extent of delegation.

I measure delegation as the day-to-day allocation of decision rights and the reason for using this particular measure is threefold. First, this measure of delegation allows for within-firm variation, which is necessary given the data limitations of using multiple respondents within a firm. Second, this measure of delegation has been used by Nagar (2002), Abernethy et al. (2004), and Demers et al. (2004) and allows me to tie my results back to these studies. Last, but not least, in contrast to more structural ways to implement delegation, such as divisionalization, the allocation of decision rights is the aspect of delegation that is most likely to be affected by incentive choices.

This paper contributes to the literature in the following ways. First, it empirically shows how the quality of contractible performance measures affects the delegation choice. More specifically, it shows that the relative incentive use of aggregate financial performance measures increases delegation when these measures have good incentive properties, which provides evidence that financial measures do play a role in the decision to delegate. Second, the results provide a plausible explanation for why previous research has been unable to find an effect of performance measurement and incentives on delegation, since these studies ignore the properties underlying the performance measures used for incentive purposes. Finally, it extends a small, but growing literature on the determinants of organizational design choices and enhances our knowledge of the interrelation between these choices.

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The data that I use in the empirical analysis consist of both survey data and archival data, the latter of which is used to validate the use of performance measures for incentive purposes. I define the use of performance measures for incentive purposes broadly in this paper. That is, it reflects how important the performance measures are for periodic evaluations, salary increases, annual bonuses, and promotion possibilities. I choose these aspects because they match the type of incentives provided to the managers participating in this study. The performance measure properties that I examine relate to the extent to which a performance measure is influenced by (1) the manager’s actions (sensitivity), (2) factors outside the control of the manager (precision), and (3) the measurement process (verifiability).

I find that, after controlling for the marginal benefits of delegation, the greater the relative sensitivity and precision of financial performance measures, the greater the returns to delegation when using these measures for incentive purposes. I further find that the greater the relative verifiability of financial performance measures, the greater the extent of delegation. Additional tests indicate that if financial performance measures are “poor” incentive measures, i.e., low on sensitivity, precision, and verifiability, then using these measures for incentive purposes creates an incentive-related cost of delegation and thus decreases delegation (cf., Nagar 2002). In contrast, if financial measures are “good” incentive measures, then using these measures for incentive purposes complements delegation choice and thus increases delegation (cf., Abernethy et al. 2004). These results are consistent with the argument that firms design their decision-making process around the quality of contractible performance measures (Prendergast 2002; Holmstrom and Milgrom 1994; Grossman and Hart 1986). When it is difficult or costly to contract on financial performance, firms reduce the need for incentive contracting by lowering the extent of delegation. Finally, robustness checks corroborate the above findings.

The remainder of this paper is organized as follows. In Section II, I present the theoretical analysis and hypothesis development. In Section III, I describe the sample selection and data collection and in Section IV the variable measurement and empirical specification. I discuss the empirical results in Section V. Finally, I provide a summary and conclusion in Section VI.

II. THEORY
Delegation and the Quality of Contractible Performance Measures

Organizational design, including the allocation of decision rights and the design of incentive systems, is the basic problem addressed by agency theory. In general, agency theory analyzes the situation in which a principal delegates authority to an agent and designs an incentive contract to motivate this risk and work-averse agent. The principal delegates authority to the agent because the agent has better decision-relevant information that is too costly to transfer due to, for example, the environmental uncertainty (Jensen and Meckling 1992). By doing this, the principal inevitably creates an incentive problem, which needs to be resolved through incentive contracting (Holmstrom 1979). Both Grossman and Hart (1986) and Holmstrom and Milgrom (1994) indicate that the design of firms reflect these contracting problems. These models demonstrate that when it is difficult or costly to contract on performance, firms arrange their affairs so as to reduce the need for incentive contracting (see also, Holmstrom 1999). The optimal allocation of decision rights is therefore affected by the ability to resolve the incentive problem caused by this allocation (Hubbard 2000).

To provide a simple formalization of the above discussion, I specify the value of delegation $V$ as follows (cf., Baker and Hubbard 2003):
\[ V = V + ms - M(s, \sigma) \]  

(1)

where \( V \) is a fixed quantity, \( s \) is the scope of the manager’s activities due to the allocation of decision rights, \( m \) is the marginal benefit of allocating decision rights, \( \sigma \) is the ability to resolve the incentive problem, and \( M(s, \sigma) \) is agency costs. I assume that \( M_1 > 0, M_{11} > 0, M_2 < 0, \) and \( M_{12} < 0 \), i.e., agency costs are increasing and convex in delegation, agency costs are decreasing in the ability to resolve the incentive problem, and the increased agency costs associated with delegation are lower the greater the ability to contract.

The optimal allocation of decision rights is then determined by setting the marginal costs of this allocation equal to the marginal revenues, i.e.:

\[ m = M_1(s^*, \sigma). \]  

(2)

Given the above assumptions, Equation (2) is invertible and the optimal allocation of decision rights is characterized by:

\[ s^* = \phi(m, \sigma). \]  

(3)

Equation (3) indicates that the optimal allocation of decision rights increases with increases in (a) the marginal benefits of delegation and (b) the ability to resolve the incentive problem caused by delegation. In this paper, I argue that the incentive properties (or quality) of some performance measures give these measures inherently greater potential to resolve the delegation-incentive problem, but the degree to which this potential can be exploited depends upon the cost to contract on these measures relative to other measures.

**Delegation and Financial versus Nonfinancial Performance Measures**

Broadening the scope of an agent’s activities by delegating more decision rights provides the agent with substantial degrees of freedom to make trade-offs among these activities (Prendergast 2002; Jensen 2001). This creates a need for performance measures that allow for (more) discretion, but at the same time creates a need for constraining the agent’s actions to prevent the extraction of private benefits.

Prendergast (2002) argues that this delegation-incentive problem can be addressed by tying pay to an aggregate measure of performance. “Aggregate” performance measures are measures that provide (some) information about “all” actions, while “specific” performance measures are measures that provide (some) information about a subset of actions. The use of an aggregate measure provides incentives for the agent to make trade-offs among all available activities, supporting the delegation of decision rights (Prendergast 2002). The aggregate measure also allows the principal to constrain the agent’s actions to those in the principal’s interest by tying this measure to pay. As a result, an aggregate performance measure can complement the delegation choice by allowing discretion to those with decision-relevant information (the agent), while also providing those lacking this information (the principal) with an instrument to constrain the extraction of private benefits (cf., Prendergast 2002).

Two other reasons for why aggregate measures complement the delegation choice are the following. First, when broadening the scope of activities, it is simply too costly to have performance measures for each type of activity (Ittner and Larcker 2002; Banker and Datar 1989; Holmstrom and Milgrom 1987), which results in an increased preference for aggregate measures. Second, aggregation complements delegation as it allows the firm to economize on bounded rationality (Arya et al. 2004; Williamson 1975).

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In contrast, using specific measures for subsets of the agent’s available actions reduces the ability to make trade-offs, which effectively reduces delegation (Abernethy et al. 2004; Jensen 2001). Moreover, since the benefits of delegation are highest in settings where the principal has no idea what the agent should be doing, it is difficult to tie pay to multiple specific performance measures because the principal is unable to identify the specific actions the agent should take and, therefore, the specific measures and their weighting (Prendergast 2002).

Comprehensive financial (accounting) measures, such as net income or return on assets, represent the most aggregate performance measures because the full consequences of every action the agent takes ultimately flow through the financial statements. Various types of nonfinancial performance measures can also aggregate information about the agent’s actions to some extent. For example, market-share provides information about all of the agent’s customer acquisition decisions. Similarly, defect rates provide information about all of the agent’s quality improvement activities. However, neither measure reflects the full consequences of these decisions, such as the costs of achieving market-share or defect goals or their revenue implications. More importantly, they do not capture decisions other than customer acquisition and/or quality initiatives. In this respect, nonfinancial measures are “specific” performance measures, in the sense that they provide (some) information about a specific subset of actions (cf., Ittner and Larcker 1998; Fisher 1995; Wruck and Jensen 1994). This suggests that the principal will prefer the incentive use of comprehensive financial measures to the incentive use of more specific nonfinancial measures when delegation is greater.

However, the extent to which this aggregation feature of financial performance measures can be exploited for delegation purposes depends on the associated contracting costs. The contracting costs are driven by the incentive properties of the performance measures and in particular by the extent to which these measures are sensitive, precise, and verifiable. In general, the more precise and verifiable a measure, and the more sensitive it is to managerial actions, the greater the returns to using this measure for incentive purposes, relative to other measures (Feltham and Xie 1994; Banker and Datar 1989; Holmstrom 1979). The costs of contracting on aggregate financial measures can therefore be determined by using the specific nonfinancial measures as a benchmark, i.e., the more sensitive, precise, and verifiable financial measures are relative to nonfinancial measures, the less costly it is to contract on the financial measures.

As a result, the better the relative incentive properties (or quality) of financial performance measures, the greater the relative incentive use of these measures is able to address the incentive problem associated with delegation and, thus, the greater the extent of delegation.3 Within this context, the ability to resolve the incentive problem σ in Equation (3) can therefore be written as:

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2 As an example, an agent could dramatically drop the price and/or increase expenditures on advertising and customer service to increase market-share. Although this increase in market-share makes this measure informative about the two decisions, it does not reflect the full revenue and cost consequences of these decisions.

3 I focus on the relative incentive use for the following reason. The argument is that aggregation of information for incentive purposes has the potential to complement delegation. Even though a higher absolute use of financial measures implies a higher absolute use of aggregate measures, this does not necessarily imply more aggregation for incentive purposes. In a given period, the absolute use of nonfinancial measures could be as high or even higher, which results in an emphasis on more specific measures and, thus, less overall aggregation. The relative incentive use of financial measures more accurately reflects the focus on overall aggregation and is also consistent with Abernethy et al. (2004) and Demers et al. (2004).
and the optimal delegation of decision rights $s^*$ as:

$$s^* = \phi(m, \frac{INC_{FIN}}{INC_{NONFIN}} \cdot \frac{QUAL_{FIN}}{QUAL_{NONFIN}})$$

(5)

where $INC_{FIN}$ ($INC_{NONFIN}$) is the incentive use of financial (nonfinancial) performance measures and $QUAL_{FIN}$ ($QUAL_{NONFIN}$) is the quality of financial (nonfinancial) performance measures, as determined by the incentive properties. Equation (5) shows that the impact of the relative incentive use of financial performance measures on delegation is conditional on the relative quality of these measures. Based on the above discussion, I state the following hypothesis.

**H1:** The impact of the relative incentive use of financial performance measures on the extent of delegation is increasing in the relative quality of these measures, as reflected by their relative incentive properties.

### III. SAMPLE AND DATA

To test the prediction stated in the previous section, I gathered data from multiple sources. The primary data are survey questionnaire data, while the secondary data are interview data and proprietary archival data. Survey data are available for 105 managers employed in 6 firms. This section presents details on the sample selection and data collection.

**Sample of Firms**

This paper focuses on how the incentive use and properties of different types of performance measures affect delegation. In order to select the firms of interest to this study, I used the following procedure. I contacted Hay Management Consultants (HMC) and explained the research question of this study. HMC provided a list of clients that were likely to be eligible for this study, which contained the name of the firm, name of the Human Resource Manager, firm address, and telephone number.

I called the Human Resource (HR) managers of 50 firms to explain the research study and solicit their participation. Participation, at first, meant giving an interview. Out of the

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4 More specifically, Equations (3) and (5) imply that the following is true:

$$\frac{\partial s^*}{\partial \left( \frac{INC_{FIN}}{INC_{NONFIN}} \cdot \frac{QUAL_{FIN}}{QUAL_{NONFIN}} \right)} = \phi_2(\cdot) \left( \frac{QUAL_{FIN}}{QUAL_{NONFIN}} \right) = -\frac{M_{12}(\cdot)}{M_{11}(\cdot)} \left( \frac{QUAL_{FIN}}{QUAL_{NONFIN}} \right) > 0.$$

I assume that the agency cost function $M(\cdot)$ is such that the cross-partial:

$$\frac{\partial^2 s^*}{\partial \left( \frac{INC_{FIN}}{INC_{NONFIN}} \right) \partial \left( \frac{QUAL_{FIN}}{QUAL_{NONFIN}} \right)}$$

is positive.
50 firms, 15 (30 percent) agreed to an interview. Noteworthy is that the majority of
the firms (17) that did not agree to participate were firms that were currently implementing
a new or “updated” incentive system, which they characterized as “politically sensi-
tive.” Other reasons for nonparticipation were time constraints (11), reorganizations (5),
and mergers (2).

The interview with the HR managers served two purposes. First, the interview was
used to get a better understanding of the incentive system in place. It was important to
examine if performance evaluation and compensation were a real issue and to what extent
incentive compensation was important. This facilitated a more specific selection of firms
relevant to this study. Second, the interview was used to ask the HR manager to support
the research and to be its “champion” within the firm.

During the interviews, the content of participation was discussed in more depth. I
explained that participation implied (1) the selection of respondents, (2) the distribution
of questionnaires by internal mail, (3) the attachment of a letter of endorsement by the HR
manager or a higher-level official, (4) administrative support for follow-up procedures, and
(5) the provision of a detailed description of the respondents’ annual bonus plan. Of the
15 firms interviewed, six declined further collaboration. The reasons why these firms did
not participate were that they did not allow me to go “into the firm” (four firms) or that
they did not have an incentive system (two firms). Of the nine firms that agreed to partic-
ipate, three requested a more tailor-made study. To assure uniformity of the research design,
I decided to design a separate study for each of these firms and to exclude them from the
current study. As a result, the final sample consists of six firms. For completeness, it should
be noted that none of these six firms have a long-term incentive plan, stock option plan,
or any other equity ownership plan. In general, the firms provide incentives to their man-
agers through periodic evaluations, salary increases, annual bonuses, and promotion pos-
sibilities. Descriptive statistics of the participating firms are provided in Table 1. The ac-
tivities of the firms relate to the provision of services, trading, and production. Firm size,
measured by the number of employees, ranges from 354 to 12,207.

Sample of Respondents

After the firms agreed to participate in the study, the HR manager of each firm selected
the sample of respondents. In making the selection, the HR managers were given three
criteria on which they should base their selection. First, the respondents should have man-
gerual responsibilities, either as head of a functional department or as head of a division,
business unit or something similar. To assure a minimum level of managerial responsibil-
ities, the respondent’s job design should have a weight greater than 400 Hay-points.5 Sec-
ond, the respondent should have an annual bonus plan. Finally, the respondent should have
experienced at least one annual performance evaluation cycle.

The HR managers were specifically asked to select as many respondents as possible
and as diverse as possible within the above three constraints. Within-firm variance in the
two main choice variables in this study, i.e., extent of delegation and the relative incentive
use of financial performance measures, should be observed for the following reason. The
same performance measure in the same firm is unlikely to have the same incentive prop-
erties for different groups of employees within the firm. A diverse selection of respondents
should therefore create a sample of employees within a firm who contribute differently to

5 The Hay-points are based on the Hay Guide Chart Profile Method, a system that compares the value of jobs
based on multiple factors such as accountability and know-how (Flannery et al. 1996, 20). A weight greater
than 400 relates to higher-level personnel.
TABLE 1
Descriptive Statistics of Participating Firms
(n = 6)

<table>
<thead>
<tr>
<th>Firm</th>
<th>Activity</th>
<th># of Employees</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Provision of financial services</td>
<td>1,690</td>
<td>9</td>
</tr>
<tr>
<td>B</td>
<td>Trade of machinery and provision of technical services</td>
<td>12,207</td>
<td>28</td>
</tr>
<tr>
<td>C</td>
<td>Provision of life and indemnity insurance</td>
<td>1,275</td>
<td>14</td>
</tr>
<tr>
<td>D</td>
<td>Trade of pharmaceutical products</td>
<td>401</td>
<td>31</td>
</tr>
<tr>
<td>E</td>
<td>Production of food products</td>
<td>7,482</td>
<td>5</td>
</tr>
<tr>
<td>F</td>
<td>Financial leasing</td>
<td>354</td>
<td>18</td>
</tr>
</tbody>
</table>

The same type of measure of performance and are also exposed to different externalities. Furthermore, within a hierarchy, it is each supervisor’s individual decision how much emphasis to put on what measure for incentive purposes (broadly defined) and how much of the day-to-day decisions to delegate, though obviously within certain boundaries. These differences and (relative) freedom of choice should create within-firm variance in the variables of interest. The selection by the HR managers resulted in 202 managers who were asked to participate in the study.

**Questionnaire Design**

To maximize the response rate, I designed the questionnaire according to the guidelines of Dillman’s (1978) *Total Design Method*. I pre-tested the questionnaire with seven academics and all six HR managers, which resulted in minor revisions of the questionnaire. Furthermore, I administered a follow-up by telephone and mail. Of the 202 questionnaires that were distributed, 114 were returned. This corresponds to an overall response rate of 56 percent. Of the 114 questionnaires returned, nine have missing data and the final sample therefore consists of 105 observations.

As the response rate is not 100 percent, though satisfactory, I conduct a test for nonresponse bias. I split the sample at the firm-specific median response time and calculate a t-test for differences in means for each of the variables of interest to this study. The results indicate that there are no significant differences between early and late respondents for any of the variables. This suggests the absence of nonresponse bias.

For the two main choice variables in this study, i.e., extent of delegation and the relative incentive use of financial performance measures, the within-firm variance as a percentage of total variance equals 72 percent and 73 percent, respectively. Furthermore, the within-firm variance for delegation (relative incentive use of financial performance measures) ranges from 70–77 percent (70–79 percent) after piece-wise deletion of each firm, which indicates that this variance is not driven by a single firm. As a result, the selection of respondents was successful in terms of creating within-firm variance in the sample.

**Proprietary Archival Data**

Of the six firms, five firms provided archival data with respect to the annual bonus contract of the respondents. This data is used to validate the survey-based measures of performance measure use. Four firms have bonus contracts for their managers that are uniform in terms of the percentage of the bonus that is dependent on financial (nonfinancial)

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6 Similar results apply for the piece-wise deletion of groups of two firms.
performance, although the number of performance measures in each category can vary significantly across managers.\textsuperscript{7} However, I have no data with respect to the number of performance measures for each of the respondents in these four firms. Two firms have tailor-made manager-specific contracts, but only one firm provided that data.\textsuperscript{8} As a result, archival data are available for 87 of the 105 managers for five out of six firms. The sample used to validate the survey-based measure of incentive use of performance measures is therefore a (large) subset of the full sample used to test the hypothesis.

\textbf{IV. VARIABLE MEASUREMENT AND EMPIRICAL SPECIFICATION}

In this section, I describe the measurement of the variables used in the empirical analysis and the empirical specification used to test the prediction stated in Section II. All measurement instruments are presented in Appendix A.

\textbf{Delegation}

I measure delegation of authority by taking the scale used by Gordon and Narayanan (1984), which is similar to that used by Nagar (2002) and Abernethy et al. (2004). The instrument asks the respondents to indicate the extent to which they have decision-making authority with respect to (1) development of new products and services, (2) hiring and firing of personnel, (3) selection of large investments, (4) budget allocations, and (5) pricing decisions. A five-point, fully anchored scale is used to indicate the level of authority. Principal component analysis reveals one factor with an eigenvalue greater than 1, which explains 51 percent of the total variance. The factor loadings of the five items range from 0.58 to 0.82. Given that all five items appear to measure one underlying construct, I compute the \textit{DELEGATION} construct by summing and averaging the standardized scores of the five items (Cronbach’s $\alpha = 0.76$).\textsuperscript{9}

\textbf{Relative Incentive Use of Financial Performance Measures}

I measure the relative use of financial performance measures for incentive purposes by comparing the importance of financial measures for evaluating and compensating the managers to that of nonfinancial measures. In order to measure this construct and the related performance measure properties as accurate as possible, I focus on three types of performance measures: (1) financial, (2) internal nonfinancial, and (3) external nonfinancial. This classification is partly based on prior literature (e.g., Ittner et al. 1997; Larcker 1981) and partly on the interviews with the human resource managers of the participating firms. First, the financial performance measures are defined as the “traditional” aggregate financial performance measures, such as return on assets and net income.\textsuperscript{10} Second, the internal nonfinancial performance measures consist of nonfinancial measures that are directly related

\textsuperscript{7} As an example, one of the four firms provided me, on request, the opportunity to look into a number of manager-specific contracts. For all these managers, 43.75 percent of the bonus was based on nonfinancial performance measures, but the number of nonfinancial performance measures for each manager ranged from 4 to 12. Given the incentives for a particular performance category, increasing the number of performance measures within that category can lead to a dilution of incentives if managers need to spread their effort over too many measures. As a result, the number of performance measures significantly affects the actual level of incentives provided to managers.

\textsuperscript{8} The archival data can be linked to the questionnaire data through codes. Each questionnaire contains a unique code that is printed on the final page of the questionnaire. The HR manager provides the archival data mentioning the codes instead of the respondent’s name, which does not violate the anonymity principle.

\textsuperscript{9} In computing all constructs, I use unit-weighted average standardized scores because these have preferred psychometric properties relative to regression estimates of factor scores (Grice and Harris 1998).

\textsuperscript{10} All examples presented with respect to each type of performance measure are measures actually used for incentive purposes by the participating firms.
to the tasks performed. Examples of these performance measures are productivity, efficiency, and successful implementation of projects. Finally, the external nonfinancial performance measures are defined as those nonfinancial measures that reflect performance in the market. Examples of these performance measures are customer satisfaction, market share, and market growth.

For each type of performance measure, I use eight items to measure its importance for (1) evaluation purposes, (2) monetary compensation, and (3) nonmonetary rewards. I use these specific items because they are in accordance with the actual type of incentives provided by the participating firms. A five-point, fully anchored scale is used to indicate the importance of each type of performance measure for incentive purposes. To measure the relative incentive use, I calculate for each item the difference between the scores for financial performance measures and the two nonfinancial performance measures by subtracting from the financial performance measure response both of the responses for the nonfinancial measures.

Principal component analysis of the relative measures of the eight items reveals one factor with an eigenvalue greater than 1, explaining 65 percent of the total variance. The factor loadings of the eight items range from 0.73 to 0.88. Based on these results, I compute the construct $REL_{INC,FPM}$ by summing and averaging the standardized scores of the eight items (Cronbach’s $\alpha = 0.92$).

To validate this survey-based construct of the relative use of financial performance measure for incentive purposes, I test whether $REL_{INC,FPM}$ is consistent with the relative weight on financial performance measures (%FPM) stated in the annual bonus contract. Despite the fact that the annual bonus is but one of the many types of incentives provided to the managers in this study, the information contained in the annual bonus systems should be sufficient to allow for a validation of the survey-based measure. I split the sample into two groups of approximately equal size based on the median reported %FPM. I specifically test whether the mean within each subsample is significantly different from zero and whether the means between subsamples are significantly different. The results indicate that in the “low-%FPM” subsample, the mean relative incentive use of financial performance measures is significantly negative ($p < 0.05$; two-tailed), which implies that the relative incentive use of financial performance measures in this subsample is, on average, significantly lower than in the full sample. The opposite applies to the “high-%FPM” subsample, in which the mean relative incentive use of financial performance measures is significantly positive ($p < 0.01$; two-tailed). Further, the means of the two subsamples are significantly different from each other ($p < 0.01$; two-tailed). These results provide some evidence of the validity of the survey-based measure.

**Performance Measure Properties**

To measure the performance measure properties, I develop new constructs. The survey questionnaire contains, for both financial and the two nonfinancial performance measures, 15 statements concerning the performance measure properties. A five-point, fully anchored scale is used to indicate the level of agreement with these statements. The 15 statements, listed in Table 2, relate to the extent to which each type of performance measure is influenced by (1) the manager’s actions, (2) factors outside the control of the manager, and (3) the measurement process. For each item, I calculate the difference between the scores for financial performance measures and the two nonfinancial performance measures by subtracting from the financial performance measure response both of the responses for the nonfinancial measures.
TABLE 2
Principal Component Analysis with Oblique Rotation of the 15 Items Related to the Properties of Financial Performance Measures Relative to those of Nonfinancial Performance Measures
(only factors loadings > 0.45 are shown; n = 105)

<table>
<thead>
<tr>
<th>Items</th>
<th>Relative Sensitivity</th>
<th>Relative Precision</th>
<th>Relative Verifiability</th>
</tr>
</thead>
<tbody>
<tr>
<td>My performance expressed in financial performance measures is strongly affected by</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. ... changes in economic conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. ... decisions made in other parts of the organization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. ... changes in the behavior of customers</td>
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</tr>
<tr>
<td>d. ... changes in the behavior or strategies of suppliers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. ... changes in the behavior or strategies of competitors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Whether I function well or not as a manager can be expressed accurately in financial performance</td>
<td>0.48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Many of the activities and tasks that I perform do not show up in financial performance a</td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. If I perform well as a manager, it is directly reflected in better financial performance</td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Working hard leads to better financial performance</td>
<td>0.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. Devotion and effort in my job leads to better financial performance</td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. Providing effort in my job leads to better financial performance</td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>l. The measurement of financial performance is objective and verifiable</td>
<td></td>
<td></td>
<td>0.76</td>
</tr>
<tr>
<td>m. The measurement of financial performance is done by objective persons</td>
<td></td>
<td></td>
<td>0.91</td>
</tr>
<tr>
<td>n. An independent person verifies the measurement of financial performance</td>
<td></td>
<td></td>
<td>0.88</td>
</tr>
<tr>
<td>o. The measurement of financial performance is predominantly of a quantitative nature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eigenvalue</td>
<td>3.66</td>
<td>2.45</td>
<td>1.91</td>
</tr>
</tbody>
</table>

aThis item is reverse-coded.
Principal component analysis of the relative measures of the 15 items reveals three independent factors with eigenvalues greater than 1, explaining 53 percent of the total variance. The factor loadings after applying oblique rotation are shown in Table 2. Examining the factor loadings reveals that the items loading on factor 1 relate to the impact the manager has on performance, the items loading on factor 2 relate to the impact of uncontrollable factors, while the items loading on factor 3 relate to the objectivity and verifiability of the measure. Given the results of the principal component analysis, I use the following three performance measure properties in the empirical analysis: (1) relative sensitivity of financial performance measures ($REL_{SEN}\_FPM$), (2) relative precision of financial performance measures ($REL_{PREC}\_FPM$), and (3) relative verifiability of financial performance measures ($REL_{VERIF}\_FPM$). I measure the constructs $REL_{SEN}\_FPM$, $REL_{PREC}\_FPM$, and $REL_{VERIF}\_FPM$ by summing and averaging the standardized scores of the items that load on respectively factor 1, factor 2, and factor 3. Cronbach’s alphas for these measures are 0.81, 0.70, and 0.83, respectively.

Control Variables

As stated in Equation (3), the extent of delegation is also affected by the marginal benefits of delegation, which relate to the cost of transferring knowledge from lower levels in the organization to the top (Christie et al. 2003; Jensen and Meckling 1992). The greater the knowledge transfer cost the greater the delegation of authority. Both the external environment and the internal environment of an organization affect the knowledge transfer costs. The knowledge transfer costs are especially high in uncertain environments and in larger firms (Christie et al. 2003; Jensen and Meckling 1992). If environmental uncertainty increases, then there is a need to respond quickly to changes in the environment and, since it is too costly for top management to acquire the necessary information for this purpose, delegation increases (e.g., Nagar 2002). Furthermore, if the size of the unit is large, then the amount of information that needs to be processed and transferred is too large and therefore too costly, which results in increased delegation (e.g., Christie et al. 2003; Jensen and Meckling 1992). Finally, if there are multiple hierarchical levels, then it is costly to centralize decision making, since this would require direct communication with and the transfer of knowledge from each individual layer (Melumad et al. 1992). Although such a hierarchical structure can distribute the burden of information processing more evenly within the organization, the benefits of this are only received when decision rights are actually delegated (e.g., Melumad et al. 1992, 1995), which implies that delegation is higher when multiple hierarchical layers are present.\(^\text{11}\) Based on prior theory, I include environmental uncertainty, size, and the number of hierarchical levels as control variables for the marginal benefits of delegation.

The environmental uncertainty variable is derived from the scales used by Govindarajan (1984) and Merchant (1990) and consists of five attributes with respect to the respondent’s work environment. The five attributes relate to the behavior of (1) customers, (2) competitors, and (3) suppliers, as well as (4) technological developments and (5) political and/or legal changes. Ten items are used to indicate to what extent each of these five attributes is predictable and has on impact on the respondent’s job and unit. A six-point, fully anchored

\(^{11}\) The hierarchical structure is potentially an endogenous variable. However, such a structural decision is most likely to precede the choices of the incentive use of performance measures and the day-to-day allocation of decision rights, and I therefore assume that it is exogenous in the empirical analysis. The results presented in the next section are not sensitive to the inclusion of the proxy for the number of hierarchical levels.
scale is used, which consists of a five-point scale to indicate the extent of predictability and impact and an additional option that can be used to indicate that the specific factor is not part of the respondent’s work environment.

Similar to the way in which Khandwalla (1972) and Libby and Waterhouse (1996) measure competition, I compute the environmental uncertainty variable by multiplying, for each attribute, the ratings on impact by predictability and taking the square root of the product. Principal component analysis reveals two factors with an eigenvalue greater than 1 that explain 60 percent of the total variance. After oblique rotation of the factor solution, the following two indicators of environmental uncertainty are identified: (1) uncertainty related to the input-side of the firm (ENV_UNC_IN; attributes: technological developments and the behavior of suppliers) and (2) uncertainty related to the output-side of the firm (ENV_UNC_OUT; attributes: behavior of customers and competitors). As a result, I measure ENV_UNC_IN and ENV_UNC_OUT by summing and averaging the standardized scores of their respective two attributes (Cronbach’s α = 0.62 for both constructs).

I measure SIZE by the ratio of the number of employees within the manager’s unit to the total number of employees. The number of hierarchical levels is proxied by the dummy variable HIER_LEVELS, which equals 1 if there are multiple hierarchical levels below the manager’s unit, and 0 otherwise.

Descriptive statistics for all variables are provided in Table 3, while Table 4 presents the Pearson and Spearman correlations between the independent variables, none of which cause multicollinearity concerns. Table 4 shows that, among the performance measure properties, only REL SEN FPM and REL VERIF FPM are significantly correlated (positive). In addition, REL SEN FPM and REL VERIF FPM are significantly positively correlated.

---

**TABLE 3**

Descriptive Statistics of Variables
(n = 105)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Actual Range</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>DELEGATION</td>
<td>0</td>
<td>0.71</td>
<td>−1.82–1.49</td>
<td>0.76</td>
</tr>
<tr>
<td>REL INC FPM</td>
<td>0</td>
<td>0.81</td>
<td>−2.50–2.15</td>
<td>0.92</td>
</tr>
<tr>
<td>REL SEN FPM</td>
<td>0</td>
<td>0.71</td>
<td>−1.63–1.94</td>
<td>0.81</td>
</tr>
<tr>
<td>REL PREC FPM</td>
<td>0</td>
<td>0.73</td>
<td>−2.31–1.65</td>
<td>0.70</td>
</tr>
<tr>
<td>REL VERIF FPM</td>
<td>0</td>
<td>0.86</td>
<td>−1.61–2.07</td>
<td>0.83</td>
</tr>
<tr>
<td>ENV UNC IN</td>
<td>0</td>
<td>0.86</td>
<td>−2.71–1.78</td>
<td>0.62</td>
</tr>
<tr>
<td>ENV UNC OUT</td>
<td>0</td>
<td>0.85</td>
<td>−4.04–1.91</td>
<td>0.62</td>
</tr>
<tr>
<td>SIZE</td>
<td>0.04</td>
<td>0.07</td>
<td>0.00–0.63</td>
<td>—</td>
</tr>
<tr>
<td>HIER LEVELS (dummy)</td>
<td>0.32</td>
<td>0.47</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

See Appendix A for variable measurement and definitions.

---

12 The five-point scale for “impact” ranges from low impact (score of 1) to high impact (score of 5) and for “predictability” from high predictability (score of 1) to low predictability (score of 5). If the attribute is not relevant, then a score of 0 is attached to that attribute regarding its impact and predictability. For each of the five attributes, I multiply the score for impact by that for predictability, where higher scores for the product term reflect greater uncertainty and the scores range from 0 to 25. The logic underlying the multiplication is that given the impact of the attributes, increased unpredictability makes it more difficult to control for this impact, which increases uncertainty. Finally, for each attribute, I take the square root of the product term to revert back to a six-point scale (0–5).
### TABLE 4
Correlation Coefficients between the Independent Variables
(n = 105)

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. REL_INC_FPM</td>
<td>1.00</td>
<td>0.53***</td>
<td>-0.00</td>
<td>0.31***</td>
<td>0.03</td>
<td>0.08</td>
<td>-0.10</td>
<td>0.35***</td>
</tr>
<tr>
<td>2. REL_SEN_FPM</td>
<td>0.48***</td>
<td>1.00</td>
<td>-0.05</td>
<td>0.30***</td>
<td>-0.05</td>
<td>-0.01</td>
<td>0.01</td>
<td>0.08</td>
</tr>
<tr>
<td>3. REL_PREC_FPM</td>
<td>0.03</td>
<td>-0.04</td>
<td>1.00</td>
<td>-0.08</td>
<td>0.21**</td>
<td>0.01</td>
<td>-0.11</td>
<td>0.07</td>
</tr>
<tr>
<td>4. REL_VERIF_FPM</td>
<td>0.32***</td>
<td>0.30***</td>
<td>-0.09</td>
<td>1.00</td>
<td>-0.03</td>
<td>0.10</td>
<td>-0.10</td>
<td>0.20**</td>
</tr>
<tr>
<td>5. ENV_UNC_IN</td>
<td>0.11</td>
<td>-0.03</td>
<td>0.17*</td>
<td>-0.03</td>
<td>1.00</td>
<td>0.17*</td>
<td>-0.16*</td>
<td>0.15</td>
</tr>
<tr>
<td>6. ENV_UNC_OUT</td>
<td>0.10</td>
<td>-0.06</td>
<td>-0.00</td>
<td>0.09</td>
<td>0.26***</td>
<td>1.00</td>
<td>0.04</td>
<td>0.21**</td>
</tr>
<tr>
<td>7. SIZE</td>
<td>0.08</td>
<td>0.11</td>
<td>-0.05</td>
<td>-0.07</td>
<td>-0.07</td>
<td>-0.09</td>
<td>1.00</td>
<td>0.02</td>
</tr>
<tr>
<td>8. HIER_LEVELS</td>
<td>0.36***</td>
<td>0.08</td>
<td>0.11</td>
<td>0.19**</td>
<td>0.16</td>
<td>0.22**</td>
<td>0.10</td>
<td>1.00</td>
</tr>
</tbody>
</table>

***, **, * Significant at the 1 percent, 5 percent, and 10 percent levels, respectively (two-tailed).
Pearson (Spearman) correlation coefficients are presented below (above) the diagonal.
See Appendix A for variable measurement and definitions.
with \( REL\_INC\_FPM \). Finally, although the principal component analysis revealed two separate constructs for environmental uncertainty, these constructs are significantly positively correlated.

**Empirical Specifications**

Based on Equation (5), the hypothesis, and the above identification of variables, I estimate the following two equations to examine the determinants of the extent of delegation:

\[
DELEGATION_{ij} = \alpha_0 + \sum_{j=1}^{5} \alpha_j D_j + \alpha_{\text{ENV\_UNC\_IN}}_{ij} + \alpha_{\text{ENV\_UNC\_OUT}}_{ij} + \alpha_{\text{SIZE}}_{ij} + \alpha_{\text{HIER\_LEVELS}}_{ij} + \alpha_{\text{REL\_SEN\_FPM}}_{ij} + \alpha_{\text{REL\_PREC\_FPM}}_{ij} + \alpha_{\text{REL\_VERIF\_FPM}}_{ij} + \epsilon_{ij}^{1}
\]

(6)

\[
DELEGATION_{ij} = \alpha_0 + \sum_{j=1}^{5} \alpha_j D_j + \alpha_{\text{ENV\_UNC\_IN}}_{ij} + \alpha_{\text{ENV\_UNC\_OUT}}_{ij} + \alpha_{\text{SIZE}}_{ij} + \alpha_{\text{HIER\_LEVELS}}_{ij} + \alpha_{\text{REL\_SEN\_FPM}}_{ij} + \alpha_{\text{REL\_PREC\_FPM}}_{ij} + \alpha_{\text{REL\_VERIF\_FPM}}_{ij} + \alpha_{\text{REL\_INC\_FPM}}_{ij} \times \text{REL\_SEN\_FPM}_{ij} + \alpha_{\text{REL\_INC\_FPM}}_{ij} \times \text{REL\_PREC\_FPM}_{ij} + \epsilon_{ij}^{2}.
\]

(7)

The variables relate to manager \( i \) in firm \( j \) and \( D_j \) is a dummy variable that is 1 if firm \( j \), and 0 otherwise, in order to control for firm-level effects. Both Equations (6) and (7) estimate whether delegation is a function of environmental uncertainty (input- and output-related), size, number of hierarchical levels, and the relative sensitivity, precision, verifiability, and incentive use of financial performance measures. Equation (6) examines whether there exists a direct association between delegation and the relative incentive use of financial performance measures. This equation is, more or less, consistent with the empirical specifications used in previous studies (e.g., Abernethy et al. 2004; Demers et al. 2004) and is therefore estimated as a first step to tie my results back to these studies. Equation (7), on the other hand, explicitly tests the hypothesis that the association between delegation and the relative incentive use of financial performance measures is a positive function of the performance measure properties. That is, it examines whether financial performance measures with better incentive properties lead to greater returns to delegation when using these measures for incentive purposes. Hypothesis 1 specifically predicts that the coefficients for the interaction terms \( \alpha_{14t} \), \( \alpha_{15t} \), and \( \alpha_{16t} \) are positive.

Both Equations (6) and (7) are initially estimated using OLS. However, to control for the possibility that the choice variable “relative incentive use of financial performance measures” causes endogeneity within the structural model of interest, I also estimate both equations using two-stage least squares (TSLS). Given that Equation (7) examines interactions between the endogenous variable and multiple exogenous variables, I estimate this...
equation using the Heckman and Vytlacil (1998) two-stage least squares estimator (hereafter, HV-estimator). This method basically (1) estimates the endogenous variable (first-stage), (2) uses the predicted values to create the interaction terms, and then (3) uses the predicted values and created interactions in estimating Equation (7) (second-stage).\(^\text{13}\)

To apply TSLS, it is necessary to have instruments, i.e., variables that are correlated with the explanatory variable (relevant) and uncorrelated with the structural error term (exogenous). I use two instrumental variables for the relative incentive use of financial performance measures that are intuitively appealing and for which specification tests indicate they are relevant and exogenous. The instruments that I use for the relative incentive use of financial performance measures focus on the extent to which managers are able to effectively communicate in financial (nonfinancial) terms because of their functional background. I expect that the relative incentive use of financial performance measures is higher (lower) for those managers who are (not) able to effectively communicate in financial terms. Specifically, I expect that managers with a functional background in sales are able to effectively communicate in financial terms, while managers with a functional background in R&D are much more able to effectively communicate in nonfinancial terms. Although functional background can affect the type of task that is performed, there is no reason to assume that it affects the extent of delegation. Thus, I expect functional background to satisfy both the relevance and exogeneity criterion.

To determine relevance, I test for the first-stage exclusion restriction and the partial \(R^2\). The first-stage exclusion restriction tests the (joint) significance of adding the instruments to the reduced form equation, while the partial \(R^2\) tests how much of the unexplained variance in the reduced form equation can be explained by adding the instruments (e.g., Wooldridge 2002; Bound et al. 1995). The results show that the test of the first-stage exclusion restriction is significant (\(p < 0.01\)) and the partial \(R^2\) equals 10 percent, which provides evidence of relevance. To determine exogeneity of the instruments, I test for the over-identifying restrictions. This test regresses the residuals of the second-stage on all exogenous variables, where the \(R^2\) of the model should be close to zero if the instruments are exogenous (e.g., Larcker and Rusticus 2004; Wooldridge 2002).\(^\text{14}\) The test of the over-identifying restrictions indicates that the null-hypothesis of exogenous instruments cannot be rejected. The problem with this latter test is that it can have low power to detect endogeneity in small samples. I therefore perform a sensitivity analysis, which Larcker and Rusticus (2004) label as the “unconstrained second-stage.”\(^\text{15}\) The results of the sensitivity analysis (for Equation (6)) show that the coefficients for the instruments are very close to

\(^{13}\) An alternative for the HV-estimator to estimate equations with interactions between endogenous and exogenous variables is the instrumental variable (IV) estimator (Wooldridge 2003). As stated, the HV-method uses the predicted values of the endogenous variable and the interactions created with these predicted values as variables in Equation (7). In contrast, the IV-method proposed by Wooldridge (2003) uses the predicted values of the endogenous variable and the interactions created with these predicted values as instruments and subsequently estimates Equation (7) using IV procedures. The difference between the HV-method and the IV-method is that the latter method does not require the linearity assumption in the first-stage reduced form equation to hold and differences can thus arise if this requirement does not hold. Although the regression specification error test (RESET) proposed by Ramsey (1969) cannot reject the null-hypothesis that the reduced form equation is correctly specified, I re-estimate Equation (7) using the method proposed by Wooldridge (2003). The results, not tabulated, are qualitatively similar to those reported in Table 5 and show that all coefficients have the same sign and approximately the same magnitude as the HV-estimators.

\(^{14}\) Formally, \(nR^2\) is distributed \(\chi^2\) with \(K-L\) degrees of freedom, where \(K\) is the number of instruments, \(L\) is the number of endogenous variables, and \(K>L\).

\(^{15}\) The unconstrained second-stage regresses the dependent variable on all exogenous variables, but where each exogenous variable is replaced by the product of its original value and its first-stage coefficient. The resulting coefficients for the instruments should be close to each other and, therefore, close to the TSLS estimate if the instruments are valid (Larcker and Rusticus 2004).
the TSLS estimate and not significantly different from each other (p = 0.99). Overall, the
tests cannot reject the exogeneity of the instruments used. Based on these tests and the
above-mentioned arguments, I use two dummy variables as instruments, i.e., SALES_MAN
and R&D_MAN, which equal 1 if the manager’s functional specialization is Sales (R&D),
and 0 otherwise.

To test for statistical significance, I do not rely on normal theory standard errors, but
rather use bias-corrected bootstrapped confidence intervals (Jeong and Maddala 1993). I
use 2,000 iterations with random resampling to estimate the parameters and to compute the
bias-corrected confidence for each parameter, which is used to determine the level of sta-
tistical significance. The bootstrap method has the advantage that it requires fewer as-
sumptions than traditional methods and is generally more accurate. It mitigates problems
associated with normal theory standard errors due to, for example, sampling variation, non-
normality, and heteroscedasticity, which is particularly relevant for TSLS given its ambig-
uous finite sample properties.

V. RESULTS
Performance Measure Properties and Delegation

Table 5 presents the results of the OLS and TSLS estimation of the determinants of
delegation. The results for Model 1 OLS show that DELEGATION is negatively affected by
REL_PREC_FPM, positively affected by REL_VERIF_FPM, and not affected by REL_-
SEN_FPM and REL_INC_FPM. This latter finding suggests that the relative incentive use
of financial performance measures does not affect delegation in a simple linear fashion,
which is consistent with the findings of Abernethy et al. (2004) and Demers et al. (2004).
It further suggests that the more precise financial measures are relative to nonfinancial
measures, the lower the extent of delegation, the more verifiable the higher the extent of
delegation, while sensitivity has no direct effect. Overall, these results are inconsistent with
delegation being directly associated with the relative incentive use of financial performance
measures.

Regarding the control variables for the marginal benefits of delegation, the results for
Model 1 OLS show that DELEGATION is positively affected by ENV_UNC_IN, SIZE, and
HIER_LEVELS. This suggests that more decision rights are delegated, the greater the en-
vironmental uncertainty on the input-side of the firm, the greater the size of the unit, and
the more hierarchical layers below the manager. Finally, Model 1 TSLS provides similar re-
sults and I therefore refrain from discussing these in detail.

Columns four and five of Table 5 present the results of adding interaction terms between
the relative incentive use of financial performance measures and the relative properties of
these measures, which provides the empirical test of the hypothesis stated in Section II.
The results for Model 2 OLS are similar to those for Model 2 TSLS with the notable exception
of the interaction term between REL_INC_FPM and REL_SEN_FPM. Although the co-
efficient for the interaction term is positive in both models, the Durbin-Wu-Hausman test

16 The parameters of interest here are the OLS parameters in the OLS models and the second-stage parameters in
the TSLS models.
17 An additional benefit of the bootstrapping procedure is that hypothesis testing is less troubled by potential
multicollinearity issues. Although it is not at all clear whether multicollinearity is an issue in regressions with
interaction terms (see, e.g., Hartmann and Moers 1999, 302), the general consequences of severe multicollinearity
are large standard errors and unstable regressors. The bootstrapped confidence interval does not rely on normal
theory standard errors and does not rely on a single estimate, which makes hypothesis testing less sensitive to
multicollinearity.
18 Appendix B presents the results of the first-stage of the TSLS regression, i.e., the estimates of the reduced form
equation for the relative incentive use of financial performance measures.
TABLE 5
(n = 105)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Model 1OLS</th>
<th>Model 1TSLS</th>
<th>Model 2OLS</th>
<th>Model 2TSLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>−0.63***</td>
<td>−0.62***</td>
<td>−0.64***</td>
<td>−0.62***</td>
</tr>
<tr>
<td>FirmA</td>
<td>0.95***</td>
<td>0.93***</td>
<td>0.92***</td>
<td>0.92***</td>
</tr>
<tr>
<td>FirmB</td>
<td>0.60***</td>
<td>0.58*</td>
<td>0.56***</td>
<td>0.50†</td>
</tr>
<tr>
<td>FirmC</td>
<td>0.66***</td>
<td>0.65**</td>
<td>0.67***</td>
<td>0.61**</td>
</tr>
<tr>
<td>FirmD</td>
<td>0.22</td>
<td>0.22</td>
<td>0.19</td>
<td>0.18</td>
</tr>
<tr>
<td>FirmE</td>
<td>0.44</td>
<td>0.40</td>
<td>0.47</td>
<td>0.36</td>
</tr>
<tr>
<td>ENV_unc_In</td>
<td>0.09*</td>
<td>0.10†</td>
<td>0.10*</td>
<td>0.09</td>
</tr>
<tr>
<td>ENV_unc_Out</td>
<td>−0.01</td>
<td>−0.01</td>
<td>−0.01</td>
<td>−0.02</td>
</tr>
<tr>
<td>SIZE</td>
<td>1.99**</td>
<td>1.95**</td>
<td>1.84**</td>
<td>1.77**</td>
</tr>
<tr>
<td>HIER_levels</td>
<td>0.40**</td>
<td>0.40**</td>
<td>0.39**</td>
<td>0.38**</td>
</tr>
<tr>
<td>REL semp FPM</td>
<td>−0.08</td>
<td>−0.10</td>
<td>−0.07</td>
<td>−0.10</td>
</tr>
<tr>
<td>REL prec FPM</td>
<td>−0.11*</td>
<td>−0.11*</td>
<td>−0.07</td>
<td>−0.06</td>
</tr>
<tr>
<td>REL verif FPM</td>
<td>0.16**</td>
<td>0.16**</td>
<td>0.16**</td>
<td>0.15**</td>
</tr>
<tr>
<td>REL inc FPM</td>
<td>−0.07</td>
<td>−0.03</td>
<td>−0.03</td>
<td>0.05</td>
</tr>
<tr>
<td>REL inc FPM × REL semp FPM#</td>
<td>0.11</td>
<td>0.20**</td>
<td>0.15*</td>
<td>0.19*</td>
</tr>
<tr>
<td>REL inc FPM × REL prec FPM</td>
<td>0.06</td>
<td>0.00</td>
<td>0.35***</td>
<td>0.35***</td>
</tr>
<tr>
<td>REL inc FPM × REL verif FPM</td>
<td>0.15***</td>
<td>0.17***</td>
<td>0.17***</td>
<td>0.17***</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.35***</td>
<td>0.34***</td>
<td>0.35***</td>
<td>0.35***</td>
</tr>
<tr>
<td>Incremental R²</td>
<td>0.15***</td>
<td>0.15***</td>
<td>0.17***</td>
<td>0.17***</td>
</tr>
<tr>
<td>Partial R²</td>
<td>0.21***</td>
<td>0.21***</td>
<td>0.24***</td>
<td>0.24***</td>
</tr>
</tbody>
</table>

***, **, *, † Significant at the 1 percent, 5 percent, 10 percent, and 15 percent levels, respectively (two-tailed test using bias-corrected bootstrapped confidence intervals).

# Indicates significant endogeneity at the 10 percent level based on the Durbin-Wu-Hausman test.
The incremental R² indicates the total variance explained by the independent variables incremental to firm effects. The Partial R² indicates how much of the within-firm variance is explained by the independent variables.

Model 2TSLS is estimated using the Heckman and Vytlacil (1998) two-stage least squares estimator.
The instrumental variables for the endogenous variable REL inc FPM in Model 1TSLS and Model 2TSLS are SALES . MAN and R&D . MAN. The first-stage adjusted R² equals 44 percent and the partial R² equals 10 percent. The test of the first-stage exclusion restriction is significant (p < 0.01), while the test of over-identifying restrictions indicates that the null-hypothesis of exogenous instruments cannot be rejected (p > 0.90 in both models). This suggests that the instruments are relevant and exogenous.

See Appendix A for variable measurement and definitions.
indicates that the OLS coefficient has a significant downward bias.\textsuperscript{19} I therefore prefer to interpret the TSLS results.

The results for Model 2\textsubscript{TSLS} show that there is a positive direct effect of $REL\_VERIF\_FPM$ and a positive interactive effect between $REL\_INC\_FPM$ and respectively $REL\_PREC\_FPM$ and $REL\_SEN\_FPM$ on $DELEGATION$. The first finding is consistent with Model 1. In contrast, the latter findings suggest that the relative sensitivity and precision and the relative incentive use of financial performance measures positively reinforce each other in determining the extent of delegation. That is, the greater the relative sensitivity and precision of financial performance measures, the greater the returns to delegation when using these measures for incentive purposes.\textsuperscript{20}

The main effect for $REL\_INC\_FPM$ in the interactive regression is not statistically significant. This main effect represents the effect of $REL\_INC\_FPM$ on $DELEGATION$ when the values of all variables with which it interacts—i.e., the performance measure properties—equal zero (Hartmann and Moers 1999, 300). Given that the zero value of the performance measure properties represents the sample average (see footnote 9), this implies that the relative incentive use of financial performance measures does not affect delegation “on average,” which is consistent with Abernethy et al. (2004) and Demers et al. (2004). To test whether this result holds in the extremes of the performance measure properties, I use the estimates from Model 2\textsubscript{TSLS} to determine the partial derivative of $DELEGATION$ to $REL\_INC\_FPM$ (see footnote 4):

$$
\frac{\partial DELEGATION}{\partial REL\_INC\_FPM} \approx 0.05 + 0.20 \cdot REL\_SEN\_FPM + 0.19 \cdot REL\_PREC\_FPM \\
+ 0.00 \cdot REL\_VERIF\_FPM.
$$

This partial derivative reflects the impact of $REL\_INC\_FPM$ on $DELEGATION$ as a function of the performance measure properties. If financial performance measures are poor incentive measures, i.e., at the minimum observed values of $REL\_SEN\_FPM$ (−1.63) and $REL\_PREC\_FPM$ (−2.31), delegation and the relative incentive use of financial performance measures are significantly negatively associated (slope $\approx −0.72$; $p < 0.10$, two-tailed). In this setting, it is costly to contract on financial performance measures relative to nonfinancial performance measures and doing so creates an incentive-related cost of delegation, which leads to less delegation (cf., Nagar 2002). In contrast, if financial performance measures are good incentive measures, i.e., at the maximum observed values of $REL\_SEN\_FPM$ (1.94) and $REL\_PREC\_FPM$ (1.65), then delegation and the relative incentive use are significantly positively associated (slope $= 0.75$; $p < 0.10$, two-tailed).\textsuperscript{21}

\textsuperscript{19} Given that Equation (7) examines interactions between an endogenous variable and multiple exogenous variables, the “standard” application of the Durbin-Wu-Hausman test (e.g., using the first-stage residuals in the second stage) cannot be applied. I therefore return to the basics of the test, i.e., test whether there is a significant difference between the OLS estimator and TSLS estimator, by using a bootstrapping procedure. More specifically, I use 2,000 iterations with random resampling and calculate, for each sample, the difference between the OLS estimator and the HV-estimator and compute bias-corrected confidence intervals, which is used to determine the statistical significance of the difference.

\textsuperscript{20} The finding that there are significant interaction effects in Model 2 essentially implies that Model 1 is misspecified. Although it is difficult to predict the consequences of this misspecification, it might explain why the relative precision of financial performance measures is significantly negatively related to delegation in Model 1, while such an effect is absent in Model 2.

\textsuperscript{21} The difference between the negative slope (−0.72) and the positive slope (0.75) is statistically significant at the 5 percent level (two-tailed).
financial performance measures complement the delegation choice, which leads to more
delegation (cf., Abernethy et al. 2004). These results provide further support for the
prediction that firms design their decision-making process around the quality of contractible
performance measures (Prendergast 2002; Holmstrom and Milgrom 1994; Grossman and
Hart 1986). When financial performance measures are able to solve the incentive
problem, firms can delegate decision-making authority; but when it is difficult or costly to
contract on financial performance, firms reduce the need for incentive contracting by
lowering the extent of delegation. In addition, these results are important as they provide a
plausible explanation for why previous research has been unable to find an effect of
incentives on delegation. For example, Nagar (2002) finds that incentive-based pay, which,
in his setting, is predominantly based on earnings, does not affect delegation. Similarly,
Abernethy et al. (2004) and Demers et al. (2004) find that the relative use of financial
performance measures for incentive purposes does not affect the extent of delegation.
All three papers ignore the impact of performance measure properties and can, therefore,
be considered an “on average” analysis (from a performance measure properties
perspective). The results in this paper suggest that the average effect is likely to be zero
because there are countervailing forces at play, which are driven by the performance
measure properties.

Overall, the results are consistent with the hypothesis that the association between
delegation and the relative use of financial performance measures for incentive purposes is
positively affected by the relative quality of these measures.22

Performance Measure Properties and Incentive Use

To provide more insight into why sensitivity and precision have an interactive
effect on delegation while verifiability has a direct effect, I examine the impact of the
performance measure properties on the relative incentive use of financial performance
measures, after controlling for the two dummy variables that represent the functional
background of the manager and (the endogenous choice of) delegation. I use the variables
related to the marginal benefits of delegation, described in Section IV, as instruments for
the delegation choice. More specifically, I use ENV_UNC_IN, ENV_UNC_OUT, SIZE, and
HIER_LEVELS as instruments. I do not expect these variables to have an impact on the
relative incentive use of financial performance measures over and above the impact of
delegation and specification tests confirm this expectation.23

22 A limitation underlying this conclusion is that I treat the performance measure properties as exogenous in
the empirical model. However, it is possible that firms actually design the performance measure properties condi-
tional on the decision to delegate, i.e., delegation affects the properties. If so, then this suggests a system of
(three) equations in which the choice variables are simultaneously determined. Ignoring the endogeneity of
the performance measure properties then potentially causes a simultaneity bias. The sign and magnitude of this
bias is generally unknown ex ante, since it requires knowledge of the (true) parameters one is trying to estimate.
Unfortunately, given the lack of valid instruments, I am econometrically unable to take the endogeneity of the
performance measure properties into account. However, the core of the problem is that delegation potentially
affects the performance measure properties. To examine this, I regress each performance measure property, i.e.,
REL_SEN_FPM, REL_PREC_FPM, and REL_VERIF_FPM, on the firm dummies and DELEGATION using
TSLS, with ENV_UNC_IN, ENV_UNC_OUT, SIZE, and HIER_LEVELS as instruments. The results (not
tabulated) show that the extent of delegation does not affect any of the three relative properties of financial
performance measures. Although these results do not rule out the potential endogeneity of the performance
measure properties, they do suggest that it is highly unlikely that the results presented in this paper are driven
by reversed causality and/or simultaneity.

23 The test of over-identifying restrictions indicates that the null hypothesis of exogenous instruments cannot be
rejected (p = 0.571). In addition, the test of the first-stage exclusion restriction is significant (p < 0.01) and
the partial $R^2$ equals 14 percent, which provides evidence of relevance.
Table 6 presents the results of the TSLS analysis, which indicates that $REL_{INC_FPM}$ is positively affected by $REL_{SEN_FPM}$ and $REL_{PREC_FPM}$, but not affected by $REL_{VERIF_FPM}$.\footnote{Appendix B presents the results of the first-stage reduced form equation for delegation.} That is, the more sensitive and precise financial performance measures are relative to nonfinancial performance measures, the greater their relative use for incentive purposes, which is consistent with the analytical literature (e.g., Banker and Datar 1989) and previous empirical evidence (e.g., Abernethy et al. 2004). The finding that sensitivity and precision affect the incentive use of financial performance measures, while verifiability does not, provides a plausible explanation for why the former properties and the incentive use of financial performance measures positively reinforce each other in determining the extent of delegation, while this reinforcing effect is absent regarding verifiability.\footnote{The observation that, of all three performance measure properties, $REL_{SEN_FPM}$ is the most significant determinant of $REL_{INC_FPM}$ might explain why the OLS coefficient for the interaction term $REL_{INC_FPM} \times REL_{SEN_FPM}$ in Model $2_{OLS}$ has a significant endogeneity bias (see Table 5).}

Table 6 further shows that $DELEGATION$ has a significant positive effect on $REL_{INC_FPM}$, which is consistent with the expectation that delegation increases the relative demand for more aggregate performance measures (e.g., Abernethy et al. 2004). Finally, the dummy variable $SALES_{MAN}$ has a significant positive effect on $REL_{INC_FPM}$, as expected, but the dummy variable $R\&D_{MAN}$ has no significant effect.

**Aggregation versus Performance Measure Properties**

The explanation that I provide for the positive interaction effects in Table 5 assumes that it is specifically the aggregate nature of financial performance measures that can complement the delegation choice. However, an alternative explanation for the interaction effects is that the incentive properties matter, irrespective of the type of performance measure and its level of aggregation. That is, the relative incentive use of any of the three types of performance measures increases delegation if these measures have relatively good incentive properties. If this alternative explanation holds, then it should not matter whether we construct the relative incentive use and properties as (1) $x$ relative to $y$ and $z$, (2) $y$ relative to $x$ and $z$, or (3) $z$ relative to $x$ and $y$. To examine the alternative explanation, I therefore re-estimate Equation (7) twice, and replace the relative incentive use and properties of financial performance measures ($x$ versus $y$ and $z$) by:

1. the incentive use and properties of internal nonfinancial performance measures relative to those of financial and external nonfinancial measures ($y$ versus $x$ and $z$);
2. the incentive use and properties of external nonfinancial performance measures relative to those of financial and internal nonfinancial measures ($z$ versus $x$ and $y$).

If the alternative explanation holds and only the incentive properties matter, then similar positive interaction effects should be observed after re-estimating Equation (7). If, however, it is the aggregate nature of financial performance measures versus the specific nature of nonfinancial performance measures that matters, in addition to the incentive properties, then no interaction effects or potentially negative interaction effects should be found.

The results (not tabulated) indicate that, for the internal nonfinancial performance measures, there are no significant interaction effects (one positive, two negative) between the relative incentive use and relative incentive properties on delegation. For the external nonfinancial performance measures, the interactions between the relative incentive use and all

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three relative incentive properties are negative, two of which are significant (sensitivity and verifiability). These findings are consistent with the theory proposed in Section II and inconsistent with the alternative explanation.

As a final test, I re-estimate Equation (7) and replace the relative incentive use and properties of financial performance measures (x versus y and z) by the incentive use and properties of external nonfinancial performance measures relative to those of internal nonfinancial performance measures (z versus y), i.e., one type of (specific) nonfinancial measure versus another type of (specific) nonfinancial measure. In line with the above results, I find no significant interactions effects on delegation. Overall, these results lend support for the argument that, in addition to the incentive properties, it is the aggregate nature of financial performance measures that allows for delegation.

VI. SUMMARY AND CONCLUSION

In this paper, I examine the determinants of delegation. I find that the contractibility of financial performance measures vis-à-vis nonfinancial performance measures increases
delegation. More specifically, the empirical results show that, if financial performance measures are good incentive measures, i.e., have relatively high sensitivity, precision, and verifiability, then using these measures for incentive purposes can complement the delegation choice, which results in increased delegation. Furthermore, I find that delegation is affected by variables related to the internal and external environment, which is consistent with the argument that delegation increases when the marginal benefits of delegation are higher.

The results of this study are subject to several caveats. First, the variables used in the empirical analysis are based on the managers’ perceptions. There is a possibility that the managers’ perceptions of the variables of interest to this study differ from their superiors’ perceptions. Although I use proprietary archival data to validate the survey-based measure of the incentive use of performance measures, which reduces the likelihood of these discrepancies, I cannot rule out that differences in perceptions exist. However, the likelihood that potential misperceptions drive the results is low given that these misperceptions should also be systematic. Second, I only examine a subset of organizational design variables and the analysis is therefore a partial equilibrium analysis (cf., Nagar 2002). Third, in any empirical analysis of choice variables on both the right-hand side and left-hand side of the equation, endogeneity remains an issue. Although I try to minimize the potential problems associated with endogeneity, by carefully selecting instruments, testing the validity of these instruments, and performing additional analyses, I cannot rule out the possibility that endogeneity is present and the model misspecified. Fourth, all of the firms that participate in this study are, or once were, clients of Hay Management Consultants. To the extent that these firms have incentive systems that differ from incentive systems of “non-clients,” the results might not be generalizable to firms that have not been “assisted” by compensation consultants. Fifth, in the theoretical and empirical analysis of this paper, I assume that incentive contracting is the only means to address the delegation-incentive problem. Other common mechanisms exist such as the budgeting and resource allocation process that might also be able to address this problem. Future research can examine to what extent these other mechanisms play a role in the delegation-incentive problem. Finally, even though financial measures are more aggregate than nonfinancial measures, financial measures themselves can be more aggregate or less aggregate (more specific). Furthermore, these measures may vary along the dimensions of sensitivity, precision, and verifiability due to, for example, cost allocations and asset allocations. Future research can examine to what extent the incentive use and properties of more aggregate financial measures relative to less aggregate financial measures affect the delegation choice.

Despite the limitations, this study makes an important contribution to the accounting literature. Consistent with economic theory, it shows that firms design their decision-making process around the quality of contractible performance measures, and particularly around the contractibility of financial performance measures. It further provides evidence that the organizational design variables are simultaneously determined, which is consistent with arguments made in the theoretical literature (e.g., Brickley et al. 1997; Baiman and Rajan 1995; Melumad et al. 1992; Milgrom and Roberts 1992).

APPENDIX A
Variable Definitions and Measurement Instruments

DELEGATION = the extent to which decision-making authority is delegated to lower-level managers (measured by items a-e below).
### Items

<table>
<thead>
<tr>
<th>Who has the decision-making authority with respect to ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Development of new products</td>
</tr>
<tr>
<td>b. Hiring and firing of personnel</td>
</tr>
<tr>
<td>c. Selection of large investments</td>
</tr>
<tr>
<td>d. Budget allocations</td>
</tr>
<tr>
<td>e. Pricing decisions</td>
</tr>
</tbody>
</table>

**Answering Format (1–5)**

- superior’s decision–my decision
- superior’s decision–my decision
- superior’s decision–my decision
- superior’s decision–my decision
- superior’s decision–my decision

**REL\_INC\_FPM** = the relative use of financial performance measures for incentive purposes (measured by the difference between financial and nonfinancial measures for items a–h below).

### Items

<table>
<thead>
<tr>
<th>How much importance does your superior attach to xxx performance measures in ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The evaluation of your performance</td>
</tr>
<tr>
<td>b. Periodic performance reports</td>
</tr>
<tr>
<td>c. Officially rating your performance</td>
</tr>
<tr>
<td>d. Periodic discussions with you</td>
</tr>
<tr>
<td>e. Determining your salary increases</td>
</tr>
<tr>
<td>f. Determining your annual bonus</td>
</tr>
<tr>
<td>g. Increasing your chance of promotion</td>
</tr>
<tr>
<td>h. Increasing your authority within the organization</td>
</tr>
</tbody>
</table>

**Answering Format (1–5)**

- no importance–very high importance
- no importance–very high importance
- no importance–very high importance
- no importance–very high importance
- no importance–very high importance
- no importance–very high importance
- no importance–very high importance
- no importance–very high importance

**REL\_SEN\_FPM** = the relative sensitivity of financial performance measures to managerial actions (measured by the difference between financial and nonfinancial measures for items f–k below);

**REL\_PREC\_FPM** = the relative precision of financial performance measures (measured by the difference between financial and nonfinancial measures for items a and c–e below); and

**REL\_VERIF\_FPM** = the relative verifiability (objectivity and verifiability) of financial performance measures (measured by the difference between financial and nonfinancial measures for items l–n below).

### Items

<table>
<thead>
<tr>
<th>My performance expressed in xxx performance measures is strongly affected by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ... changes in economic conditions</td>
</tr>
<tr>
<td>b. ... decisions made in other parts of the organization</td>
</tr>
<tr>
<td>c. ... changes in the behavior of customers</td>
</tr>
<tr>
<td>d. ... changes in the behavior or strategies of suppliers</td>
</tr>
<tr>
<td>e. ... changes in the behavior or strategies of competitors</td>
</tr>
<tr>
<td>f. Whether I function well or not as a manager can be expressed accurately in xxx performance</td>
</tr>
</tbody>
</table>

**Answering Format (1–5)**

- fully disagree–fully agree
- fully disagree–fully agree
- fully disagree–fully agree
- fully disagree–fully agree
- fully disagree–fully agree
- fully disagree–fully agree
- fully disagree–fully agree
g. Many of the activities and tasks that I perform do not show up in \textit{xxx} performance

h. If I perform well as a manager, it is directly reflected in better \textit{xxx} performance

i. Working hard leads to better \textit{xxx} performance

j. Devotion and effort in my job leads to better \textit{xxx} performance

k. Providing effort in my job leads to better \textit{xxx} performance

l. The measurement of \textit{xxx} performance is objective and verifiable

m. The measurement of \textit{xxx} performance is done by objective persons

n. An independent person verifies the measurement of \textit{xxx} performance

o. The measurement of \textit{xxx} performance is predominantly of a quantitative nature

\textit{xxx} reflects "financial," "external nonfinancial," or "internal nonfinancial."

\textit{ENV\_UNC\_IN} = environmental uncertainty related to the input-side of the firm (measured by items c and d below); and

\textit{ENV\_UNC\_OUT} = environmental uncertainty related to the output-side of the firm (measured by items a and b below).

<table>
<thead>
<tr>
<th>Items</th>
<th>Answering Format (0 [N.R.]; 1–5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Impact of ... on your job and unit</td>
<td></td>
</tr>
<tr>
<td>a. Behavior and/or buying patterns of customers</td>
<td>no impact–very high impact</td>
</tr>
<tr>
<td>b. Behavior and/or strategies of competitors</td>
<td>no impact–very high impact</td>
</tr>
<tr>
<td>c. Technological developments in your profession</td>
<td>no impact–very high impact</td>
</tr>
<tr>
<td>d. Behavior and/or strategies of your suppliers</td>
<td>no impact–very high impact</td>
</tr>
<tr>
<td>e. Legal and/or political developments</td>
<td>no impact–very high impact</td>
</tr>
<tr>
<td>II. Predictability of (changes in) ...</td>
<td></td>
</tr>
<tr>
<td>a. Behavior and/or buying patterns of customers</td>
<td>very predictable–very unpredictable</td>
</tr>
<tr>
<td>b. Behavior and/or strategies of competitors</td>
<td>very predictable–very unpredictable</td>
</tr>
<tr>
<td>c. Technological developments in your profession</td>
<td>very predictable–very unpredictable</td>
</tr>
<tr>
<td>d. Behavior and/or strategies of your suppliers</td>
<td>very predictable–very unpredictable</td>
</tr>
<tr>
<td>e. Legal and/or political developments</td>
<td>very predictable–very unpredictable</td>
</tr>
</tbody>
</table>

\textit{SIZE} = ratio of the number of employees within the manager's unit to the total number of employees; and

\textit{HIER\_LEVELS} = dummy variable that equals 1 if there are multiple hierarchical levels below the manager's unit, and 0 otherwise.

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APPENDIX B

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>REL_INC_FPM</th>
<th>DELEGATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.64***</td>
<td>-0.60***</td>
</tr>
<tr>
<td>FirmA</td>
<td>0.35†</td>
<td>0.92***</td>
</tr>
<tr>
<td>FirmB</td>
<td>0.87***</td>
<td>0.55***</td>
</tr>
<tr>
<td>FirmC</td>
<td>0.53**</td>
<td>0.63***</td>
</tr>
<tr>
<td>FirmD</td>
<td>-0.09</td>
<td>0.23</td>
</tr>
<tr>
<td>FirmE</td>
<td>1.05**</td>
<td>0.37</td>
</tr>
<tr>
<td>ENV_UNC_IN</td>
<td>-0.06</td>
<td>0.10*</td>
</tr>
<tr>
<td>ENV_UNC_OUT</td>
<td>0.01</td>
<td>-0.01</td>
</tr>
<tr>
<td>SIZE</td>
<td>0.74</td>
<td>1.92**</td>
</tr>
<tr>
<td>HIER_LEVELS</td>
<td>0.29*</td>
<td>0.39**</td>
</tr>
<tr>
<td>REL_VERIF_FPM</td>
<td>0.07</td>
<td>0.16**</td>
</tr>
<tr>
<td>REL_SENSOR_FPM</td>
<td>0.41***</td>
<td>-0.11*</td>
</tr>
<tr>
<td>REL_PREC_FPM</td>
<td>0.05</td>
<td>-0.11*</td>
</tr>
<tr>
<td>R&amp;D_MAN</td>
<td>0.18</td>
<td>-0.00</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.44***</td>
<td>0.33***</td>
</tr>
<tr>
<td>Partial R²</td>
<td>0.10***</td>
<td>0.14***</td>
</tr>
</tbody>
</table>

***, **, *, †Significant at the 1 percent, 5 percent, 10 percent, and 15 percent levels, respectively (two-tailed test using bias-corrected bootstrapped confidence intervals).
See Appendix A for variable measurement and definitions.

REFERENCES


*The Accounting Review, July 2006*


