Succeeding in managerial accounting. Part 1: knowledge, ability, and rank

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Abstract

Using data on 2941 practicing managerial accountants, we explore rank-based differences in measured ability, and technical, industry, and tacit managerial knowledge. Our data indicate that concomitant with increases in rank are: (1) decreasing levels of, and increasing variability in, measured entry-level technical knowledge, (2) increasing measured levels of, and generally decreasing variability in, industry knowledge, (3) increasing levels of, and non-monotonic changes in the variability in, measured tacit managerial knowledge, and (4) no differences in levels of, or variability in, measured ability. Ours is the first large-sample exploration of rank-based differences in the knowledge “stocks” of managerial accountants. Study results provide insight into knowledge acquisition processes and the matching of knowledge to jobs across ranks in managerial accounting.

1. Introduction

A knowledge advantage is a sustainable advantage (Davenport & Prusak, 1998, p. 17).

What do managerial accounting (MA) professionals know and when do they know it? Gaining insight into this question is critical to effectively managing individual and organizational MA knowledge (cf. Davenport & Prusak, 1998; Demarest, 1997; Drucker, 1998; Ruggies, 1998). Increasingly, effective management of organizational knowledge is argued to be the most important attribute of successful organizations (Drucker, 1995; Toffler, 1990).

Herein, we investigate the relationship between knowledge, ability, and rank in MA practice. More specifically, we measure what managerial accountants at differing ranks know, and, their problem solving ability. Our purpose is to implement the advice of economists and management consultants that organizations begin to measure their “stock” of knowledge as a starting point for understanding available skills and potentially unmet knowledge needs (e.g. Machlup, 1980). Consistent with Grant (1996) and Simon (1991, p. 125), we assume that individual knowledge is an appropriate unit of analysis for understanding the “stocks” of organizational knowledge.

Managerial accountants are an important but understudied professional group. There are more practicing accountants working outside of public accounting than external auditors working in public accounting firms (US Department of Labor, 1992). Yet with few exceptions (e.g.
Dearman & Shields, 1999), research investigates the role and importance of technical auditing knowledge and problem solving ability in one segment of the professional practices of public accounting firms — external auditing. As Libby and Luft (L&L) (1993, p. 446) note in their review of the determinants of judgment performance in accounting settings, “Nearly all of the research discussed here was conducted in the audit context.” No recent reviews of behavioral accounting (Birnberg & Shields, 1989; Burgstahler & Sundem, 1989; Caplan, 1989; Hopwood, 1989; Libby, 1989, 1995; Libby & Luft; Lord, 1989; Solomon & Shields, 1995) or MA research (Atkinson, Banker, Kaplan & Young, 1997; Foster & Young, 1997; Shields, 1997) discuss the knowledge or ability required in MA.

Investigations of the nature of personnel hierarchies in organizations are central to both building and refining theories of the firm and to understanding organizational process of knowledge management. Many streams of research investigate organizational hierarchies, including economics (Baker, Gibbs & Holmstrom, 1994; Malcolmson, 1984; McCue, 1996; Rosenbaum, 1984), finance (Baker, Jensen & Murphy, 1988), psychology (Carson, Carson, Griffith & Steel, 1994; Deshpande, Scholderbek & Joseph, 1994), organizational behavior (Lambert, Larcker & Weigelt, 1993) and accounting (e.g. Abdolmohammadi & Shanteau, 1992; Bonner & Lewis, 1990; Goetz, Morrow & McElory, 1991). This research supports the simplicity, stability, and importance of organizational rank in understanding firms’ performance evaluation and compensation systems (e.g. Baker, Jensen & Murphy, 1988).

Rank in MA appears to be similarly simple, stable, and economically significant. For example, Shields (1997, p. 9) notes that analytic MA research has progressed partially as the result of its “...inclusion of ... multiple hierarchical levels (but at most three levels which may be consistent with today’s flat organizations).” Similarly, a recent large sample study of MA (Siegel, Kulesza & Sorensen, 1997) that included both interviews and surveys indicates that managerial accountants are both attentive to and concerned with rank. In addition, managerial accountants’ ranks directly correlate with their economic rewards. For example, one recent salary survey indicates that MA managers earn about 35.49% more than seniors ($54,722 versus. $40,389, on average) while MA seniors earn about 24.06% more than juniors ($40,389 versus. $32,556, on average) (CFS International, 1998). Accordingly, in this study, we examine differences in knowledge and ability across three levels of MA rank.

We next summarize the accounting research that is relevant to our question and propose a theory of the relationship between knowledge, ability, and rank in MA. Following this, we describe our research method, report our results, and discuss their contributions, implications, and limitations.

2. Theory and hypotheses

Existing accounting research has generally followed one of two approaches to understanding the role of knowledge and ability in auditing and MA: (1) identifying the knowledge that is perceived as important by accountants and auditors, and (2) examining the relationships among experience, ability, knowledge, and performance. Several studies survey or interview practicing managerial accountants to obtain their perceptions of the knowledge needed for professional success (Caplan, 1968; Deakin & Summers, 1975; Lander & Reinstein, 1987; Van Zante, 1980; New Accountant, 1998). The results suggest high between-study variability in the perceived importance of specific knowledge to MA practice across the 20-year period of this research. The most recent and comprehensive study (Siegel & Sorensen, 1994; Siegel et al., 1997) suggests that changing practice demands are one possible explanation for the high variability in the perceived importance of specific knowledge among managerial accountants. Using both a large-sample survey (800 respondents) and in-depth interviews, Siegel et al. found that managerial accountants increasingly value industry knowledge and “softer” skills, such as leadership, negotiation, and accounting personnel management. Surveys explicate the knowledge that managerial accountants perceive is needed for MA practice. However, this research does not measure the “stock” of managerial accountants’ knowledge.
An alternative approach, more common in auditing than MA research, explores the relationship between experience, knowledge, ability, and performance in accounting settings. Early research in this genre often assumed that accounting-related work experience was a proxy for the knowledge needed in a specific job. More recent research suggests that the value of experience is that it creates learning opportunities (Davis & Solomon, 1989; Libby & Tan, 1994; see also Schmidt, Hunter & Outerbridge, 1986). Therefore, knowledge is a better predictor of performance in accounting than experience (Bonner, 1990; Bonner & Walker, 1994). In the only study of which we are aware that explores the role of knowledge in MA, Dearman and Shields (1999) studied 42 managers cost-related experience, cost-accounting knowledge, and cost-related judgments in an experimenter-adapted management case. Their data suggest the value of relevant cost accounting knowledge to managers’ judgments.

To summarize, previous survey research suggests that: (1) managerial accountants need knowledge and skill beyond the technical MA knowledge found on professional accounting examinations (e.g. the C.M.A. exam) and (2) knowledge is a better predictor of performance than experience. However, existing research has not attempted a large-sample assessment of what managerial accountants know. In addition, no existing research explores rank-based differences in managerial accountants’ knowledge. Herein, we explore rank-based differences in the averages of (question 1) and variability in (question 2) managerial accountants’ measured entry-level technical managerial accountant knowledge (ELTMAK), industry knowledge, tacit managerial knowledge (TMK), and ability.

2.1. Question 1: Are there rank-based differences in measured knowledge content and ability among managerial accountants?

Knowledge is information stored in memory (Libby, 1995; Schank & Abelson, 1995). Because individuals have limited information storage and processing capability, they specialize in particular kinds of knowledge (Grant, 1996; Simon, 1991). We expect rank-based differences in the stock of managerial accountants’ knowledge for two reasons. First, promotions are the primary means of providing incentives in most organizations (Baker et al., 1988). Jobs differ in the amount and type of knowledge that they require (e.g. Committee of Sponsoring Organizations of the Treadway Commission, 1992) and organizations must match individual employees’ knowledge to jobs through hiring, promotion, and retention decisions. Therefore, promotion-based incentives should create knowledge differences among managerial accountants at differing ranks.

Second, the opportunities and incentives for job-related learning differ by jobs. Partially as a consequence, accountants learn differing types of knowledge at different ranks (Bonner & Pennington, 1991). For example, we expect managerial accountants to learn entry-level technical knowledge primarily from instruction before beginning full-time work. Alternatively, we expect industry and tacit managerial knowledge to be learned on-the-job through self-study and interaction with colleagues. We expect these two processes, i.e. the matching of employees to jobs and the differing times within a career at which knowledge is acquired, to produce between-rank knowledge differences among managerial accountants.1

2.1.1. Entry-level technical managerial accounting knowledge (ELTMAK)

Entry-level technical MA knowledge is the factual knowledge that constitutes entry-level MA training (e.g., CMA examination content). We speculate that managerial accountants learn ELTMAK in college before beginning full-time MA work. We do not expect significant on-the-job learning of ELTMAK among MA professionals.

Survey evidence suggests that ELTMAK is critical to the work of junior-level managerial accountants (Siegel & Sorensen, 1994; Siegel et al.,

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1 Knowledge can be usefully characterized on two dimensions: content (i.e. specifically what is known) and structure (i.e. the organization of knowledge) (Bedard & Chi, 1993). Both the content and structure of knowledge are important to accounting success. We focus on knowledge content (and not structure) because this focus seems best suited to investigating a large sample of managerial accountants for a short time period.
1997) but is less important at higher ranks. Similar results obtain for public accounting firms. For example, Bhamornsiri and Guinn (1991) found that audit, tax, and consulting partners all rated technical competence as less important in promotions to partner than promotions to senior and manager. These results suggest that higher-ranking accounting professionals have broader responsibilities (e.g. supervision, strategic planning) that depend less on ELTMAK for success. Assume that:

1. ELTMAK is primarily learned prior to beginning full-time work, and
2. success in lower-ranking managerial accountants' jobs depends more on ELTMAK. If these assumptions are true, then the levels of ELTMAK among higher-ranking managerial accountants should be no higher than that of lower-ranking managerial accountants:

**Hla.** The entry-level technical managerial accounting knowledge (ELTMAK) of MA managers will be no higher than that of MA seniors, the ELTMAK of MA seniors will be no higher than that of MA juniors.

### 2.1.2. Industry knowledge

Accounting-related industry (or “subspecialty”) knowledge consists of the practices, controls, companies, and systems of an industry. Evidence suggests that industry experience can improve the accuracy of auditors' knowledge of financial statement errors (Ashton, 1991) and business operations (Solomon, Shields & Whittington, 1999), and the quality of auditors judgments related to interest rate swaps (Bonner & Lewis, 1990). However, no existing research attempts to measure, or investigates the role and importance of, industry knowledge in MA practice. We speculate that managerial accountants primarily learn industry knowledge on-the-job rather than through entry-level instruction. Evidence from audit practice supports this speculation. For example, Bonner and Lewis found higher levels of financial services industry knowledge among audit managers than seniors. These assumptions lead us to expect increasing levels of industry knowledge with rank among managerial accountants:

**Hlb.** The industry knowledge of managerial accountants will be higher among managers than seniors, the industry knowledge of senior accountants will be higher among seniors than juniors.

### 2.1.3. Tacit managerial knowledge (TMK)

Tacit managerial knowledge consists of the skills needed to (1) effectively manage one's personal productivity and career and (2) build working relationships with others. Professionals acquire TMK not through formal instruction, but rather by observing mentors' and colleagues' reactions to actions and behaviors. Sternberg and Wagner (1985) posit three dimensions of TMK. The TMK of managing self enables maintaining one's personal productivity, which includes prioritizing and completing tasks, using goals to self-motivate, taking appropriate risks, and learning from observing others. The TMK of managing others involves developing and maintaining relationships with superiors, subordinates, and stakeholders, and maintaining useful and productive social relationships. The TMK of managing one's career requires an understanding of the determinants of one's professional success and demonstrating one's substantive contributions to superiors. It includes successfully promoting one's ideas and maintaining visibility among those who influence one's career.

Sternberg and Wagner provide evidence of the relevance of TMK to professional success among academics and business managers (Sternberg, 1997; Sternberg & Wagner, 1985, 1987; Wagner, 1987). Tan and Libby (1997) demonstrate the relevance of overall TMK (but not the three subscale measures) to senior-and manager-level external auditors'success in the Singapore office of a public accounting firm. However, the study of TMK is in its infancy. Only limited evidence exists on the role and importance of tacit knowledge in accounting or business. For example, no existing study explores the relevance or importance of TMK to MA practice.

As with industry knowledge, we expect TMK to be acquired primarily beyond entry-level training. Survey evidence suggests that higher level MA
positions demand broader, “softer,” managerial skills that appear similar to TMK (e.g. leadership, managing personnel, and negotiation) (Siegel & Sorensen, 1994; Siegel et al., 1997). Similarly, Bharmornsiri and Guinn (1991) find that tax, audit, and consulting partners perceive communication, interpersonal, and practice development skills as more important to higher-than lower-level promotions in public accounting. These observations lead us to predict higher levels of TMK among more senior managerial accountants:

Hlc. All three forms of managerial accountants tacit managerial knowledge (TMK — career, self, and others) will be higher among managers than seniors, all three forms of TMK will be higher among seniors than juniors.

2.1.4. Problem solving ability.

We investigate managerial accountants problem-solving ability (PSA) for two reasons. First, analytical ability measures explain a significant amount of performance variability in many domains (Jensen, 1993), including external auditing (e.g. Bonner & Lewis, 1990) and financial accounting (e.g. Burrell, 1929). Second, the extent to which knowledge versus ability affects performance in accounting implies different strategies for managing organizational knowledge (cf. Libby & Tan, 1994, p. 703). Specifically, PSA is generally regarded as invariant (i.e. stable) among adults (e.g. Sternberg, 1997), while training and experience affect knowledge (e.g. see Bonner & Walker, 1994).

Prior research suggests an equivocal relationship between PSA and rank. For example, Bonner and Lewis (1990) found higher levels of ability among manager auditors and undergraduate accounting students than audit seniors, while Bonner, Davis and Jackson (1992) found no relationship between PSA and tax planning performance. Other researchers have found a positive relationship between ability and rank in public accounting (Tan & Libby, 1997) and nonmilitary jobs (Schmidt et al., 1986).

The invariance of PSA among adults leads us to expect no learning effects on PSA. If we assume that (1) success in MA, at all levels, demands high PSA and (2) companies promote and retain higher-performing managerial accountants, then we would expect increases in ability with rank. Alternatively however, market competition for high PSA managerial accountants may remove them from samples of MA professionals (e.g. through promotions to division manager or CFO). Such market effects would decrease mean PSA among senior- and manager-level managerial accountants. Because we expect the second of these effects to be smaller than the first, we predict that PSA will not decrease with increases in rank:

Hld. The problem-solving ability (PSA) of managers will be no less than that of seniors; the problem-solving ability (PSA) of seniors will be no less than that of juniors.

2.2. Question 2: Are there rank-based differences in the variability of knowledge content and ability among managerial accountants?

Theories of organizational knowledge and learning suggest two inter-related processes that influence the variability of individuals’ learning in organizations: (1) the matching of employees to jobs through promotion, hiring, and retention decisions, and, (2) opportunities and incentives for job-related learning. We speculate that the size of these effects on the between-rank variability of knowledge varies with knowledge content.

Consistent with our discussion of hypothesis Hla, we expect the matching of employees to jobs to be the primary influence on the variability of junior managerial accountants’ ELTMAK. Specifically, assume that managerial accountants primarily learn ELTMAK in college training and that companies hire juniors primarily based on ELTMAK. Further, assume that ELTMAK affects junior-level retention, but not promotion decisions. If true, then junior managerial accountants will have comparatively low (i.e. truncated) variability in ELTMAK since some potential junior-level hires with less than the required minimum are
not hired, while some junior-level hires with less than the required minimum are not retained.

Seniors and managers should have comparatively higher ELTMAK variability than juniors for two reasons. First, as the result of longitudinal changes in their knowledge (for example, forgetting previously known ELTMAK) and second, because promotion to and retention at the senior and manager ranks are made regardless of ELTMAK. This suggests the following:

**H2a.** The variability in entry-level technical managerial accounting knowledge (ELTMAK) will be higher among managers than seniors, the variability in ELTMAK will be higher among seniors than juniors.

Consistent with our discussions of H1b and H1c, assume that entry-level managerial accountants are not explicitly trained in or hired based on industry and TMK and correspondingly, that their industry knowledge and TMK exhibits high variability. Further, assume that organizations prefer higher industry and TMK among senior- and manager-level managerial accountants. If true, then the matching of employees to jobs will result in juniors having comparatively high variability in industry and TMK. However, this variability will decrease at the senior and manager ranks through promotion and retention decisions. Mitigating these processes, however, are the potential effects of on-the-job learning of industry and TMK. Specifically, assume significant, though individually differing rates of, learning of industry and TMK among hired junior-, senior- and manager-level managerial accountants. If true, then learning effects would, over time, increase the variability of managerial accountants’ industry and TMK at all ranks.

These speculations suggest countervailing effects from the matching and learning functions of knowledge management. Therefore, we predict no rank-based differences in the variability of industry and TMK.

**H2b.** The variability in managerial accountants’ industry knowledge will not differ across ranks (i.e. between juniors, seniors, and, managers).

**H2c.** The variability in all three forms of managerial accountants’ tacit managerial knowledge (TMK) will not differ across ranks (i.e. between juniors, seniors, and, managers).

Finally, we speculate that the matching of employees to jobs and the market competition for managers (but not learning effects) should affect PSA. Promotion and retention of higher PSA accountants should decrease the variability of PSA with increases in rank. However, market competition for the highest PSA managerial accountants may result in their promotion to non-accounting positions. We expect the second of these effects to be smaller than the first. Therefore, we predict that PSA will not decrease with increases in rank:

**H2d.** The variability in managers’ problem-solving ability (PSA) will be no less than that of seniors, the variability in seniors’ problem-solving ability (PSA) will be no less than that of juniors.

3. Method

3.1. Archival data

We obtained the cooperation of a managerial accountants’ industry association (MAIA) whose members included practicing managerial accountants in three industries [(SIC codes 26 (paper and allied products), 27 (printing, publishing, and allied industries) and 28 (chemicals and allied products)]. The participating MAIA provided us with individual-level data consisting of all of their current junior, senior, and manager members’ industry, company size, gender, education, professional certification, and organizational position.

The classification of members as juniors, seniors, and managers is part of the MAIA database, which is derived from information provided by Chief Financial Officer (CFO) members of the association. To confirm that our data were consistent with differing levels of experience between the junior, senior, and manager ranks, we tested for and found significant differences in work
experience in accounting \[F(2, 2938)=4303.2, \ P<0.001\] and work experience with current employer \[F(2, 2938)=5647.6, \ P<0.001\] between the junior, senior, and manager ranks in our sample [post-hoc analysis using Scheffe’s test \(P \leq 0.05\)]. Juniors in our sampled averaged 53.6 months (4.47 years) of work experience in accounting, seniors 107.5 months (8.96 years), and managers 160.1 months (13.3 years). As expected, rank is highly correlated with both work experience in accounting \((r=0.864, \ P<0.001)\) and work experience with current employer \((r=0.891, \ P<0.001)\). We also tested for but found no significant differences between ranks in gender \((P=0.173)\) or company size \((P=0.760)\).

3.2. Research instrument

We used the association’s proprietary electronic mail system to distribute a research instrument to all members (see Appendix for sample questions). The overall response rate was 49.58\% (2941 respondents/5932 members in junior, senior and manager-level positions). Association executives estimate that their collective membership comprises between 73 and 81\% of all US managerial accountants working in these industries. If their membership estimate is accurate, then our sample represents between 36 and 40\% of all US managerial accountants working in these industries.

There were no differences in the proportions of responses from junior, senior, and manager members in our sample \((\chi^2(2)=0.043, \ P=0.9786)\). We also tested for non-response bias and found no significant differences between respondents and non-respondents in their industry, company size, gender, education level, professional certification, or rank \((P \geq 0.49)\). Respondents replied to two solicitations sent one week apart. We tested for differences between respondents to the first and second solicitations. There were no differences in early and late respondents’ PSA, ELTMAK, industry knowledge, TMK, or experience among juniors, seniors, or managers \((0.102 \leq P \leq 0.810)\).

We built several controls into the software used in administering the instrument. To lessen the likelihood that respondents forwarded the instrument to others for completion, the instrument could only be returned from the association members’ computer address. Only completed instruments could be returned. The instrument consisted of six sections: (1) technical (MA) knowledge, (2) TMK, (3) general intelligence/problem solving ability (PSA), (4) industry knowledge, (5) self-perceptions, and (6) perceptions of skill and knowledge acquisition. Items within sections were presented in random order. Respondents could not return to earlier sections of the instrument after completing them. Herein, we report data from sections one through four of the instrument.

3.2.1. Entry-level technical managerial accounting knowledge (ELTMAK)

Based on pilot testing, we chose 10 questions from the Certified Management Accountant’s (CMA) exam. Because we wanted a broad sample of entry-level technical MA knowledge, we included at least two questions from each of the exam’s four sections. Reliability on this measure was adequate (Cronbach’s \(\alpha = 0.531)\) and comparable to the reliability of similar “omnibus” constructs in previous accounting research.2

3.2.2. Industry knowledge

We worked with nine controllers (three from each industry in our sample) to develop and pilot test 10 industry knowledge questions for each of the three industries represented in our sample. Cronbach’s \(\alpha\) for the industry knowledge instrument indicated moderate reliability (SIC code 26 = 0.691, SIC code 27 = 0.701, and SIC code 28 = 0.687).

3.2.3. Tacit managerial knowledge (TMK)

We administered the 39 item, self-scoring version of Wagner’s TMK instrument that has been shown to discriminate senior from junior-level managers (Sternberg & Wagner, 1985).3 Factor analysis indicated that all items loaded consistent

2 Some accounting researchers argue against the use of reliability measures for “omnibus” (i.e. multi-dimensional) constructs such as general PSA and technical knowledge (e.g. Bonner & Walker, 1994; Dearman & Shields, 1999).

3 Thanks to Professor Richard Wagner for sharing this instrument and advising us on how to best administer it.
with the three factors identified by the tests’ developers (i.e. career, self, and others). Cronbach’s \(\alpha\) indicated high reliability for all three factor scores (career = 0.971, self = 0.973, others = 0.957). Factor scores were not highly correlated (0.12 \(\leq r \leq 0.19\)), indicating good discriminant validity.

3.2.4. Problem solving ability (PSA)

We used the eight-item measure of PSA previously developed and validated in Bonner et al. (1992) and Bonner and Walker (1994).\(^4\) Reliability (Cronbach’s \(\alpha = 0.444\)) is similar to that observed in previous administrations of this instrument.

3.3. Models and analyses

3.3.1. Hypothesis 1 — ANOVAs and MANOVA

We tested hypothesis one using ANOVAs for the PSA, ELTMAK, and industry knowledge variables and MANOVA for the TMK measures. We included respondents’ rank as a three-level (i.e. juniors, seniors, and managers) independent variable in the ANOVA and MANOVA models. PSA, ELTMAK, industry knowledge and skill were the dependent variables in the ANOVAS. The three dimensions of TMK (i.e. career, others, and self) comprised the set of dependent variables in the MANOVA.\(^5\) We performed post-hoc comparisons using Scheffe’s test (\(P < 0.05\)).

3.3.2. Hypothesis 2 — Homogeneity of variance

We tested hypothesis two using Bartlett’s (Winer, 1971) and Levene’s (Snedecor & Cochran, 1980) homogeneity of variance tests. We used both tests because they use differing measures of sample variability and make different assumptions about

\(^4\) Thanks to Professor Sarah Bonner for sharing this instrument and advising us on how to best administer it.

\(^5\) To test the independence of the TMK sub-scales, we computed three ANCOVAs with rank as the independent variable, participants’ overall TMK score as a co-variate, and the three TMK sub-scales as the dependent variable. Significant between rank differences (\(P \leq 0.016\)) obtained in each of these ANCOVAs, which indicates that the TMK sub-scales are relatively independent of one another. Thanks to an anonymous review for suggesting this test of TMK sub-scale independence.

4. Results

4.1. Question 1: Are there rank-based differences in measured knowledge content and ability among managerial accountants?

Hypothesis 1a predicts that entry-level technical managerial accounting knowledge (ELTMAK) will remain stable or decrease with increases in rank. The results support hypothesis 1a and indicate significant decreases in ELTMAK with rank \(F(2,2938) = 312.0, P < 0.001;\) Scheffe’s test \(P < 0.05); see Table 1\]. Hypotheses 1b and 1c predict increases in industry and tacit managerial knowledge, respectively, with rank. The results support hypotheses 1b and 1c. Specifically, our ANOVA results indicate increasing industry knowledge with rank \(F(2,2938) = 362.1, P < 0.001;\) Scheffe’s test \(P < 0.05\]) supporting hypothesis 1b. Similarly, the results for both overall TMK and the three sub-scale TMK measures support the hypothesis 1c prediction of increasing TMK with rank [overall MANOVA Wilks’ \(\lambda = 0.687, P \leq 0.001; TMK — career, F(2,2938) = 121.0, P < 0.001; TMK — others, F(2,2938) = 49.0, P < 0.001; TMK — self, F(2,2938) = 49.0, P < 0.001];

\(^6\) We tested the normality of the industry knowledge, TMK, technical knowledge and ability data using the Kolmogorov–Smirnov test (Conover, 1980). Because the data failed to approximate a normal distribution, we also tested hypotheses 1a–1d using the non-parametric Kruskal–Wallis test. The statistical significance of the Kruskal–Wallis test results are identical to those reported in the results section.

\(^7\) We also used three tests to identify extreme observations in the data: (1) Cook’s Distance, (2) Deleted Residuals, and (3) Mahalanobis’ Distances (Cook, 1977; Neter, Wasserman & Kutner, 1990; StatSoft, Inc, 1997). These tests identified between 12 (using Mahalanobis’ Distances with technical managerial accounting knowledge as the dependent variable) and 49 (using Cook’s Distance with TMK as the dependent variable) extreme observations. Omitting the extreme values identified by these procedures did not affect the statistical significance of the reported results.
Hypothesis H1d predicts that ability will remain stable or decrease with rank. Consistent with hypothesis H1d, there are no significant rank-based differences in ability \[ F(2, 2938) = 0.5, P = 0.609, \text{See Table 1}. \]

### 4.2. Additional analyses

As reported previously, managerial accountants’ rank correlates with their experience. To better understand the relationships among experience, knowledge, and problem solving ability, we computed the inter-correlations among these measures. These correlational results are consistent with the reported rank-based results. Specifically, industry knowledge and all three forms of tacit managerial knowledge correlate positively with both years of experience with the current employer \( r \geq 0.246, P \leq 0.001 \) and total years of experience \( r \leq 0.248, P \leq 0.001 \) while ELTMAK correlates negatively with years of experience with the current employer \( r = -0.372, P \leq 0.001 \) and total years of experience \( r = -0.363, P \leq -0.001 \). Also consistent with our rank-based results, PSA is uncorrelated with

### Table 1

ANOVA results for measured knowledge and ability by rank\(^a\)

<table>
<thead>
<tr>
<th>Construct/hypothesis</th>
<th>Juniors ((n = 1797))</th>
<th>Post-hoc comparisons (predicted)</th>
<th>Seniors ((n = 798))</th>
<th>Post-hoc comparisons (Predicted)</th>
<th>Managers ((n = 364))</th>
<th>(F) (2,2938)</th>
<th>(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured entry level technical managerial accounting knowledge (ELTMAK)/H1a</td>
<td>0.88 (0.10)</td>
<td>((\geq))[(\geq)]</td>
<td>0.81 (0.12)</td>
<td>((\geq))[(\geq)]</td>
<td>0.72 (0.14)</td>
<td>312.0</td>
<td>0.001</td>
</tr>
<tr>
<td>Measured industry knowledge/H1b</td>
<td>0.61 (0.15)</td>
<td>((\leq))[(\leq)]</td>
<td>0.69 (0.15)</td>
<td>((\leq))[(\leq)]</td>
<td>0.83 (0.12)</td>
<td>362.1</td>
<td>0.001</td>
</tr>
<tr>
<td>Measured tacit managerial knowledge (TMK) — career/H1c</td>
<td>67.1 (20.9)</td>
<td>((\leq))[(\leq)]</td>
<td>75.9 (23.1)</td>
<td>((\leq))[(\leq)]</td>
<td>85.1 (22.8)</td>
<td>121.0</td>
<td>0.001</td>
</tr>
<tr>
<td>Measured tacit managerial knowledge (TMK) — self/H1c</td>
<td>62.5 (20.0)</td>
<td>((\leq))[(\leq)]</td>
<td>78.7 (24.3)</td>
<td>((\leq))[(\leq)]</td>
<td>87.8 (22.4)</td>
<td>293.8</td>
<td>0.001</td>
</tr>
<tr>
<td>Measured tacit managerial knowledge (TMK) — others/H1c</td>
<td>18.6 (6.8)</td>
<td>((\leq))[(\leq)]</td>
<td>23.6 (7.6)</td>
<td>((\leq))[(\leq)]</td>
<td>26.8 (6.9)</td>
<td>279.5</td>
<td>0.001</td>
</tr>
<tr>
<td>Measured problem solving ability (PSA)/H1d</td>
<td>0.85 (0.13)</td>
<td>((\geq))[(\geq)]</td>
<td>0.84 (0.13)</td>
<td>((\geq))[(\geq)]</td>
<td>0.84 (0.12)</td>
<td>0.5</td>
<td>0.609</td>
</tr>
</tbody>
</table>

\(^a\) Standard deviations in parentheses.
years of experience with the current employer ($r = -0.018$, $P = 0.332$) and total years of experience ($r = -0.026$, $P = 0.158$).9

4.3. Question 2: Are there rank-based differences in the variability of knowledge content and ability among managerial accountants?

Table 1 provides standard deviations for the statistical tests of hypotheses 2a–2d; Table 2 reports the results of Bartlett’s and Levene’s tests of the homogeneity of variance. Hypothesis 2a predicts higher variability in ELTMAK among managers than seniors, and higher variability among seniors than juniors. The results support hypothesis 2a (Bartlett’s and Levene’s $P < 0.001$; See Table 2).

Hypothesis 2b predicts no rank-based differences in the variability of industry knowledge. The results generally do not support hypothesis 2b. Inconsistent with H2b, the overall homogeneity of variance test indicates significant differences across ranks (Bartlett’s and Levene’s $P < 0.001$). Also inconsistent with H2b, the variability of industry knowledge decreases between seniors and managers (Bartlett’s and Levene’s $P < 0.001$). However consistent with H2b, there are no differences in the

We also collected and analyzed data on participants’ beliefs about the sources of their (1) technical, (2) leadership, (3) political, and (4) time management skill as well as their (5) analytical ability. For each of the types of skill and ability, participants considered four possible sources: (1) formal education, (2) peers, (3) superiors, and (4) other experiences. We analyzed the data using MANOVAs and ANOVAs with rank as the independent variable and the responses to the 20 questions as the dependent variables. Results indicated that, relative to juniors, seniors and managers believe that they acquire more technical and analytical skill from peers, more analytical abilities, and leadership and time management skill, from “other experiences” and fewer analytical abilities from formal education. In addition, relative to managers, juniors and seniors believe that they acquire more time management skill from peers and less political knowledge from formal education. Finally, relative to managers and juniors, seniors believe that they acquire more analytical abilities from superiors.
variability of industry knowledge between junior and senior managerial accountants (Bartlett’s $P = 0.335$; Levene’s $P = 0.458$).

Hypothesis 2c predicts no rank-based differences in the variability of TMK. The results fail to support hypotheses 2c. Inconsistent with H2c, the overall homogeneity of variance tests indicates significant differences in all three forms of TMK across ranks (Bartlett’s and Levene’s $P \leq 0.037$). Also inconsistent with H2c, there are significant increases in the variability of all forms of TMK between juniors and seniors (Bartlett’s and Levene’s $P \leq 0.01$). The conclusions related to the variability of TMK — self and TMK others depend on the statistical test. For TMK — self, Bartlett’s test indicates a marginally significant decrease between seniors and managers, $(P = 0.084)$. In contrast, Levene’s test indicates no difference in the variability of TMK — self between seniors and managers $(P = 0.139)$. For TMK — others, Bartlett’s test indicates decreasing variability between seniors and managers $(P = 0.039)$. In contrast, Levene’s test indicates no difference in the variability of TMK — others between seniors and managers $(P = 0.128)$.

Hypothesis 2d predicts that the variability of PSA will remain stable or decline with rank. The results support hypothesis 2d (Bartlett’s $P = 0.297$; Levene’s $P = 0.221$) and indicate no between-rank differences in the variability of ability.

### 5. Discussion

We next discuss our results and their limitations related to ELTMAK, industry and TMK, and PSA.

#### 5.1. ELTMAK

Consistent with our hypotheses, we find decreasing levels of (H1a), and increasingly variability in (H2a), entry-level technical managerial accounting knowledge (ELTMAK) with increases in rank. But in contrast to our results, Tan and Libby (1997) report a positive relationship between technical knowledge and rank in their auditor data from the Singapore office of a public accounting firm (their technical knowledge means by rank, stated in percentage correct: staff: 0.676; seniors: 0.777; managers 0.799). One possible explanation for this difference between Tan and Libby’s and our results relates to differences in the matching of employees to jobs in public and managerial accounting. Specifically, technical knowledge may be less important at higher ranks in MA than comparable auditor positions. Alternatively, success in higher ranking MA positions may require technical knowledge (e.g. of plant-related chemical or engineering processes) that is unrelated to ELTMAK.

Between-rank differences in the composition of our sample provide another possible explanation for the observed decreasing levels of ELTMAK with increases in rank.\(^\text{10}\) For example, it is possible that hiring less technically adept senior and manager-level managerial accountants might explain these results. As we explain in the following two paragraphs, we conducted two sets of analyses to test this explanation. These analyses do not support the argument of changing sample composition as an explanation for the observed results.

In the first set of analyses, we compared the ELTMAK of the 621 individuals promoted from within the studied organizations to the senior rank with the 177 individuals hired from outside the studied organizations at the senior rank. We also compared the ELTMAK of the 311 individuals promoted from within the studied organizations to the manager rank with the 35 individuals hired from outside the studied organizations at the manager rank. Within-rank $t$-tests of means and Hartley $F$-Max, Cochran $C$, and Bartlett Chi-square tests for differences in variability indicated no differences in means $(P \geq 0.165)$ or variability $(P \geq 0.243)$ at either the senior or manager ranks between those promoted from within and those hired from outside. Unexpectedly, the managers who were hired from outside of their companies have higher levels of, and lower variability in, technical skills than those promoted from within, though these differences are not statistically significant.

In our second set of analyses, we tried to more carefully partition (within the constraints of our data set) outside hires without traditional

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\(^{10}\) Sincere thanks to an anonymous reviewer for suggesting this explanation.
accounting training from the rest of our sample. For these analyses, we compared the 761 individuals who were either promoted from within to the senior rank, or, hired from outside with accounting degrees, with the 37 individuals in our sample who were hired from outside at the senior rank with MBA degrees. Similarly, we compared the 329 individuals in our sample who were either promoted from within to the manager rank or, hired from outside with accounting degrees with the 17 individuals hired from outside at the manager rank with MBA degrees. We conducted the same statistical tests as in our first analysis with these samples. The results again indicated no differences in either means (\( P \geq 0.369 \)) or variability (\( P \geq 0.286 \)) between the two groups. Interestingly, for both the seniors and managers in our second analyses, individuals hired from outside who possessed MBA degrees had higher levels of, and lower variability in, ELTMAK, though these differences are not statistically significant.\(^{11}\)

Another possible explanation for the ELTMAK results is that the content of ELTMAK has changed from that learned by today’s seniors and managers and that our instrument therefore fails to accurately capture longitudinal changes in ELTMAK. To provide evidence related to this argument, we performed a content analysis of the 1977 CMA and CPA examinations and of one managerial (Dopuch, Birnberg & Demshi, 1974) and one intermediate accounting (Welsch, Zlatkovich & Harrison, 1976) textbook from the mid 1970s. We chose 1974 through 1977 as reference years since these are the earliest times at which the current managers in our sample would have been entry-level accountants.

With one exception (a question related to the value chain), we found that the ELTMAK content on our instrument appeared in the content analyzed textbooks and professional examinations. Therefore, we re-analyzed the ELTMAK data using the nine questions for which there appeared to be no longitudinal change in coverage between 1974–1977 and present coverage. There were no differences in statistical significance between the obtained results and those reported in the Results section. Although our content analysis of previous sources is less than definitive, it fails to support the argument that the changing content of ELTMAK explains our results.

However, our study is a cross-sectional quasi-experiment that lacks random assignment of participants to conditions and longitudinal data. Therefore, we cannot offer definitive causal explanations for the observed ELTMAK results. For example, it is possible that seniors and managers forget ELTMAK because their current job responsibilities do not require it. Unfortunately, our data do not allow us to test this explanation.

5.2. Industry and tacit managerial (TMK) knowledge

Consistent with our hypotheses, we find increasing levels of industry (H1b) and tacit managerial knowledge (H1c) with rank. One of our research contributions is in developing and validating a measure of industry knowledge, and in demonstrating concomitant increases in rank and industry knowledge among managerial accountants. Previous audit research suggests that industry-specific experience affects audit judgments (Ashton, 1991; Bedard & Biggs, 1991; Thibodeau, 1996). However, with one exception (Bonner & Lewis, 1990), research does not directly measure industry knowledge or investigate differences in industry knowledge by rank. Our finding of rank-based differences in industry knowledge implies (though does not conclusively prove) that industry knowledge holds relevance to MA practice, particularly at higher ranks.

We also contribute to extant research by testing for and finding evidence of the relevance of all three forms of TMK to MA practice (H1c). Our TMK results extend Tan and Libby’s (1997) in three ways. First, we show the relevance of TMK in a large-sample study of US accountants. Second, we demonstrate the relevance of TMK in a previously untested accounting domain: MA

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\(^{11}\) Unfortunately, we do not have data on whether the individuals who were hired from outside with MBA degrees also have bachelor’s degrees in accounting. In addition, we do not have data on whether their MBA degrees include accounting concentrations. Still, it seems likely that, even if we had such data, the sample of such individuals would be so small that they would have a negligible effect on our results.
practice in three industries. Third, we examine the three sub-scales of TMK (i.e. career, self, and others) for the first time in accounting research and find that all three forms of TMK are relevant to MA success. But the extent to which “tacit” managerial knowledge is truly tacit, i.e. learned through experience and not instruction, is a largely unexplored issue. While there is some evidence that inter- and intra-personal skills can be learned from instruction in accounting contexts (e.g. see Stone & Shelley, 1997), the processes by which accounting professionals acquire tacit managerial knowledge is an important topic for future research.

We find less support for our predictions of decreases in the variability of industry and TMK with increases in rank. The data partially support our hypothesis of decreasing (though not monotonically) variability in industry knowledge with ranks (H2b), with managers having lower variability in industry knowledge than juniors or seniors. The data do not support our hypothesis of monotonically decreasing variability in TMK (H2c) with rank. Instead, study results suggest the existence of an inverted U relationship, with lower variability at the junior and manager ranks and higher variability at the senior rank. Our results for the variability of industry and TMK indicate that the processes of learning and of matching employees to jobs in managerial accountants are more complex than we have depicted herein. We consider our inferences related to hypothesis two tentative and of primary value in guiding investigations that further illuminate the processes that affect the variability of managerial accountants’ industry and TMK.

5.3. Ability

Consistent with our hypotheses, we find no rank-based differences in levels of (H1d) or variability in (H2d) ability. However, the uniformly outstanding PSA performance of our participants provides one possible explanation for our null PSA results. We administered the same research instrument as used in Bonner et al. (1992). Strikingly however, our participants averaged 84.6% correct on this instrument while Bonner et al.’s averaged 53.5% correct (Bonner et al., p. 17). Why did our participants so significantly outperform those of Bonner et al.? While we can not offer a definite explanation, one possibility may relate to the small sample size (and correspondingly high error variance) of the PSA data in the Bonner et al. study (n = 37).

The high variance in performance on the PSA between ours and the Bonner et al. (1992) study supports the criticisms of theoretical ambiguity and measurement problems associated with the PSA construct (e.g. see Bonner & Walker, 1994; Dearman & Shields, 1999). The concept of “g” intelligence, on which the PSA measure is based, is controversial in psychology research (Gardner, 1983; Jensen, 1993; Mayer & Salovey, 1993; Sternberg, 1984; Sternberg & Wagner, 1993). While it is not our objective to resolve these controversies, we encourage work exploring multiple measures of ability and triangulating measures of ability with attempts to also capture work place behaviors and knowledge (e.g. Schmidt et al., 1986). It seems likely that combining quantitative (e.g. psychometric) with qualitative (e.g. interviews with recruiters, partners, CFOS) methods will provide greatest insight into the role of ability in professional accounting practice (cf. Bryman, 1988).

6. Summary

Ours is among the first large-sample exploration of rank-based differences in the knowledge “stocks” of managerial accountants. The high statistical power and correspondingly low β error in our tests of hypotheses are one important advantage of our method (Cohen, 1969/1988, 1992; Kraemer & Thiemann, 1987). Another advantage of our approach is that we triangulate prior managerial accounting research methods (e.g. using surveys, interviews, and experimenter-adapted tasks) with direct measures of knowledge content (i.e. industry and TMK) that hold relevance to managerial accounting, but are uninvestigated in previous research. Ours is also

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12 We conducted additional analyses to confirm that TMK differences occur between juniors, seniors, and managers in all three of the examined industries (P < 0.001).
among the first investigations of organizational knowledge management processes in accounting. However, while our investigation helps to illuminate the rank-based differences in the knowledge stocks of managerial accountants, it does not explore the effects of managerial accountants' knowledge and ability of their professional success. In part 2 of this paper, we explore this important issue.

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Appendix. Example questions

A1. Examples of managerial accounting questions

1. The current market price of Action Pharmaceutical's common stock is $34. A 6-month call option has been written on the stock. The option has an exercise price of $40, and a market value of $4. A financial analyst estimates that at the end of 6 months, the expected value of the stock is $42. What is the value just prior to expiration of the option if the stock closes at $42 at the end of 6 months?
   (a) $4.00.
   (b) $0.
   (c) $6.00.
   (d) $8.00.
   (e) $2.00.

2. Spotech Co.'s budgeted sales and budgeted cost of sales for the coming year are $212,000,000 and $132,500,000, respectively. Short-term interest rates are expected to average 5 percent. If Spotech could increase inventory turnover from its current 8 times per year to 10 times per year, its expected cost savings in the current year would be
   (a) $165,625.
   (b) $0.
   (c) $331,250.
   (d) $81,812.
   (e) $250,000.

In planning and controlling capital expenditures, the most logical sequence is to begin with
   (a) analyzing capital additions proposals.
   (b) making capital expenditure decisions.
   (c) analyzing and evaluating all promising alternatives.
   (d) identifying capital addition projects and other capital needs.
   (e) developing capital budgets.

A2. Examples of tacit managerial knowledge questions

Directions for completing task

The following questions ask for your views on matters pertaining to the work of a manager. Questions 1 through 11 ask you to rate the importance you would assign to various items in making work-related decisions and judgments.

Use a 1 to 7 rating scale. A rating of 1 should signify "not important," while a 7 should signify "extremely important." A rating of 4 should signify "moderately important."

1 2 3 4 5 6 7
Not Important Moderately Important Extremely Important
Try to use the entire scale when responding, although not necessarily for each question. For example, you may decide that none of the items listed for a particular question are important, or that they all are. There are, of course, no “correct” answers. You are encouraged to briefly scan the items of a given question before responding to get some idea of the range of importance for the items. Remember, you are being asked to rate the importance you personally assign to each item in making the judgment or decision mentioned in the question stem.

2. Your company has sent you to a university to recruit and interview potential trainees for management positions. You have been considering characteristics of students that are important to later success in business. Rate the importance of the following student characteristics by the extent to which they lead to later success in business.

(a) Ability to set priorities according to the importance of your tasks.
(b) Motivation.
(c) Ability to follow through and bring completion to tasks.
(d) Ability to promote your ideas; to convince others of the worth of your work.
(e) The need to win at everything no matter what the cost.

7. You have just been promoted to head of an important department in the company. The previous head had been transferred to an equivalent position in a less important department. Your understanding of the reason for the move is that the performance of the department as a whole was mediocre. There were not any glaring deficiencies, just a perception of the department as so-so rather than as very good. Your charge is to shape up the department. Results are expected quickly. Rate the following pieces of advice colleagues have given you by their importance to succeeding in your new position.

(a) Give your superiors frequent progress reports.
(b) Announce a major reorganization of the department that includes getting rid of whomever you believe to be “dead wood.”
(c) Make people feel completely responsible for their work.
(d) Be honest in your evaluations of those who are doing poorly.

A3. Examples of general intelligence and problem-solving ability questions

For each of the problems in this (General Problems) section, circle only one answer per question. For questions 1 and 2, choose the analogous pair of words.

1. MITIGATE: SEVERE:
   (a) compile: available
   (b) restore: new
   (c) contribute: charitable
   (d) qualify: general

Use the following information to answer questions 3 through 5:

Last week’s total hours worked and hourly wages for the cashiers at market X

<table>
<thead>
<tr>
<th>Cashier</th>
<th>Hourly wage</th>
<th>Total hours worked</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>$4.25</td>
<td>40</td>
</tr>
<tr>
<td>Q</td>
<td>4.75</td>
<td>32</td>
</tr>
<tr>
<td>R</td>
<td>5.00</td>
<td>26</td>
</tr>
<tr>
<td>S</td>
<td>5.50</td>
<td>25</td>
</tr>
<tr>
<td>T</td>
<td>5.50</td>
<td>22</td>
</tr>
</tbody>
</table>

Note: Last week no more than two cashiers worked at any one time, no cashier worked more
than 12 hours on the same day, and on each day, each cashier worked continuously.

3. If Market X is open 96 hours per week, for how many hours last week were two cashiers working at the same time?

(a) 49.
(b) 48.
(c) 36.
(d) 24.

Use the following information to answer questions 6 through 8.

P, Q, R, S, and T are the computers in the five overseas offices of a large multinational corporation. The computers are linked in an unusual manner in order to provide increased security for the data in certain offices. Data can be requested only:

from P by Q from S by Q
from P by T from S by T
from Q by P from T by R
from R by P

6. If computers Q, R, S, and T are the only ones operating, which of the following requests for data can be made, either directly or through one or more of the other computers?

(a) a request by Q for data from T.
(b) a request by T for data from R.
(c) a request by R for data from Q.
(d) a request by R for data from S.

A4. Examples of publishing industry questions:

1. The machine used to place ready-to-run advertisements into the newspaper immediately after the paper is printed but before the newspaper is bundled is called a(n)

(a) Inserter
(b) Sorter
(c) Stacker
(d) Organizer

2. ___ agreed to acquire Providence Journal Co. for $1.54 billion in cash and stock in a move that would make the media Concern one of the nation’s largest television-station owners. After the transaction, this Company will become the nation’s eight-largest TV operator, with stations reaching about 12% of U.S. households.

(a) Belo Corp.
(b) Media General Inc.
(c) Times Mirror Co.
(d) Washington Post Co.

3. Which of the following waste products is considered hazardous waste material?

(a) Water-based inks
(b) Developing chemicals
(c) Newsprint waste
(d) Scrap aluminum plate material

A5. Examples of paper industry questions:

1. In the paper making process, which of the following processes is first?

(a) Bleacher
(b) Thickener
(c) Chipper
(d) Washer

2. The Clinton administration and 15 timber Companies struck a deal on Sep 17, 1996 to protect several tracts of old growth forests in the Northwest. Under the deal, filed in US District Court in Eugene OR, the Companies will be allowed to log substitute groves less critical to fish and wildlife. One of the timber Companies involved in this agreement was:

(a) Boise Cascade Corp.
(b) Crown Paper Co.
(c) Westvaco Corp.
(d) Weyerhaeuser Co.

3. Kimberly-Clark Corp., Dallas, said it acquired a 49.9% stake in Hogla, the Consumer-products subsidiary of __, for $49.9 million.

(a) American Israeli Paper Mills Ltd.
(b) Avenor Inc.
A6. Examples of chemical industry questions

1. Which of the following is not a competitor in the printing ink industry?
   (a) Betz Laboratories
   (b) Lawter International Inc.
   (c) New York Times Inc.
   (d) Valhi Inc.

2. ___ said it acquired a 50% stake in privately held Waste Control Specialists L.L.C. of Houston for $25 million. The diversified company said Waste Control holds permits for storage, handling, treatment and disposal of certain hazardous chemical wastes.
   (a) Betz Laboratories
   (b) Lawter International Inc.
   (c) New York Times Inc.
   (d) Valhi Inc.

3. Inks consist essentially of two components, the ___, an insoluble solid or a dye, and the ___, a liquid in which the colourant is suspended or dissolved.
   (a) colourant/vehicle
   (b) gloss/opaque
   (c) pigment/opaque
   (d) gloss/vehicle

References


New Accountant (1988). Where have all the accountants gone? 14, 18, 19, 33.


