The Strategic Relevance of Competitor Cost Assessment – an Empirical Study of Competitor Accounting

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Abstract

In order to facilitate collecting and analysing accounting information with a competitive focus and in the context of strategic management accounting, the term competitor accounting has been developed in the literature. In the present study, the effectiveness of a central instrument of competitor accounting, the assessment of the competitor's cost, is examined in a laboratory experiment. The results reveal that cost leaders who are aware of their cost lead, act differently than cost leaders without such knowledge. Informed cost leaders implement their strategic decisions much more resolutely. They employ a far more expansive production quantity policy and a more aggressive pricing policy. Through pursuing these strategies aggressively, this knowledge of the competitive strengths at the cost level leads to better company performance.

Keywords

**Strategic Management Accounting
Competitor Accounting
Competitor Cost Assessment
Competitor Analysis**

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Introduction

The literature introduces a number of theories and models that forecast competitors' actions within the context of strategy development (Singer and Broderie, 1990). In recent literature, approaches can increasingly be found in which such a competitive analysis is attributed to strategic management accounting (Ward, 1992, pp. 86-90). A special term has been presented in the literature for collecting and analysing accounting information with a competitive focus in the context of strategic management accounting: The various procedures are subsumed by the term competitor accounting (Ward, 1996, p. 238).

There is a limited number of empirical studies to date on strategic management accounting and its subdivision of competitor accounting (Lord, 1996). The alleged lack of empirical evidence on strategic management accounting is filled to some extent by contributions by Lord (1996), Dixon (1998), Bhimani and Keshtvarz (1999), Guilding, Cravens and Tayles (2000), Roslender and Hart (2003) and Meyer (2004). No study has so far discussed the significance of the analysis of competitor-related costs. The objective of the present study is to examine the potential influence of the relative cost position on strategic decisions and to investigate a possible connection between knowledge of competitor-related costs and the success of one's own company. In order to design the experiment as realistically as possible, the business game MARGA is used.

This paper is structured as follows. Firstly, the terms competitor accounting and competitor cost assessment are specified. Next, the results of previous studies on competitor accounting are discussed and the contribution of the present study explained. The hypotheses relating to the strategic relevance of competitor-related cost information are then developed.

Subsequently, the method of the study, the structure of the experiment and approaches for measuring the variables are explained.

The following section introduces the results of the study which are then discussed critically.

Competitor Cost Assessment as a Method of Competitor Accounting

Competitor accounting is regarded as an independent topic within the field of strategic management accounting (Jarvenpaa, 1998, p. 6). Competitor accounting is the analysis of accounting information relating to competitors. The use of competitor accounting is supposed to: provide detailed insight into a competitor's present cost and financial situation; determine one's own competitive position and predict future competitive strategic behaviour. On the basis of a factor analysis of the application frequency of twelve instruments within strategic management accounting, Guilding et al. (2000) attributed the following three methods to competitor accounting:
(1) Competitive position monitoring,
(2) Competitor appraisal based on published financial statements and
(3) Competitor cost assessment.

Competitor cost assessment includes a regularly updated forecast of competitors' unit costs (Guilding, 1999, p. 585). The assessment of relative cost compared to that of competitors is particularly important for decision making (Ward et al., 1992, p. 19). The results of this comparison are used for sensitisation, e.g. to one's own weaknesses, benchmarking, authorisation and decision-making (Ghoshal and Westney, 1991, pp. 24-27). In the case of a cost disadvantage, possible threats by competitors which lower their prices below long-term cost are recognised at an early stage. Well formulated cost reduction programs may prevent cutthroat competition from developing. Cost benchmarking helps a company improve its future cost situation by providing key ratios of the competitors' cost structures and thus methods of process optimisation (Fifer, 1989, p. 18). In this authorisation context, knowledge of the

competitors' cost situation may justify particular suggestions and convince the organisation of the feasibility of cost reduction programs. Knowledge of the competitors' cost situation is particularly significant if investments in new technologies tie up substantial capital (Hesford, 2001, pp. 5-6). These long-term obligations constitute a heavy cost burden in the form of depreciation (Jones, 1988, p. 33). If competitors make similar investments, there is a risk of excess capacity. Due to the high fixed costs of such investments, all companies try to utilise their existing capacities as fully as possible. Only companies with a cost lead will survive the resulting cutthroat competition.

The comparison of one's own unit costs with those of the competitors requires a systematic procedure. The framework of the analysis introduced here distinguishes between the methods applied for cost assessment, data procurement, the transitional calculations required to establish basic data comparability, the strategic supplementary data and a concluding assessment of the results.

Three methods can be used for reliable product cost assessment: a process-related, component-wise or production factor-related procedure. In the *process-related* examination, the cost of individual output phases is assigned to the point at which they are caused. Therefore, the cost-causing factors in each output phase must be identified accurately and defined. Alternatively, the cost of each structural component can be determined and these *components* added to the total cost of the product analysed. Reverse engineering is frequently used. This breaks the products down and analyses them with respect to the materials they comprise, components used, functional production methods and processes. Finally, the product cost can be derived from the cost of the competitors' different *production factors*. Information gained from mutual suppliers of equipment makes it possible to assess the condition and utilisation of the competitors' assets. Relative differences in the cost of work can

be derived from the machinery and equipment, the shift patterns and collective agreements.

The different sources of *data collection* can be categorised as follows according to the difficulty of access (Hallaq and Steinhorst, 1994, p. 789): internal employees, published material, third parties and the observation and analysis of physical evidence. First of all, consulting present or former *employees* in the company *itself* would seem advisable. Internal supply personnel are regarded as the key source of information about competitors. (Subramanian and IsHak, 1998, p. 18). Furthermore, *material published* about competitors can be examined and information from commercial data bases can be utilised. However, compared to these publicly accessible sources, *third parties* such as, for example, individual industry experts are considered more valuable. However, above all, dialogue should be sought with suppliers and customers who do business with the company and its competitors. Finally, information can be gained by immediate observations and analysing physical evidence.

In order to provide a meaningful comparative analysis of the cost data of competitors, a number of transitive calculations must be made. These consider random perturbations at the instrumental level, cost side or value dimension of the products. *Instrumentally* possible distortions can be avoided by different calculation methods, for example overhead cost allocation. Next, the estimation of the competitors' *costs* must be adjusted to the internal production volumes and the company's own product variety (Jones, 1988, p. 34). Furthermore, freight costs, customs and other indirect product-related costs must be recorded and compared. Finally, an adjustment for possible *value* differences between the products (quality, customer service) to be compared must be made.

In order to avoid an isolated examination of the present time, supplementary future- and strategy-related data must also be considered. The effects of *future* cost reduction *programs* by the competitors should be predicted and taken into account for the calculation of the product cost difference. In order to ensure that the cost figures are not interpreted out of *context*, it is necessary to ensure a connection with soft data such as competitors' strategies, capacity extensions, planned process changes and new product lines.

Finally, the quality of the competitors' cost estimation must be assessed both at the level of individual data and the relative product cost as indicated by the results obtained. For evaluating the quality of the *individual data,* the criteria of quality and reliability must be taken into consideration. (Roemer, 1988, p. 495). *Quality* represents the significance and degree of novelty of the insights gained by competitor-related data. The *reliability* represents the credibility of such cost information which can be manipulated relatively easily. At the *results level,* the accuracy with which the competitors' costs have been forecast is normally verified by comparing competitors' balance sheets which have been constructed from cost estimates in published balance sheets (Jones, 1988, p. 34-35).

Practitioners attribute a high degree of relevance to competitors' cost information (Hesford, 2001, pp. 21-22). Cost information about competitors can easily be quantified, interpreted and distributed. Therefore, these 'hard' figures are more readily accepted by management than soft information such as the psychological profiles of competitor top executives. This is because there is the impression that the cost data are 'true' figures, rather than estimates and mere speculation (Lord, 1996, p. 363).

The advantage of the higher credibility of cost information about competitors is at least partly offset by the considerable difficulty in procuring such information (Marren, 1998). Even simple estimates of competitors' costs involve considerable expense. The high cost of obtaining the information and the obstacles to acquiring

the data, which sometimes cannot be overcome, limit the potential for estimating competitors' costs. This conflict between the benefit of competitor cost information and the problems involved in obtaining this information is also reflected in the previous studies on competitor accounting.

Research on Competitor Accounting

Despite a large body of studies at the marketing-accounting interface (Ratnatunga 1988), only a few contributions on competitor accounting are of an empirical nature. Recently between 1999 and 2004 there were six extensive empirical studies on using instruments of competitor accounting (Guilding 1999; Gruetter-Settele 1999; Guilding et al. 2000; Hesford 2001; Cravens and Guilding 2001, Meyer 2004). In spite of the different terms used by the various authors (competitor accounting, competitor-focused-accounting and accounting information in competitive intelligence), they all demonstrate equally the practical relevance of accounting data relating to competitors. The most important results from the different studies are introduced below.

The Guilding study (1999) is dedicated to the use of instruments of competitor accounting in New Zealand companies. Guilding identifies a far greater application of the instruments than previously expected. Monitoring the competitive position proves to be the instrument of competitor accounting used most often and regarded as the most useful (Guilding, 1999, p. 593). Compared to the other instruments, competitor cost assessment is used relatively infrequently. The application frequency of this method is below the average value of the measurement scale (Guilding, 1999, p. 593). Furthermore, Guilding identifies three factors which exert a significant influence on the use and perceived usefulness of competitor accounting: company size, competitive strategy and strategic mission.

Gruetter-Settele (1999) studied company analyses of the annual financial statements of their competitors. In the context of a

business game conducted in a laboratory setting with participants from the German-speaking world, he examined whether there is a connection between the strategic decisions of companies and their knowledge of financial statement ratios of competitors. He focuses in particular on the extent to which planning accuracy, basic strategic orientation and the strategically relevant individual decisions are influenced. Gruetter-Settele observed an influence on pricing strategy, variable production costs and the profit situation. His experiment proved that competitors' annual financial statements influence a company's decision-making. He came to the conclusion that the evaluation of competitors on the basis of published annual financial statements should become a fixed part of competitive analysis.

In a study of companies from Great Britain, New Zealand and the USA, Guilding et al. (2000) analysed the use of twelve different practices of strategic management accounting. They came to the conclusion that the three above-mentioned instruments of competitor accounting represent the most popular techniques of strategic management accounting, together with strategic pricing (Guilding et al., 2000, p. 113). Based on the observed perceived benefit of competitor accounting, the potential of these instruments does not yet appear to be exhausted. In all methods used, the perceived benefit received a much higher value than the previous application frequency. There are still clear differences between the recipient's information needs and that which accounting is able to provide (Guilding et al., 2000, p. 128), because a perceived high benefit leads to expectations of a much more frequent use of competitor-related information from the accounting department.

Hesford (2001) interviewed American members of the Society of Competitive Intelligence Professionals about the use of accounting information. With regard to the instruments, he focuses on two methods: (1) the assessment of competitors on the basis of published annual financial statements; and (2) evaluation of competitors' cost. The

focus of the study is on the determinants of the use of accounting information. With increasing competition, organisational support and accounting knowledge, Hesford (2001) identified an increasing demand for accounting information in the context of competitive intelligence. The increased use of accounting information has a positive influence on the effectiveness of competitive intelligence. Accounting data seem to be more helpful in strategic decision-making than other sources of information used by the decision makers. Such data is considered reliable and relatively undistorted; while qualitative information such as company press releases are strongly influenced by the competitors themselves. Finally, an increased effectiveness of competitive intelligence also has a positive effect on the corporate performance. Hesford (2001) concludes that monitoring financial information is a central part of competitive intelligence.

In a written questionnaire Cravens and Guilding (2001) surveyed accountancy department managers of American companies to inquire about the incidence, use and perceived utility of strategic management accounting. In accordance with previous studies, competitor accounting is regarded as the prevalent topic and the most heavily used method of strategic management accounting. Companies pursuing a strategy of R&D-leadership apply the techniques of competitor accounting to a relatively high degree (Cravens and Guilding, 2001, p. 112).

Meyer (2004) conducted a survey on the diffusion of 20 strategic management accounting innovations in a sample of the largest Danish businesses. The methods analysed included competitor cost assessment (competitor cost analysis) and competitive position monitoring (strategic positioning analysis). The evaluated instruments of strategic management accounting reveal a wide range of possible applications (Meyer, 2004, p. 21). The most commonly used methods are competitor cost analysis, strategic pricing and target price/target profit. In contrast to Guilding,

Meyer did not identify a group of strategic management accounting instruments which focus mainly on competitors, the two analysed instruments of competitor accounting loaded on different factors (Meyer, 2004, p. 18f.).

The review of recent studies of the use of competitor-related accounting information demonstrates a need for further research in three different areas: method, subject, and objectives of the studies.

With regard to the method of the studies, all were interview-based, apart from Gruetter-Settele's study. Some researchers discuss the limitations of relying on interviews. For example, a lack of standardisation of terms can result in a varied understanding of the same term or overlapping content of the instruments (Guilding, 1999, p. 594). Observation, however, allows immediate analysis of the behaviour of economic actors in specific decision-making situations. Compared to interviews, the filter of self-assessment for the study group does not apply.

In all of the studies except that of Gruetter-Settele, the subjects are experts, that is staff in the fields of competitive intelligence and management accounting. However, these individuals are information producers rather than persons in the company who make decisions on the basis of the competitor-related information. We argue that the benefit of accounting information should be assessed by the information users. In this respect, a future study should provide a generalisation of the statements with regard to the occupational groups included.

Finally, on the basis of the present status of investigation, new studies should address the need for further information identified in previous studies. For further analysis Guilding (1999) suggests a focus on the following study objectives: consequences for corporate performance and competition-related effects of competitor accounting. Such effects may be regarded as the "litmus test" of effectiveness of these methods. In a laboratory experiment, Gruetter-Settele (1999) already confirmed the significance

of information from annual financial statements for certain strategically relevant individual decisions. However, no study has yet investigated the decision-making relevance of competitor cost assessment or the effect on performance of obtaining and processing such information.

Materials and Methods

Development of Hypotheses

Within strategic management accounting, the relevance of competitor-related cost information is stressed in the literature (Simmonds, 1981; Ratnatunga, 1983; Jones, 1988; Bromwich, 1990). The point is made that obtaining and processing the cost data of competitors allows a company to assess its own strengths and weaknesses in terms of costs. If one company performs its activities more efficiently than others, competitive advantages arise and can be used strategically (Porter, 1999, p. 63).

Previous empirical studies, however, stress that there is a considerable discrepancy between the advantage perceived by information recipients and the actual utilisation of competitor-related cost information. However, potential advantages of obtaining and processing the cost data of competitors can only be gained if the insights provided are relevant to strategic decisions and if the data can positively influence the quality of decisions. If the strategic relevance of cost information about competitors is confirmed, the cost data should be recorded systematically and considered in the decision-making process, despite the high cost of obtaining the information.

The study of the influence of competitor-related information on strategic decisions requires knowledge of a clearly defined strategy from the competition. Knowledge of cost-related strengths and weaknesses is most relevant to potential cost leaders. Their entire strategic orientation is based on achieving a better cost position than the competition. In this case, knowledge of industry-internal cost advantages and disadvantages represents an increase in planning and decision security. Therefore,

knowledge of the relative cost position of cost leaders should also be associated with more profitable performance.

The decision to pursue a strategy of cost leadership has a variety of consequences for production, investment and marketing. An analysis of these decisions facilitates a verification of the implementation of the cost leadership strategy. Typically, cost leadership is accompanied by an expansive volume strategy in order to benefit from economies of scale and experience-curve effects. A decision to increase production quantity requires appropriate production capacity. In terms of a strategy of cost leadership, investments relating to business expansion can be expected. The expanded capacities and increased production volumes require an appropriate application of marketing policy instruments. Increased sales volume can be achieved by price reductions. On the basis of these follow-up decisions, researchers can examine whether informed cost leaders are more likely to pursue a cost leadership strategy than cost leaders who are unaware of their favourable cost position.

The following fundamental hypothesis is derived from the above reflections. Knowledge of the strengths and weaknesses of the prevailing cost position is derived from an estimation of competitors' costs, and influences the strategic decisions and the economic performance of cost leaders. Companies which possess cost information about competitors should therefore make different strategic decisions and, ultimately, be more successful than companies which do not have such information. In this respect, the following four hypotheses are investigated separately:

- *Hypothesis 1: Investment behaviour*
  Informed cost leaders extend their production capacities to a greater extent than uninformed cost leaders.
- *Hypothesis 2: Production quantity policy*
  Informed cost leaders achieve a higher production quantity than uninformed cost leaders.

- *Hypothesis 3: Price policy*
  Informed cost leaders have a lower price level than uninformed cost leaders.
- *Hypothesis 4: Company performance*
  Knowledge of their own relative cost position leads to more successful strategies for informed cost leaders, and to more profitable company performance than uninformed cost leaders.

The general validity of the fundamental hypothesis can be examined, despite the restriction of this study to the cost leadership strategy only. As a possible restraining variable, the phase of the product life cycle must be taken into account. The ratios to be measured in the context of monitoring the competitive situation are crucially dependent on the prevailing phase of the industry's life cycle (Ward et al., 1992, pp. 19-20). The relative cost position only becomes a critical success factor during increasing price competition in a relatively mature industry. However, cost information should be of strategic relevance in pursuing a cost leadership strategy independent of the phase of the product life cycle.

Study Method

In Section 3, attention is drawn to the methodological limitations of previous studies. In order to achieve the necessary correspondence with reality, actual decisions made by managers must be taken into account. However, the necessary data for the study of actual economic life is not normally accessible to outsiders. Because of this limitation, laboratory experiments, via either case studies or business games, are a suitable substitute for actual management decisions. In a case study, however, the complexity of interrelationships in a long-term dynamic competition situation cannot be described adequately. The use of a company simulation for obtaining data, however, has crucial advantages:

- The starting situation, environmental development and information status can be created identically for all fictitious companies. The comparability of the data is thereby guaranteed.

- With regard to content priorities, the temporal structure of the experiment and the process can be planned in detail at the beginning and, therefore, the cause-and-effect-relationships can be observed specifically by excluding random acts.
- Fictitious companies do not have the opportunity to hold back "sensitive" information, except as permitted within the experiment.
- A business game is able to simulate a dynamic competitive situation over a longer period of time.

The above advantages are partly negated by the considerable abstraction of business games. In a simulation, "reality" is not taken into account by the subjects. Rather, only the perception of reality and assumptions about its functioning matter to the subjects. The abstraction of operational business games is sometimes so intense that the entire simulation is rather removed from reality. Certain effects that distort or simplify reality can result from such an abstraction. Sometimes even the behaviour of people in managerial business games diverges from reality. However, the company simulation MARGA selected for this study is well accepted in operational practice. Since 1971 MARGA has been employed as an instrument for instruction and further education in human resources development. The number of business executives who have taken part in MARGA to date is estimated at well over 70,000. The number of participants, which is unique for the German managerial business game market, certifies the realism of the corporate simulation.

MARGA simulates the marketing, production, purchasing, logistics, personnel and finance departments of an entire company. All departments are closely connected with one another and managed by the participants, who must make a total of 77 separate decisions per period. Three products can be offered in four markets: Europe, Russia, the USA and Japan. Product 1 is a consumer good in the maturity stage, Product 2 is a newly developed service in the introduction stage

and Product 3 is a technically sophisticated business good in the growth stage of the product life cycle. The participants in the business game are divided into four competing companies which conflict with each other at the beginning of the game selling the same products and having the same resource structure. The objective of the game is to maximise accumulated profit and to reach the next round as the group winner.

This selection criterion and the market situation of an oligopoly cause high competitive intensity in the business game MARGA. Therefore, certain determinants of the use of accounting information were not taken into account in the study as intervening variables (Peyrot et al., 2002, p. 748). In this connection, Hesford (2001) identified a positive relationship between the intensity of competition and demand for accounting information. The general structure of the business game reduces the application. In this instance the business game was only used in the context of a highly competitive market. Independent of the business sector, the products can be characterised as consumer, service or business goods and furthermore, they are at different stages of their life cycles.

MARGA simulates a time horizon of six business game periods. As a result of the time-lapse effect of business games, this simulated time horizon is sufficient for an analysis of strategic decisions. MARGA is offered in seminars for further education and as a distance business game. However, if it is used as a distance business game, it is only possible to have a large number of participants with the same version of the simulation model and an identical general setting.

The business game was offered in two different versions during the study period: a normal version and a version reduced by one round and intended for students. Primarily, this paper introduces the results of the normal company simulation of six periods. A key limitation of previous studies relates to the relatively homogenous pool of subjects; an examination of the

business game version for students would not eliminate this deficit. In contrast, the participants in the study on which we focus here are management-level employees working in different positions. The participants were recruited from a variety of business sectors and have different occupational training. In addition, the managers have a higher level of practical education and broader work experience, as compared to the students. We ran the distance game with 1,500 management personnel organised into 284 teams. The results reported here focus on the 71 cost-leading teams. Additionally, the hypotheses were verified on the basis of the business game version for students, comprising 472 teams and about 2,500 participants. However, the results of this controlled observation are only mentioned where they differ significantly from the results of the study group of management executives (Heinen, 2002).

Structure of the Experiment

The 284 participating MARGA teams are randomly assigned to groups of four companies. Only these four companies compete directly against each other. The 71 MARGA groups are further divided into 36 study and 35 control groups. All teams in the study group receive certain competitor-related cost information which is not made available to the teams in the control group. This information takes the form of a "ticker report" which is noticeably displayed at the end of the second period. The "ticker report" contains information about which of the four companies is the cost leader with regard to Products 1, 2 and 3. In contrast, the teams in the control group do not receive this information nor have an opportunity to obtain the information elsewhere, either directly or indirectly.

The "ticker report" summarises the competitor-related cost information of the cost-lead. This is a simplification compared to the contents studied for competitor cost assessment. Rather than detailed estimates of the competitors' cost, aggregate information about the relative competitive strength on the cost level is provided. Thus, the difficulties in obtaining the cost

information observed in previous studies are taken into account. In reality, information about a cost lead could possibly be obtained more easily than through detailed quantitative cost information about competitors. In reality, companies may collect even more detailed information about the cost situation of competitors; e.g., about the amount of the cost advantage. Moreover, it can be expected that some competitors achieve a higher information advantage about the relative unit costs. Consequently, the companies' actively employing competitor accounting may have a more comprehensive information lead.

Additionally, this information can be linked to other competitor-related cost information provided by MARGA. After the second period, all teams, including the control teams, receive an annual financial statement containing the balance sheets and profit and loss statements of all four companies. This provides substantial financial and performance-related economic information. In addition, the experience curve is integrated in the MARGA-support software which was provided to the participants. For each of the three products, the expenditure on materials and the team performance of the workers can be established precisely after the second period. It is therefore possible to predict the cost-related effects of the experience curve for one's own company and the competitor.

The "ticker report" is intended to ensure that the information status of one's own relative cost position within the study group and the control group really differs. However, it was only possible to establish whether this information had received the necessary high level of attention by means of a post experiment survey of the participants in all the teams within the study group. All 144 teams in the study group were included in the survey, not just the 36 cost leaders for each product. 85 percent of the 61 responses that could be interpreted confirmed that the ticker report had supported them in their assessment of the strategic situation. Eighty percent of the respondents had used the information for certain decisions. Therefore, it may be

assumed that the cost information about the competitors was consciously taken into account by the majority of decision-makers when making their decisions.

Approach to Measuring the Variables

As a result of the experimental structure, significant differences between the study group and the control group only appear after the second period. Furthermore, the empirical study concentrates on the examination of the strategic decisions of cost leaders. In the business game, a cost leader is a company with the lowest variable production cost in its group per item for Products 1, 2 or 3. A company can only be a cost leader for one of the three products; that is, there is no single company that dominates all three products. A product-differentiated identification of the cost leadership position seems justifiable, because there exist few cross-relationships between each product. The production of the three products is carried out on three different machine types which must be purchased separately and independently of each other. There are no sales interconnections in the product range; that is, each product can be offered separately in each market. Only the decisions of the cost leaders of each of the three products are recorded in separate data records and assessed in the empirical study. The decisions of a cost leader as to pricing policy can be analysed marketwise; i.e., four times per product. Other decisions made by the current cost leader, such as on investment and production quantities can only be made and examined product-wise; that is, only once per product.

Hypothesis 1: Investment Behaviour

Investment behaviour is measured by establishing machine capacities. Because each product is produced on a different machine, a product-differentiated identification is possible. Capacity units per machine type are recorded for the current cost leaders. The capacity available in each period is the result of all investments and disinvestments made up to this time. Because capacity expansions can only be carried out in certain fixed steps, the feature "capacity units" can only assume a limited

number of values. Therefore, it is based on a metric scale level. The following null hypothesis, H_01, is formulated as the starting point for the statistical test method: The teams within the study group and the control group which are in a position of cost leadership do not display significantly different investment behaviour in the individual periods of the study; i.e., each group has similar available production capacity.

Hypothesis 2: Production Quantity Policy

The production quantity policy is recorded as the percentage deviation from the average of the accumulated production quantity of the cost leader for all four market members of the group. Theoretically, the production quantity can assume an unlimited number of values. The development of this attribute is therefore steady and has a metric scale. Specifically, it leads to the following null hypothesis, H_02: The teams of the study group and the control group which have a cost leadership position do not display significant differences with regard to the production volume strategies in the individual periods of the study; that is, the percentage deviation of the accumulated production quantity of the cost leader from the group average is similar in both study and control groups.

Hypothesis 3: Price Policy

In order to investigate the price policy, the percentage deviation of the price of the cost leader from the average price of the four competitors is recorded. Measuring the deviation from the average price makes the result independent of the absolute price level of individual groups of four. It develops differently in each group within the business game and can assume very low values, for example as a result of cut-throat price wars. Again, the attribute under consideration is steady and has a metric scale. The null hypothesis, H_03, is: The study group and control group teams which have a cost leadership position do not yield significant differences in price strategy in the individual periods. In both groups the percentage deviation of the price of the cost

leader from the average of all four competitors is low.

Hypothesis 4: Performance of the Company

The ranking of the product-specific contribution margin within the group, calculated as gross sales minus product-specific variable cost, is used as an indicator of team economic performance. In order to proceed to the next round of the business game, a team must have achieved a higher accumulated annual net profit than the three competitors. Therefore, the measurement figure "position" should be given preference over the product-specific contribution margins accumulated over time. "Position" is independent of the price level which develops differently in each of the groups of four and can strongly influence the financial results positively or negatively. The attribute "position" can only have the values 1, 2, 3 or 4. Therefore, the data is discrete and has an ordinal scale. The null hypothesis, H_04, is: The teams within the study group and the control group which are cost-leaders, do not yield significant rank order differences in the individual periods.

The partial exclusion of temporal connections can be analysed critically through measuring the variables. The statistical examination of decision-making at certain individual times and the analysis of the results of these individual examinations neglect interdependencies over time. However, an alternative way of proceeding, using the reception of data as time series, was not implemented. The precise period evaluation allows a more accurate analysis of possible distortions resulting from tactical behaviour towards the end of the game. Instead of taking time into account explicitly, the passage of time is included implicitly in the variables examined, for example in the context of Hypothesis 1 on strategic investment behaviour. It is not merely the net increase in capacity per period that is considered, but rather the entire capacity which has been established over the course of the game. Similarly, the variables of Hypotheses 2 and 4 contain information relating to the

entire time frame, with respect to the accumulated production quantity, economic performance and accumulated profit.

Results

The nature of the data plays a decisive role in the selection of test methods. Because of the discrete data, the Wilcoxon rank sum test is employed for Hypotheses 1 and 4. For Hypotheses 2 and 3, the Kolmogorov-Smirnov adjustment test is used to test the cardinal data. All 71 data sets can be applied to all hypotheses. An error probability of 10 percent is chosen as the level of significance. This value is expressed in p-values of 0.1 in the present survey.

The statistical procedure is explained in more detail using the first hypothesis on investment behaviour as an example. The application of the Wilcoxon ranking sum test in SPSS results in a divided output. The first part is described for only one product in Table 1 and the second part for all products in Table 2. The data from the 36 teams of the examination group and the 35 teams of the control group are ordered according to increasing size in the Wilcoxon ranking sum test. The X-values to which the data of the examination group are assigned are allocated to the relevant ranks of the data series which is increasing in value. Afterwards, the sum of all ranks of the X-values is taken and the rank sums shown for Product 1 in Table 1. The average rank results from the proceeding division of rank sum by the number of the values, N. In a similar procedure, the values of the control group are derived. The rank sum described in Table 1 and therefore also the medium rank, reveal significant differences for Product 1 beginning in Period 3.

Table 1:   Calculation of ranks for Hypothesis 1 and Product 1

	Classification	N	Average rank	Rank sum
Period 1	Study group	36	35.40	1,274.50
	Control group	35	36.61	1,281.50
Period 2	Study group	36	36.67	1,320.00
	Control group	35	35.31	1,236.00
Period 3	Study group	36	40.36	1,453.00
	Control group	35	31.51	1,103.00
Period 4	Study group	36	41.58	1,497.00
	Control group	35	30.26	1,059.00
Period 5	Study group	36	40.49	1,457.50
	Control group	35	31.39	1,098.50
Period 6	Study group	36	40.10	1,443.50
	Control group	35	31.79	1,112.50

Hypothesis 1: Strategic Investment Behaviour

Table 2 describes the p-values of all six experiment series. The significance levels are noted in italics. For products 1 and 2, the teams in the study group invested more in production capacity after they had received information about their cost position. By contrast, the null hypothesis for Product 3 cannot be rejected in any of the periods 3 to 6. The clear change in p-values from Period 2 to the following periods is not sufficient to support rejection. The companies in the study group were clearly sometimes able to utilise free capacity reserves for Product 3, resulting in investment activities that were lower than expected. Because different results were achieved for all three products without exception, the results of the business game version for students should also be taken into account. Despite considerably reduced p-values from Periods 2 to 3 the null hypothesis could not be rejected in that version for any of the three products in any of the relevant periods. The results indicate a change in investment strategy of the teams in the student study group, but less

strong than in the group of management personnel. These differences might be explained by a lack of professional experience, but most likely they are the result of using different versions of the business game. The business game variation

for students is one round shorter, so that there is less incentive to establish additional machine capacities. Because of the negative results of the student groups hypothesis 1 is not supported.

Table 2: Hypothesis 1, p-values

	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
Product 1	0.798	0.781	*0.069*	*0.020*	*0.062*	*0.088*
Product 2	0.256	0.390	*0.018*	*0.048*	*0.052*	*0.056*
Product 3	0.823	0.743	0.263	0.261	0.286	0.294

Hypothesis 2: Production Quantity Policy
As expected, there are no differences in production volume in the first two periods (see Table 3). From Period 2 to 3, the rapid reduction in p-values already noted in tests of Hypothesis 1 recurs. It may be concluded that there is a change in the production quantity strategy for the teams in the study group after Period 2. After receiving the ticker-report, cost leaders in the study group achieve a higher production quantity than uninformed cost leaders. Except for the last period of Product 1 and the last two periods of Product 3, the null hypothesis can be rejected in all cases. In Period 6, the teams in the study group and control group no longer make significantly different decisions. This could be attributed to the

imminent end of the business game which encourages teams to employ short-term tactics. Occasionally, production volumes are reduced in order to avoid a possible high inventory level which is assessed at variable production cost at the end of the game. Despite three p-values which were not within the expected range, these results, as well as the results achieved with the business game variation for students, generally support a rejection of Null Hypothesis 2. Hence, the teams in the study group chose a more expansive production strategy than the teams in the control group. They wish to use learning curve effects to protect and exploit their more favourable cost position.

Table 3: Hypothesis 2, p-values

	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
Product 1	0.819	0.612	*0.049*	*0.050*	*0.094*	0.389
Product 2	0.958	0.995	*0.083*	*0.049*	*0.040*	*0.042*
Product 3	0.892	0.417	*0.094*	*0.095*	0.168	0.270

Hypothesis 3: Price Policy
The third hypothesis is examined on the basis of a total of 12 data sets; i.e., three products each within four markets. Table 4 shows the p-values in all 12 data sets. Apart from isolated cases, the null hypothesis can be rejected in Periods 3 to 6. However, even in the few cases where the p-value is greater than 0.1, the clarity and persistence of the change, support the rejection of Null Hypothesis 3. In addition, the results of the student version of the business game support the expected relationship even more clearly. The observations should be

interpreted as follows: the percentage deviation of the price of the cost leader from the average price of all four competitors is lower in the study group teams than in the control group teams. Informed cost leaders reduce their price level more aggressively than uninformed cost leaders, because they know that they face a lower risk than their competitors in a price war. They attack their opponents with price cuts, hoping to exploit their vulnerability. The other companies must react by means of price reductions; otherwise they will lose a proportion of

their market share. This explains the expected lower price level in the study group. In summary, Hypothesis 3 can be confirmed with a significance level of 10 percent.

Table 4: Hypothesis 3, p-values

		Period 1	**Period 2**	**Period 3**	**Period 4**	**Period 5**	**Period 6**
Product 1	M 1	0.975	0.862	0.163	*0.088*	*0.100*	*0.020*
	M 2	0.983	0.557	*0.097*	*0.078*	*0.055*	*0.040*
	M 3	0.862	0.819	*0.094*	0.102	*0.010*	*0.010*
	M 4	0.862	0.956	*0.027*	*0.052*	*0.015*	*0.002*
Product 2	M 1	0.992	0.925	0.180	*0.029*	*0.088*	0.249
	M 2	0.991	0.757	0.142	*0.005*	*0.024*	*0.085*
	M 3	0.928	0.975	*0.091*	*0.011*	*0.044*	*0.085*
	M 4	0.646	0.993	*0.100*	*0.083*	*0.023*	*0.078*
Product 3	M 1	0.394	0.844	*0.098*	*0.058*	0.129	*0.022*
	M 2	0.958	0.757	*0.054*	*0.023*	0.131	*0.079*
	M 3	0.629	0.925	*0.026*	*0.043*	*0.039*	*0.011*
	M 4	0.618	0.948	*0.057*	*0.074*	*0.073*	*0.082*

Hypothesis 4: Economic Performance
While the first three hypotheses aimed at certain strategic decisions made by the business game teams, the dependent variable of interest in testing Hypothesis 4 is the overall profit as measured by the rank order. Table 5 expresses the overall results from the fourth hypothesis on the basis of p-values. With the exception of Product 3 in Period 3, the p-value is above the predetermined significance level of 10 percent. The change in p-values from Period 2 to 3 is sufficiently large to support a rejection of the null hypothesis, particularly since all the following p-values

fall below 5 percent. The teams in the study group achieve higher positions and therefore perform better than the teams in the control group; compared to their competitors they achieve higher product-specific contribution margins for the different products. The higher contribution margins are a consequence of the lower product-specific variable costs, which are achieved by greater levels of production. The more aggressive strategy, which is made possible by access to external cost information, leads to better company performance. Therefore, there is strong support for Hypothesis 4.

Table 5: Hypothesis 4, p-values

	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
Product 1	0.975	0.595	*0.068*	*0.035*	*0.007*	*0.062*
Product 2	0.681	0.834	*0.074*	*0.028*	*0.026*	*0.024*
Product 3	0.639	0.819	0.166	*0.038*	*0.038*	*0.031*

Altogether, the results confirm three of the four hypotheses at a significance level of 10 percent. Lower significance levels were attained in some cases. Despite a clear

tendency towards conforming Hypothesis 1, in which investment behaviour is examined, it could not be confirmed at the specified significance level. However, Hypothesis 2,

in which decisions about production quantities are analysed, provides the expected results. Therefore, the laboratory experiment confirms that strategic decisions are affected if the competitor-related cost position is known. Two further aspects supporting the fundamental hypothesis should be taken into consideration:

- The dramatic and enduring change in p-values from Period 2 to the following periods which was observed without exception; and
- The coordinated procedure of the teams in the study group for the expansive volume strategy associated with a significantly more aggressive pricing policy.

Discussion

From this coordinated procedure in the production and marketing areas, it can be concluded that the teams in the study group which are aware of their competitive strengths at the cost level, employ this knowledge by selecting cost leadership as their fundamental strategic orientation. In this respect, knowledge of competitive strengths at the cost level influences the strategic actions of decision-makers. This, in turn, appears to lead to better economic performance. The greater success of the cost leaders who are aware of their competitive advantage is a result of greater commitment to the implementation of their strategy.

In contrast, decision-makers in the same favourable cost position, but unaware of their strengths at the cost level, do not recognise their strategic opportunities. They either choose other strategies which do not exploit their competitive advantage at the cost level to its full extent, or choose a cost leadership strategy, but do not implement it with the same conviction as cost leaders who are conscious of their advantage. The ignorance or uncertainty of one's own competitive strengths and weaknesses results in a lower economic performance.

In the context of the laboratory experiment, an immediate relationship between competitor-related cost information and corporate performance was proven. If one

regards operational business games as a realistic simulation of corporate reality, this study confirms that the collection of competitor-related cost information leads to competitive advantages. These results confirm the findings of Subramanian and IsHak (1998) that firms which have advanced systems to monitor their competitors' activities exhibited greater profitability than firms that did not have such systems.

The results demonstrate that competitor cost assessment is a powerful tool for maintaining or gaining competitive advantage. Knowledge of the cost advantages and disadvantages of competitors allows an anticipation of their future behaviour. In addition, the analysis of external cost information can have far-reaching implications within a company. It can influence the investment behaviour, production quantity and pricing policy.

Therefore, the cost study should be part of an integrated attempt to understand the competitor's capabilities and intentions. Management accountants must take responsibility for this task. They play an important role, because it is necessary to obtain reliable internal product costs in order to conduct competitor cost analysis. In addition to the information provided on internal operations, they should deliver information on competitor costs. The job of management accountants requires an intensive information-gathering approach. They should use all easy accessible sources like direct observation, mutual suppliers, mutual customers, former employees and published accounting data to analyse competitor's costs.

Despite the interest of management accountants in very precise external cost data, the study shows that it is sufficient to have information about the relative cost position compared to that of the competitor. Even upper and lower limits to the competitor's manufacturing cost function are sufficiently reliable for management to use for decision making. Understanding its own cost position is more important, than

knowing the exact "numbers" of your competitors.

Analyses under changing conditions could be used to check the general effectiveness of competitor-related cost information which was observed for the cost leader in this study. It may be expected that companies with different strategic orientations take their awareness of their own cost advantages into account and make good use of it. In the case of differentiation or concentration strategies, planning and decision certainty increase with extensive knowledge of the cost position of competitors. In particular, knowledge of one's own cost disadvantages helps to avoid certain risks. However, the practical use of insights into the strategic relevance of competitor-related cost information gained here (only for the cost leader), requires more generalised evidence of its viability, i.e. for different industry types. This seems to be especially important for markets where competitor-cost information is very difficult to obtain. In the approach of collecting the cost figures from competitors, a company does not really know if it is the cost leader. In this respect, it is necessary to clarify whether the information analysed has a similarly high significance for companies which are not cost leaders themselves. In addition, in the real world, firms that discovered they were not cost leaders in markets where cost was important might develop different product lines or territories to avoid competing where they cannot lead.

However, for the specific application in operational practice from the point of view of the company, the question of the economic efficiency of the competitor accounting techniques seems far more important. The collection of information takes place in the laboratory experiment carried out in this study without cost and time delays. The advantage of competition-related cost information is therefore not encountered with real data collection costs, at most, only in the analysis of such data. However, the economic efficiency of collecting competition-related cost information, in particular, is strongly

doubted by some authors (Marren 1998). Other studies also indicate the high cost of collecting information about the competition, which may possibly not justify the resulting competitive advantages. Guilding et al. (2000, p. 128) observe differences between the information that the addressee requires and the attainable accountancy. Hesford (2001, pp. 21-22) identifies an above average analysis frequency and a low monitoring frequency for cost information. Therefore, future research should consider the economic efficiency of these techniques: Is competitor cost information in fact free or does it require significant management resources to gather, interpret and act upon? In particular, field studies are recommended for analysing the practices applied for evaluating corporate cost structures.

With such study, the theoretical analysis framework and concepts could thus also be checked for their suitability in practice and developed further. In any strategic decision setting, accounting information about competitors' cost structures inevitably includes some uncertainty. Future research should take into consideration this uncertainty and analyse its effect on strategic decision making, especially the aggressiveness in increasing capacities and slashing prices.

Finally, the quality of cost information may well be a consequence of strategic decisions. Firms that have already chosen a strategy of cost leadership may devote more effort to competitive intelligence. Further studies could usefully analyse the influence of competitive strategy on the extent and quality of the business intelligence unit and their ability to deliver external cost information.

The results of the study also indicate a need for action in companies analysed by competitor accounting. That is, information gained from the annual financial statement could influence strategic decisions taken by competitors (Johnson, 2002). Furthermore, as a result of the unfavourable competition-related consequences, the content and extent of the voluntary reporting should be

reconsidered in general. Finally, in order to avoid a cost situation which is transparent to the competitor, internal counter-intelligence should also be increased or if necessary, fully reformulated.

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