About the strategic relevance of competitor cost assessment – An empirical study regarding competitor accounting

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Abstract

In order to facilitate the collection and analysis of accounting information focused on the competitor in the context of strategic management accounting, the term competitor accounting has been developed. In a number of studies, the application frequency and the perceived benefit, the influencing factors of the application and the effectiveness of accounting information has been researched. However, no empirical results are available as to the extent to which such information influences strategic decision behavior, or if knowledge of such information leads to better company performance in the long run. In the present study, all these aspects are researched in a laboratory experiment for a central instrument of competitor accounting – the assessment of the competitor’s cost. The decision behavior of more than 1,500 participants of the business game MARGA was observed. The results reveal that cost leaders who are informed about their cost lead act differently than cost leaders without such knowledge. Informed cost leaders put their strategic decisions into practice much more resolutely. They employ a much more expansive production quantity policy and a more aggressive pricing policy. By more resolute pursuit of the strategies, knowledge of the competitive strengths on cost level finally leads to better company performance.

1. Introduction

The literature introduces a number of theories and modeling a forecast of the competitors’ actions within the context of development of the own strategy. Increasingly in recent literature, approaches can be found in which this task area is attributed to strategic management accounting. In this context, strategic management accounting entails collection and analysis of information about the cost structures and product markets of the company, the cost of its competitors and monitoring of the company and competitors’ strategies in these markets over a number of periods. In general, three basic perspectives of strategic management accounting can be distinguished: (1) the environmental or marketing orientation, (2) the focus on competitors and (3) the long-term, future-related orientation. A special term has been developed for the collection and analysis of accounting information with a focus on competitors in the context of strategic management accounting. The different procedures are summarized under the term competitor accounting.

The number of empirical studies to date regarding the strategic management accounting is limited. Not a single study has discussed the significance of the analysis of competitor-related cost information. The objective of this study is to examine the possible influence of the relative cost position on strategic decisions and to investigate a possible connection

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1 See the overview of SINGER/BRODERIE (1990).
3 See BROMWICH (1990), p. 28.
between knowledge of competitor-related cost information and the success of one’s own company.

This article is structured as follows. First of all, the term competitor accounting is put into concrete terms and the estimation of the competitors’ costs, which is the focus of interest, is explained in detail. Afterwards, the results of previous studies concerning competitor accounting are introduced and the existing need for research (contribution of this study) is identified. At the beginning of chapter 4, the hypotheses concerning the strategic relevance of competitor-related cost information are developed. Afterwards, the method of the study, structure of the experiment and the approaches for measuring the variables are explained. Chapter 5 introduces the results of the study which are finally discussed critically in chapter 6.

2. Competitor cost assessment as a method of competitor accounting

2.1. Competitor accounting

According to the literature, competitor accounting is regarded as an independent topic within the field of strategic management accounting.\(^7\) Although it is attributed to a large extent to certain instruments, no clear definition of the term exists. Therefore, an attempt is made first of all to bring about an appropriation of the term by distinguishing competitor accounting from related instruments. In this context it is particularly necessary to make a distinction regarding competitive intelligence, which is concerned with all the information related to competitors.

*Competitive intelligence* includes the systematic collection and analysis of information about competitors. The data collected comprises all factors influencing the competitive environment of a company.\(^8\) The differences between competitor accounting and competitive intelligence become apparent with regard to the prevailing distinctiveness of the features functional emphasis, type of information, time horizon, method of analysis and object of examination.

With regard to the *functional emphasis* in competitor accounting, the actual data analysis is central. In contrast, competitive intelligence is concerned much more intensively with data management, i.e., obtaining the data, structuring it and examining its reliability. With regard to the *type of information*, competitor accounting aims primarily at so-called hard (i.e. quantifiable) figures, especially ratios. Competitive intelligence primarily supplies soft, qualitative data, which often pinpoints particular developments rather unclearly. In a *chronological perspective*, the more concrete figures of competitor accounting are based on a contemplation of the present with an outlook on the nearer future. In contrast, the less exact competitive intelligence data focus on a longer period of time and give information regarding a more distant future. Regarding *evaluation*, competitor accounting utilizes primarily analytical and technical abilities.\(^9\) These include the ability to identify the key ratios in a situation, to understand the relationships between them and to decide which of them is the most relevant.\(^10\) In contrast, synthetic and interpersonal abilities prevail in the field of competitive intelligence. Although the data seem incoherent, connecting patterns can be recognized. Besides the ability to exploit the content of the statement in a network, distinctive

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\(^7\) For an overview see JARVENPAA (1998), p. 6.

\(^8\) See BARNDT (1994).

\(^9\) Technical abilities in the context of competitive intelligence are those which are necessary for the execution of specialized activities. See PRESCOTT/GRA NT (1988), p. 16.

interpersonal abilities are also necessary. In particular, the exploitation of external sources of information requires distinctive communicative and social intelligence. In the field of competitor accounting, the object of the examination is both internal and external information, with equal emphasis on each. For example, statements regarding the relative cost situation of competitors require detailed knowledge about their own value chain as a basis of comparison. Contrary to that, competitive intelligence is primarily focused on external information, which must first be collated from the different relevant environments. Table 1 summarizes the essential differences between competitor accounting and competitive intelligence.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Competitor Accounting</th>
<th>Competitive Intelligence</th>
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<tbody>
<tr>
<td>Functional emphasis</td>
<td>Data analysis</td>
<td>Data management</td>
</tr>
<tr>
<td>Type of information</td>
<td>Hard, quantitative</td>
<td>Soft, qualitative</td>
</tr>
<tr>
<td>Time horizon</td>
<td>Contemplation of the present, near future</td>
<td>Forecast of the future, distant future</td>
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<tr>
<td>Type of evaluation</td>
<td>Analytical, technical abilities</td>
<td>Synthetic, interpersonal abilities</td>
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<tr>
<td>Object of the examination</td>
<td>Internal and external</td>
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</tbody>
</table>

Table 1: Differences between competitor accounting and competitive intelligence

Based on this comparison of term-constituting features the following definition is derived: Competitor accounting comprises the analysis of information from accounting relating to competitors. It is thereby supposed to gain detailed insight into their present cost and finance situation, to determine one’s own competitive position and to predict the future strategic behavior of the competitors. Above all, the evaluation of internal and external accounting data which must be performed in competitor accounting requires a high degree of analytical and technical knowledge.

On the basis of a factor analysis of the application frequency of twelve instruments within strategic management accounting, GUILDING/CRAVENS/TAYLES were able to attribute the following three methods to competitor accounting:

1. Monitoring the competitive position (competitive position monitoring),
2. Evaluation of the competitors on the basis of financial statements published (competitor appraisal based on published financial statements) and

Monitoring the competitive position entails extensive analysis of the competition which, beside market share, also includes turnover, return on sales, volume and cost per item, price per item and cash flow, capacity utilization, liquidity and availability of resources for essential competitors. The competitor appraisal based on published financial statements is the numerical analysis of published financial information as a part of the assessment of sources of competitive advantages of competitors. The competitor cost assessment, which is the focus of interest in the present article, is explained below.

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2.2. Competitor cost assessment

Competitor cost assessment includes a regularly updated forecast of competitors’ costs per item. The assessment of the relative cost position compared to the competitor is of particular interest in this study. The results of this comparison may have a lasting influence on one’s own pricing strategy. In case of a cost disadvantage, possible threats by competitors who reduce their prices below the long-term cost position of the competitors are recognized at an early stage. Well-directed cost reduction programs can possibly prevent the impending cutthroat competition. On the other hand, one’s own strategic success could be based on the exploitation of cost-related vulnerability of the competitors. Only the comparison of relative costs makes it possible to assess a number of strategic options.

The comparison of one’s own unit costs with those of the competitors requires a systematic procedure that includes an assessment of the production equipment, the economies of scale, the relationship with the cost-influencing stakeholders such as suppliers and the technological product design. In order to provide a meaningful comparative analysis of the cost data of competitors, a number of transitive calculations must be carried out. First of all, the estimation of the competitors’ costs must be adjusted to the internal production volumes and the company’s own product variety. The effects of future cost reduction programs by the competitors must be predicted and taken into account for the calculation of the product cost difference. Furthermore, freight costs, customs and other indirect product-related costs must be recorded and compared. Finally, an adjustment for possible differences in value between the products to be compared must be carried out. If applicable, expected exchange rate variations must also be taken into account.

Practitioners attribute a high degree of relevance to the competitors’ cost information. Cost information about competitors can be quantified, interpreted and distributed easily. Therefore, they are more readily accepted by the management than soft information such as psychological profiles of competitor top executives. The knowledge of the competitors’ cost situation has a high significance if investments in new technologies tie up capital to a large extent. To improve the competitive position, extensive long-term obligations are undertaken, weighing heavily on the cost position in the form of depreciation. If competitors make similar investments, there is a risk of excess capacities. As a result of the high fixed costs, all companies try to utilize the existing capacities as well as possible. Only companies with a cost lead will be able to survive the cutthroat competition resulting from this. In connection with capacity decisions, ZAJAC/BAZERMANN were able to determine “blind spots” in the competitor analysis of many companies. The intentions and decisions of competitors are generally not adequately taken into account in companies. At the same time, companies tend to overestimate their relative power and financial stamina.

However, the advantage of the higher credibility of cost information about competitors is at least partly offset by the considerable problems of the procurement of information. Even simple estimates of competitors’ cost entail considerable expenses. For example, the accuracy of the forecast of the competitors’ cost is normally verified by comparing the balance sheets

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15 See GUILDING (1999), p. 584.
17 See JONES (1988), p. 34.
22 See ZAJAC/BAZERMANN (1991); p. 37.
of competitors which have been created on the basis of the cost estimates from the published balance sheets. The high cost of obtaining the information and the obstacles to acquisition of the data, which can sometimes not be overcome, therefore limit the opportunities of employing an estimate of the competitors’ cost. This conflict between the benefit of competitor cost information and the problems involved in obtaining this information is also reflected in the empirical studies of competitor accounting.

3. Research with regard to competitor accounting

3.1. Previous studies

In the years 1999-2001, four extensive empirical studies regarding the use of the instruments of competitor accounting were carried out. In spite of the different terms used by the authors (competitor accounting, competitor-focused-accounting and use of accounting information in competitive intelligence), they all demonstrate equally the practical relevance of accounting data related to competitors. The most important results from the different studies are introduced below.

The GUIDING study (1999) is dedicated explicitly to the use of instruments of competitor accounting in New Zealand companies. GUIDING identifies a far greater application of the instruments than previously expected. Monitoring the competitive position proves to be the instrument of competitor accounting which was used most and was regarded most useful. Compared to the other instruments, competitor cost assessment is relatively seldom used. The application frequency of this method is below the medium value of the measurement scale. Furthermore, GUIDING identifies three factors with significant influence on the use and the perceived usefulness of competitor accounting: company size, competitive strategy and strategic mission. Companies permanently establishing new product-market combinations and who give up risky positions at an early stage ("prospector") apply the practices more often and see a much greater benefit. Furthermore, the size of the company correlates positively with the application frequency and the perceived benefit of competitor accounting.

GRÜTTER-SETTELE (1999) makes a detailed study of companies’ analyses of the annual financial statements of competing companies. The starting point of this study is the fundamental hypothesis that the annual financial statements of competitors can be used as a potential basis for the formulation of a company strategy. In the context of a business game conducted in a laboratory setting with participants from the German language area, he examines whether there is a connection between the strategic decisions of companies and the knowledge of ratios of the annual financial statements of competitors. He focuses in particular on the extent to which planning accuracy, basic strategic orientation and the strategically relevant individual decisions are influenced. GRÜTTER-SETTELE observes an influence on price strategy, variable production costs and on the profit situation. His experiment proves that the competitors’ annual financial statements influence competitors’ decision-making. In his study, GRÜTTER-SETTELE comes to the conclusion that the evaluation of the competitors

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26 See GUIDING (1999), p. 593.
on the basis of published annual financial accounts should become a fixed part of competitive analysis.

In a study with companies from Great Britain, New Zealand and the USA, GUILDING, CRAVENS and TAYLES (2000) analyze the use of twelve different practices of strategic management accounting. They come to the conclusion that the three aforementioned instruments of competitor accounting belong to the techniques of strategic management accounting which are most popular, together with strategic pricing, i.e., the analysis of strategic factors in the pricing process. With the exception of competitor cost assessment in New Zealand, this result was confirmed for the three instruments in all the countries studied. Based on the perceptions of the benefit of competitor accounting experienced, the potential of these instruments does not appear to be exhausted yet. In all the methods, the benefit perceived received a much higher value than the previous application frequency. Obviously there are still differences between the requirements of the information addressee and what accounting is able to provide because the benefit perceived as high makes one expect a much more frequent use of competition-related information from the accounting department.

HESFORD (2001) interviewed American members of the Society of Competitive Intelligence Professionals with regard to the use of accounting information. With regard to instruments, he aims at two methods: (1) the assessment of competitors on the basis of published annual financial accounts; and (2) evaluation of competitors’ cost. The determinants of the use of accounting information are the focus of the study. With increasing competition, organizational support and accounting knowledge, HESFORD identifies an increasing demand for accounting information in the context of competitive intelligence. The increased use of accounting information has a positive effect on the effectiveness of the competitive intelligence. Figures taken from accounting seem to be more helpful in the process of strategic decisions than other sources of information used by the staff of competitive intelligence. Accounting information is considered reliable and not very much distorted while qualitative information such as press releases of the company is strongly influenced by the competitors themselves. Finally, a higher effectiveness in competitive intelligence also has a positive effect on the performance of the company. HESFORD concludes that the monitoring of financial information is a central part of competitive intelligence.

3.2. Further need for research

The review of recent studies of the use of competitor related accounting information demonstrates a need for further research in three different respects. This concerns the study method, the subject of the studies and the objectives of the studies.

With regard to the method of the studies, all were interview-based, except GRÜTTER-SETTELE’s study. In empirical research, it is also possible to use observation techniques aside from the interview. Observation allows the immediate analysis of the behavior of economic actors in concrete decision situations. Compared to the interview, the filter of the self-assessment of the study group does not apply. Some of the authors discuss the limitations of

relying on interviews. For example, a lack of standardization of terms can result in different understandings of the same term or overlapping contents of the instruments.\(^{37}\)

Regarding the *subjects of the studies*, all of the studies except GRÜTTER-SETTELE are aimed at experts. They concentrate on staff in the fields of competitive intelligence and management accounting. However, this concerns information producers but not persons in the company who make decisions on the basis of the competitor related information. We argue that the benefit of the accounting information should be assessed by the information users. In this respect, a future study should allow a generalization of the statements with regard to the occupational groups included.

Finally, on the basis of the present status of investigation, new studies should be aimed at the further information requirement identified in previous studies. In terms of this study, GUILDING, for example, suggests a focus on *study objectives*, consequences for the performance of the company and competition-related effects of competitor accounting in further analyses.\(^{38}\) Such effects may be regarded as the litmus test of effectiveness of these methods. In a laboratory experiment, GRÜTTER-SETTELE has already confirmed the significance of information from annual financial statements for certain strategically relevant individual decisions. However, no study has yet investigated the decision relevance of competition cost assessment or the effect on performance on obtaining and processing such information.

### 4. Empirical study

#### 4.1. Development of hypotheses

Within strategic management accounting, the relevance of competitor-related cost information is highlighted in the literature.\(^{39}\) According to this, obtaining and processing the cost of competitors allows the company to assess its own strengths and weaknesses on the cost level. If a company executes strategically relevant activities more efficiently than other suppliers, competitive advantages arise and can be used strategically.\(^{40}\) In previous empirical studies, however, it is pointed out that there is a considerable discrepancy between the advantage perceived by the information addressees and the actual utilization of competitor-related cost information. But potential that may be exhausted can only be gained, if the insights gained are relevant for strategic decisions and if decision quality can be influenced positively by it. If the strategic relevance of cost information about the competitor is confirmed, despite the high expenses of obtaining competitors’ cost data, it should be recorded systematically and considered in the decision process.

The study of the influence of competitor-related information on strategic decisions requires the knowledge of a clearly defined competition strategy. According to PORTER, we should distinguish between the general competition strategies of cost leadership, differentiation and concentration on priorities.\(^{41}\) Knowledge of strengths and weaknesses on cost level is of the highest relevance for potential cost leaders. Their entire strategic orientation is based on obtaining a better cost position relative to the competitors. In this case, the knowledge of


\(^{38}\) See GUILDING (1999), p. 594.


\(^{40}\) See PORTER (1999b), p. 63.

\(^{41}\) See PORTER, (1999a), p. 75.
industry-internal cost advantages and disadvantages represents an increase of planning and decision security. Therefore, knowledge of the relative cost position of cost leaders should also be associated with higher performance of the company.

The fundamental decision for cost leadership is linked with a variety of consequences in the areas production, investment and marketing. Analysis of these decisions allows the verification of the actual implementation of the cost leadership strategy by the companies. Most of the time, cost leadership is accompanied by an expansive amount strategy in order to gain from economies of scale and experience curve effects. An expansive production amount policy requires the establishment of appropriate production capacities. In terms of a strategy of cost leadership, investments for expansion of the business can be expected. The extended capacities and the increased production volumes require an appropriate application of the marketing policy instruments. A larger sales volume can be realized particularly 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 not aware of their favorable cost position.

The following fundamental hypothesis is derived from the above reflections. The knowledge of the strengths and weaknesses of the cost position is derived from an estimation of competitors cost, 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, in the end, be more successful than companies which do not have such information. In this respect, the following four hypotheses are investigated separately:

Hypothesis 1: Investment behavior
Informed cost leaders extend their production capacities to a greater extent than cost leaders who are not informed.

Hypothesis 2: Production quantity policy
Informed cost leaders have a higher production quantity than cost leaders who are not informed.

Hypothesis 3: Price policy
Informed cost leaders have a lower price level than cost leaders who are not informed.

Hypothesis 4: Company performance
Knowledge of their own relative cost position leads to more successful strategies for informed cost leaders, and to a higher company performance than in cases when the cost leaders are not informed.

The fundamental hypothesis is to be examined with regard to its general validity despite the restriction on the cost leadership strategy. As a possible restraining variable, the position in the product life cycle is to be taken into account. The ratios which must be gathered in the context of monitoring the competitive situation are crucially dependent on the phase of the life cycle the industry is in. The relative cost position only becomes a crucial success factor during increasing price competition in a relatively mature industry. However, cost information should be of strategic relevance in pursuit of a cost leadership strategy independent of the phase within the product life cycle.

4.2. Study method

In chapter 3.2, attention is drawn to the methodological limitations of previous studies. In order to gain the necessary connection to reality, actual decisions taken by managers must be taken into account. The data necessary for the study of actual economic life is normally not accessible to outsiders. As a result of these problems, laboratory experiments are suitable, either as case studies or business games. In a case study, however, the complexity of the connections in a long-term dynamic competition situation cannot be described adequately.

Business games are understood as models of a company or parts of a company which are abstracted but realistically simulate the entire events and goal conflicts of a company. In the present study, the use of a company simulation for obtaining data has crucial advantages:

- The starting situation, the development of the environment and the information status can be created identical for all fictitious companies. The comparability of the data material is thereby guaranteed.
- With regard to priorities of content, the order of the experiment and the course can be planned in detail in the beginning and therefore the cause-and-effect-relationships can be observed specifically by exclusion of random.
- Fictitious companies do not have the opportunity to hold back “sensitive” information, except as permitted by within the experiment.
- A business game is able to simulate a dynamic competitive situation over a longer period of time.

From all the company simulations which are available on the business game market, the general management business game MARGA was selected. It simulates an entire company with marketing, production, purchase, logistics, personnel and finance departments. All departments of the company are narrowly connected with each other and must be managed by the participants with a total of 77 separate decisions per period. Three products must 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 pioneering stage and product 3 is a technically highly developed investment good in the growth stage of the product life cycle. The participants of the business game are divided into four competing companies which come into conflict with each other at the beginning with the same products and the same resource structure. The market situation can be characterized as an oligopoly in which one’s own actions influence the success of the competitor and cause reactions. The objective of the game is to realize the highest accumulated profit and to reach the next round as the group winner. As a result of the time-lapse effect of business games, the simulated time horizon of six business game periods is sufficient for an analysis of strategic decisions. The business game MARGA is offered in seminars for further education and as a distance business game. However, it is only possible for a large number of participants with the same version of the simulation model and identical general setting if it is used as distance business game.

The business game was offered in two different versions during the study period: a normal version and a version which was reduced by one round and intended for students. Primarily, this article 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 used. It would not be possible to remedy this deficit in an examination of the business game version for students. As opposed to this, the participants of the study which we focus upon here are

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management-level employees in different management positions. The participants were recruited from a variety of business sectors, special domains and have different occupational training. In addition, the management executives have a higher level of practical education and broader work experience. We ran the distance game with 1,500 management personnel organized 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 which was larger with 472 teams and about 2,500 participants. However, the results of this control observation are only mentioned where they differ significantly from the results of the study group consisting of management executives.

4.3. Structure of the experiment

The 284 participating MARGA teams are assigned to groups of four companies, each by random selection. Only these four competitors 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 control groups. This information takes the form of a "ticker report" which is provided and noticeably displayed at the end of the second period. It contains information on which of the four companies in a group has the cost leadership with regard to the products 1, 2 and 3. In contrast, the teams in the control group do not receive this information and do not have any opportunity to obtain the information elsewhere, either directly or indirectly. The “ticker report” summarizes the competitor-related cost information in the publication of the cost-leading company. This is a simplification relative to the contents studied for competitor cost assessment. Instead of detailed estimates of the competitors’ cost, aggregate information about the relative competitive strength on cost level is provided. The difficulties with regard to gaining the information observed in previous studies are thereby taken into account. In reality, the information about a cost lead could possibly be obtained much more easily than via detailed quantitative cost information about competitors. However, the central statement about the relative cost position, particularly about the cost leader examined in this study, is provided. Additionally, this information can be connected with other competitor-related cost information that has been provided by MARGA. At a point in time after the second period, all the teams - including the control teams - receive an annual financial statement containing the balance sheets and profit and loss accounts of all four companies. Much financial and performance-related economic information can be derived from it. 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 cost-relevant effects of the experience curve effect for one’s own company and the competitor.

The “ticker report” is intended to ensure that the information status regarding 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 attention by postexperiment 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% of the 61 answers that could be interpreted confirmed that the ticker report had supported them in the assessment of the strategic situation. 80% of the respondents had used the information for certain decisions. Therefore it may be assumed that the cost

44 For details of the results of the business game variation for students see HEINEN (2002).
information about the competitors was by the majority of decision-makers consciously taken into account when making the decision.

4.4. Approach for measurement of the variables

As a result of the chosen structure of the experiment, significant differences between the study group and the control group can 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 which has the lowest variable production cost in its group per item of the product 1, 2 or 3. Only one company has the most favorable cost position for each of the three products (i.e., there is no single company that dominates in all three products). A product-differentiated identification of the cost leadership seems justifiable because of the few cross-relationships among each of the products (for example, the different products are produced on different machines). 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 with regard to the price policy can be analyzed marketwise, i.e., four times per product. Other decisions taken by the current cost leader like the investment behavior and the determination of the production amounts can only be made and examined product-wise, i.e., only once per product. In the business game a product-differentiated analysis is possible as there are no immediate relationships or dependencies among the three products and the four markets. 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 interconnections in the product range with regard to sales, i.e., each product can be offered separately on each of the markets.

Hypothesis 1: Investment behavior

Investment behavior is measured by establishing the machine capacities. As each product is produced on a different machine, a product-differentiated identification is possible. Capacity units per machine type are recorded and available to the current cost leaders. The capacity available in each period is the result of all investments and disinvestments made up to this time. As capacity expansions can only be carried out in certain steps, the feature “capacity units” can only take a limited number of values. Therefore it is based upon a metric scale level. The following null hypothesis H₀₁ 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 a significantly different investment behavior in the individual periods of the study, i.e., each of the groups has a similar amount of available production capacity.

Hypothesis 2: Production quantity policy

The production quantity policy is recorded by the deviation in percent of the accumulated production amount of the cost leader from the average accumulated production quantity of all four of the market members of the group. Theoretically, the study feature can take an unlimited number of values. The development of the features is therefore steady and has a metric scale. In concrete terms, it leads to the following null hypothesis H₀₂: The teams of the study group and the control group which have cost leadership do not display significant differences with regard to the production amount strategies in the individual periods of the study, i.e., the deviation in percent of the accumulated production amount of the cost leader from the group average is similar in both the study and the control groups.

Hypothesis 3: Price policy
In order to investigate the price policy, the deviation in percent of the price of the cost leader from the average price of all the four competitors is recorded. Again, the feature of the analysis is steady and has a metric scale. The null hypothesis $H_03$ is: The teams of the study group and control group who have cost leadership do not display significant differences with regard to price strategy in the individual periods. The deviation in percent of the price of the cost leader from the average of all four competitors is low in both groups.

Hypothesis 4: Performance of the company

The order of the product-specific contribution margin within the group is used as indicator of the economic performance of the teams. It is calculated by the gross sales minus product-specific variable costs. However, the absolute amount of the product-specific contribution margin is not measured. In order to reach the next round of the business game, a team must have realized a higher accumulated annual net profit than the three competitors. Therefore, the measurement figure “position” is to be given preference over the product-specific contribution margins accumulated during the course of time. It is independent of the price level which develops differently in each of the groups of four and can strongly influence the financial results in a positive or negative manner. The feature “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 in a cost-leading position do not show significant differences in the individual periods with regard to their rank order.

Regarding the choice of the test methods, the nature of the data plays a decisive role. Because of the discrete data, the Wilcoxon rank sum test\(^45\) is employed for hypotheses 1 and 4 and. For hypotheses 2 and 3, the Kolmogorov-Smirnov adjustment test\(^46\) is used to test the cardinal data. All 71 data sets can be used for all hypotheses.

An error probability of 10% is chosen as the level of significance. This value is expressed in p-values of 0.1 in the present survey. Therefore, the null hypothesis is wrongly disproved with a maximum probability of 10%. If the error probability in the individual period falls to a significance level of 5% and partly even to 1%, it corresponds to p-values of 0.05 and 0.01, which do not support the applicable null hypothesis. Consequently, the probability that the data from the study group and the control group are really different increases, confirming the fundamental hypothesis examined in this study.

For assessment of the hypotheses, the development over time of the p-values during the periods is also examined. The changes from period 2 to period 3 and the further development of the values after period 3 are decisive in this study. The clearer the p-value falls from period 2 to period 3, the earlier it can be inferred that the teams within the study group and the control group are making different decisions.

## 5. Results

The results of test of the individual hypotheses are presented below.\(^47\) First of all, using product 1 as an example, the statistical procedure is discussed in detail. The application of the Wilcoxon-rank sum test in SPSS is shown as a two-piece output and is described in tables 2 and 3.


\(^{46}\) For the Kolmogorov-Smirnov adjustment test see HARTUNG (1999), p. 520 ff.

\(^{47}\) For more details see HEINEN (2001), p. 163 ff.
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<td></td>
</tr>
<tr>
<td><strong>Period 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study group</td>
<td>36</td>
<td>36.67</td>
<td>1,320.00</td>
</tr>
<tr>
<td>Control group</td>
<td>35</td>
<td>35.31</td>
<td>1,236.00</td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Period 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study group</td>
<td>36</td>
<td>40.36</td>
<td>1,453.00</td>
</tr>
<tr>
<td>Control group</td>
<td>35</td>
<td>31.51</td>
<td>1,103.00</td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Period 4</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study group</td>
<td>36</td>
<td>41.58</td>
<td>1,497.00</td>
</tr>
<tr>
<td>Control group</td>
<td>35</td>
<td>30.26</td>
<td>1,059.00</td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Period 5</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study group</td>
<td>36</td>
<td>40.49</td>
<td>1,457.50</td>
</tr>
<tr>
<td>Control group</td>
<td>35</td>
<td>31.39</td>
<td>1,098.50</td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Period 6</strong></td>
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<tr>
<td>Study group</td>
<td>36</td>
<td>40.10</td>
<td>1,443.50</td>
</tr>
<tr>
<td>Control group</td>
<td>35</td>
<td>31.79</td>
<td>1,112.50</td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: MARGA hypothesis 1, product 1, calculation of the rankings

In the Wilcoxon-rank sum test, the data of the 36 teams in the study group and the 35 teams in the control group are put into ascending order according to size. The x-values the data of the study group are assigned to, are allocated the corresponding ranks of the ascending data series, where medium ranks are assigned to identical values. Afterwards, all ranks of the x-values are summed up and this results in the rank totals issued in table 2. The average rank is a result of the subsequent division of the rank sum by the number of the values N. The values of the control group are calculated by the same procedure.

<table>
<thead>
<tr>
<th>p-value, or asymptotic significance (2-sided)</th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
<th>Period 4</th>
<th>Period 5</th>
<th>Period 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.798</td>
<td>0.781</td>
<td>0.069</td>
<td>0.020</td>
<td>0.062</td>
<td>0.088</td>
</tr>
</tbody>
</table>

Table 3: MARGA hypothesis 1, product 1, test statistics

The p-values shown in table 3 are two-sided asymptotic significance probabilities under SPSS on the basis of which the assessment of the approval or disapproval of the null hypothesis is carried out. For periods 1 and 2, this value is clearly above the pre-determined limit of 0.1. In periods 3-6 the null hypothesis is rejected as the p-values determined are clearly lower than 0.1. Therefore, the results support the hypothesis that the teams in the study group and the control group do not show significantly different investment behavior in the first two periods, but show significant differences after the teams in the study group have been informed regarding their cost advantages.

Hypothesis 1: Strategic investment behavior

48 See LEHMANN (1975), p. 5 ff.
Table 4 describes the p-values of all six experiment series. The significances are written in italics and the significance level (* p<0.1; ** p<0.05; *** p<0.01) is highlighted. For products 1 and 2, the teams in the study group invested more in production capacities after they had received the information about their cost position. Contrary to that result, the null hypothesis with regard to product 3 cannot be rejected in any of the periods 3 to 6. The clear change of the p-values from period 2 to the following periods is not sufficient to support rejection. As different results were realized for all three of the products without exception, the results of the business game version for students should also be taken into account. The null hypothesis could not be rejected in that version for any of the three products in any of the relevant periods. Although considerably reduced p-values from period 2 to period 3 indicated a change in the investment strategy of the teams in the study group of students, it has no statistical significance. This means that there is no support for hypothesis 1.

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
<th>Period 4</th>
<th>Period 5</th>
<th>Period 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product 1</td>
<td>0.798</td>
<td>0.781</td>
<td>0.069*</td>
<td>0.020**</td>
<td>0.062*</td>
<td>0.088*</td>
</tr>
<tr>
<td>Product 2</td>
<td>0.256</td>
<td>0.390</td>
<td>0.018**</td>
<td>0.048**</td>
<td>0.052*</td>
<td>0.056*</td>
</tr>
<tr>
<td>Product 3</td>
<td>0.823</td>
<td>0.743</td>
<td>0.263</td>
<td>0.261</td>
<td>0.286</td>
<td>0.294</td>
</tr>
</tbody>
</table>

Table 4: Hypothesis 1, p-values (* , **, *** indicate statistical significance at p < 0.10, p<0.05 and p<0.01)

Hypothesis 2: Production quantity policy
As expected, there are no differences in the first two periods with regard to production amounts (see table 5). From period 2 to period 3 the rapid reduction of p-values already noted in tests of hypothesis 1 recurs. It may be concluded that there is a change in the production quantity strategy in the teams of the study group after period 2. 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 the control group no longer make significantly different decisions. This could be attributed to the upcoming end of the business game which encourages the teams to employ short-term tactics. Occasionally, the production amounts are reduced in order to avoid the possibility of an inventory level which is assessed at variable production cost at the end of the game. In addition, the companies in the study group were obviously sometimes able to utilize free capacity reserves regarding product 3 with the result that investment activities were lower than expected. Despite three p-values which were not within the expected range, the entire picture of these results as well as the results realized with the business game variation for students supports rejection of null hypothesis 2. Hence, the teams in the study group chose a more expansive strategy than the teams in the control group.

<table>
<thead>
<tr>
<th></th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
<th>Period 4</th>
<th>Period 5</th>
<th>Period 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product 1</td>
<td>0.819</td>
<td>0.612</td>
<td>0.049**</td>
<td>0.050**</td>
<td>0.094*</td>
<td>0.389</td>
</tr>
<tr>
<td>Product 2</td>
<td>0.958</td>
<td>0.995</td>
<td>0.083*</td>
<td>0.049**</td>
<td>0.040**</td>
<td>0.042**</td>
</tr>
<tr>
<td>Product 3</td>
<td>0.892</td>
<td>0.417</td>
<td>0.094*</td>
<td>0.095*</td>
<td>0.168</td>
<td>0.270</td>
</tr>
</tbody>
</table>

Table 5: Hypothesis 2, p-values (* , **, *** indicate statistical significance at p < 0.10, p<0.05 and p<0.01)

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 6 shows the p-values established in all 12 data sets. Apart from isolated cases, the null hypothesis can be rejected in periods 3 to 6. However, in the few cases where the p-value is greater than 0.1, the clarity and the persistence of the change supports rejection of the null hypothesis 3. In addition, the results of the business game version for students support the expected relationship even more clearly. The observations must be interpreted as the deviation in percent of the price of the cost leader from the average price of all four competitors is lower in the teams in the study group than in the teams in the control group. This explains the expected lower price level in the study group. In summary, hypothesis 3 can be confirmed with a significance level of 10%.

<table>
<thead>
<tr>
<th>Product 1</th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
<th>Period 4</th>
<th>Period 5</th>
<th>Period 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 1</td>
<td>0.975</td>
<td>0.862</td>
<td>0.163</td>
<td>0.088*</td>
<td>0.100*</td>
<td>0.020</td>
</tr>
<tr>
<td>M 2</td>
<td>0.983</td>
<td>0.557</td>
<td>0.097*</td>
<td>0.078*</td>
<td>0.055*</td>
<td>0.040**</td>
</tr>
<tr>
<td>M 3</td>
<td>0.862</td>
<td>0.819</td>
<td>0.094*</td>
<td>0.102</td>
<td>0.010***</td>
<td>0.010***</td>
</tr>
<tr>
<td>M 4</td>
<td>0.862</td>
<td>0.956</td>
<td>0.027**</td>
<td>0.052*</td>
<td>0.015**</td>
<td>0.002***</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product 2</th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
<th>Period 4</th>
<th>Period 5</th>
<th>Period 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 1</td>
<td>0.992</td>
<td>0.925</td>
<td>0.180</td>
<td>0.029**</td>
<td>0.088*</td>
<td>0.249</td>
</tr>
<tr>
<td>M 2</td>
<td>0.991</td>
<td>0.757</td>
<td>0.142</td>
<td>0.005***</td>
<td>0.024**</td>
<td>0.085*</td>
</tr>
<tr>
<td>M 3</td>
<td>0.928</td>
<td>0.975</td>
<td>0.091*</td>
<td>0.011**</td>
<td>0.044**</td>
<td>0.085*</td>
</tr>
<tr>
<td>M 4</td>
<td>0.646</td>
<td>0.993</td>
<td>0.100*</td>
<td>0.083*</td>
<td>0.023**</td>
<td>0.078*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product 3</th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
<th>Period 4</th>
<th>Period 5</th>
<th>Period 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 1</td>
<td>0.394</td>
<td>0.844</td>
<td>0.098*</td>
<td>0.058*</td>
<td>0.129</td>
<td>0.022**</td>
</tr>
<tr>
<td>M 2</td>
<td>0.958</td>
<td>0.757</td>
<td>0.054*</td>
<td>0.023**</td>
<td>0.131</td>
<td>0.079*</td>
</tr>
<tr>
<td>M 3</td>
<td>0.629</td>
<td>0.925</td>
<td>0.026**</td>
<td>0.043**</td>
<td>0.039**</td>
<td>0.011**</td>
</tr>
<tr>
<td>M 4</td>
<td>0.618</td>
<td>0.948</td>
<td>0.057*</td>
<td>0.074*</td>
<td>0.073*</td>
<td>0.082*</td>
</tr>
</tbody>
</table>

Table 6: Hypothesis 3, p-values (* , **, *** indicate statistical significance at p < 0.10, p<0.05 and p<0.01)

Hypothesis 4: Economic performance
While the first three hypotheses are aimed at certain strategic decisions of the business game teams, the overall profit as measured by the rank order is the dependent variable of interest in testing hypothesis 4. Table 7 expresses the entire picture of the examination of the fourth hypothesis on the basis of p-values. With the exception of product 3 in period 3, the p-value is above the pre-determined significance level of 10%. In a strict procedure, the null hypothesis cannot be rejected in this case regarding the chosen significance level. On the other hand, the change in the p-values from period 2 to period 3 is sufficiently large to support rejection of the null hypothesis, particularly since all the following p-values fall below 5%. The teams in the study group achieve higher positions and therefore perform much more successfully than the teams in the control group. Therefore, there is strong support for hypothesis 4.

<table>
<thead>
<tr>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
<th>Period 4</th>
<th>Period 5</th>
<th>Period 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product 1</td>
<td>0.975</td>
<td>0.595</td>
<td>0.068*</td>
<td>0.035**</td>
<td>0.007***</td>
</tr>
<tr>
<td>Product 2</td>
<td>0.681</td>
<td>0.834</td>
<td>0.074*</td>
<td>0.028**</td>
<td>0.026**</td>
</tr>
<tr>
<td>Product 3</td>
<td>0.639</td>
<td>0.819</td>
<td>0.166</td>
<td>0.038**</td>
<td>0.038**</td>
</tr>
</tbody>
</table>
Altogether, the results confirm three of the four hypotheses with a significance level of 10%. Lower significance levels were attained in some cases. Despite a clear tendency, hypothesis 1, in which the investment behavior is examined, could not be confirmed on the basis of the required significance level. However, the 2nd hypothesis, in which the decisions about the production amounts are analyzed, provides the expected results. Therefore, the laboratory experiment confirms that strategic decisions are affected if the competitor-related cost position is known.

Although the empirical study is based on a significance level of only 10% regarding most of the data sets, two further aspects support the fundamental hypothesis should be taken into consideration:

- The dramatic and enduring change of the 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 with regard to the expansive amount strategy in connection with a significantly more aggressive price policy.

### 6. Conclusions

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

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

The advantage of cost information which has been determined in previous surveys is confirmed in this study by a different study method. HESFORD, however, was only able to determine an indirect effect by the following chain of causation: the use of accounting information increases the effectiveness of competitive intelligence and an effective competitive intelligence has a positive effect on the company’s performance. In contrast, in the context of the laboratory experiment an immediate relationship between the competitor-related cost information and the performance of the company was proven. If one regards operational business games as a suitable simulation of a corporate reality, this study confirms that the collection of competitor-related cost information leads to competitive advantages.

However, the limitations of the study should not be neglected. These include the abstraction of operational business games, the considerable simplification of the cost information.
provided, the partial exclusion of connections with regard to time, the focus on the cost leader and the highly competitive intensity.

Contrary to the studies of Guilding, Guilding/Cravens/Tayles and Hesford, which relied on interview methods, the behavior of participants in an operational business game was directly analyzed. In a simulation, “reality” is not taken into account by subjects. Rather, only the perception of the reality and the assumptions about its functioning matter to subjects. The abstraction of operational business games is sometimes so intense that the whole simulation is not very close to reality. Certain effects distorting or simplifying the reality can be a result of the abstraction, e.g. the independence of the three products produced in Marga. Sometimes even the behavior of people in managerial business games is different than in reality. However, the sweeping judgement of a suspected "artificial environment" of business games seems unjustified, particularly with regard to the company simulation which was chosen in this study. Marga has been employed as an instrument for instruction and further education in human resources development since 1971. The number of business executives who have taken part in Marga to date is estimated at well over 50,000. The number of participants, which is unique for the German managerial business games market, demonstrates the considerable acceptance of Marga in operational practice and therefore speaks to the realism of the company simulation.

A further advantage of this study is that the laboratory experiment allows the control of a number of possible random disturbances. For example, the cost of obtaining information about competitors is equally high for all companies. All the teams of a group of four are provided with identical information at the same time. However, only the fundamental information about the company with cost-leadership per product is published. But these simplifications with regard to the cost information provided does not constitute a limitation of the general validity of the study results. 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 in economic life that some competitors may realize a higher information advantage regarding the relative unit costs. Consequently, the companies actively employing competitor accounting may have a more comprehensive information lead. In this case, clearer support of the fundamental hypothesis could be expected as a result of more detailed cost evaluations and unequal information status.

The partial exclusion of connections with regard to time can be critically analyzed in a measurement of the variables. The statistical examination of certain individual times and the lining up of the results of these individual examinations neglects interdependencies with regard to time. Instead of taking the time into account explicitly, the passage of time is included implicitly in the variables examined, for example in the context of hypothesis 1 regarding the strategic investment behavior. Not merely the net increase of capacity per period is considered, but the entire capacity which has been established during the whole course of the game. Similarly, the variables of the hypothesis 4 regarding the economic performance and the accumulated profit contain information about the entire course of time. In a more qualitative way, the development of the p-values with regard to time along the periods is analyzed. Above all, the period-exact evaluation allows a better analysis of possible distortions resulting from tactical behavior towards the end of the game.

The empirical study is only aimed at companies who are in a cost-leading position. Therefore, competitor cost assessment may become more significant the more central the relative unit costs are for the company and its strategic position. Therefore, it is more likely to find evidence for the strategic relevance of competitor-related cost information in this company.
strategy. But companies with different strategic orientations can also take their knowledge of the own cost advantages into account and make well-directed use of it. In the case of differentiation or concentration on priorities, planning and decision certainty increase if extensive knowledge of the cost position of competitors exists. In particular, knowledge of one’s own cost disadvantages helps to avoid possible risks. However, the question of knowledge of competitive advantages or disadvantages on the cost level is more important for cost leaders than for companies with a different strategic position and shall be left for future studies.

Above all, certain determinants of the use of accounting information could not be taken into account in the study as intervening variables. In connection with this, HESFORD has identified a positive relationship between the intensity of competition and the demand for accounting information.\(^{49}\) With regard to markets simulated in this managerial business game, a high competitive intensity that is equal across all markets must be assumed. At the beginning, all companies act in the same markets with similar products. Additionally, only the team with the highest accumulated profit of each group reaches the next period. The general structure of the business game reduces the possible limitation to competition-intensive markets. Independent of the business sector, the products can be characterized as consumer, service or investment goods and furthermore, they are in different stages of their life cycles.

In spite of the aforementioned limitations, the study verifies the effectiveness and strategic relevance of the collection of competitor-related cost information. As a result of the significance of competitor-related cost information, the question may now be posed as to the degree of detail to which this analysis must be carried out and which resources must be provided in order to obtain the information. In connection with this, there is currently a lack of insight regarding how the information from accounting can be connected to other sources of the cost position of competitors appropriately, such as product reverse engineering. This more extensive requirement for research should be the object of future empirical studies regarding competitor accounting.

References:

\(^{49}\) See HESFORD (2001), p. 5f.


