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**Stock Prices of German Internet
Companies in 2000**

- an empirical investigation of value drivers on the Neuer Markt -

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Abstract

This paper looks at the value-relevance of accounting data and measures of web-traffic for Internet firms listed on the Neuer Markt. In particular, the objective is to identify value drivers during the period from October 1999 to May 2000. In doing so, the study attempts to contribute to the understanding of the investment behaviour of market participants during that time, in a market environment characterised by rapid technological change and growth. The study subdivides Internet companies into Ecommerce and Enabler firms and analyses the value-relevance accordingly. It emerged that, across both samples, no significant value-relevance of traditionally applied financial valuation metrics such as earnings and cash-flow could be evidenced. However, a positive association of total sales with market capitalisation can be shown for both samples, and in addition, sales and marketing expenses (Ecommerce) as well as research and development costs (Enabler) can also be identified as value drivers. Furthermore, the paper finds a number of webmetrics to be highly value-relevant and positively associated with market capitalisation, viz. customer loyalty, reach, page impressions and unique visitors. Combining and comparing the information content and value-relevance supports the notion that webmetrics, which are not part of standardised reporting regulations, did provide at least as much explanatory power for variations in market value as standardised accounting data.

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Stock Prices of German Internet Companies in 2000

– An empirical investigation of value drivers on the Neuer Markt –

1 Introduction

During the last quarter of 1999 and the first of 2000, stock prices of companies in the Internet industry increased sharply, a development of considerable potential interest to investors and researchers alike. However, it could be observed that valuation metrics aimed at measuring financial performance, such as financial variables in general and earnings in particular, retained their traditional form and did not evolve parallel to rising stock prices in this new sector. Therefore, the validity and sustainability of capital market valuations observable during that time could and indeed had to be questioned.¹ As a result, the so-called Internet bubble and its possible bursting became the object of much discussion in academic circles and in the media. As a central element of this discussion, the question arose as to what else, if not financial performance, could be driving up stock prices and which value drivers could be empirically identified. Consequently, a number of working papers were produced, focusing on the developments at Nasdaq and investigating the value-relevance of financial information in comparison to alternative industry-specific measures.² One such alternative valuation metric is webmetrics – measures of web traffic –, which has met with increased interest on the part of analysts and investors.

Corresponding developments on Germany's Neuer Markt have however at present not been investigated to the same extent: this paper aims to make a start at rectifying this situation. The objective of this paper is therefore to seek empirical evidence as to the value-relevance of firm-specific measures, both financial and industry-specific, and to eventually derive value drivers of Internet companies during the period from October 1999 to May 2000. Hence, the intention of this paper is not to develop a formal

¹ It seems difficult to develop a valuation model that explains why an Internet Firm is trading at a P/E multiple exceeding 300. See *Ladermann and Smith* (1998): 121.

² See for instance *Demers and Lev* (2001), *Hand* (2000a, 2000b), *Rajgopal et al.* (2000) or *Trueman et al.* (2001a).

valuation model for firms in the Internet industry, but rather to seek evidence of factors closely related to movements in stock prices that are relevant to the firms' business activities. In doing so the study attempts to contribute to the understanding of the investment behaviour of market participants during that time in a market environment characterised by rapid technological change and high growth. In this setting one might assume that investors would shift their focus away from financial measures towards alternative metrics when evaluating investment opportunities. As the paper furthermore seeks evidence of the value-relevance of financial information as compared to webmetrics, it allows conclusions to be drawn with respect to the disclosure of value-relevant information in such a market environment.³ Strict compilation provisions ensure availability of financial data in a standardised manner and hence guarantee comparability. Industry-specific information such as measures of web-traffic, however, has not been included in reporting regulations and thus to date a standardised reporting system and framework does not exist. What this paper examines specifically is the value-relevance of a selection of webmetrics, viz. page impressions, unique visitors, reach, stickiness and customer loyalty in addition to several financial variables, viz. total sales, earnings before interest and taxes, operating cash-flow, sales and marketing expense and research and development expenses.

A selection of papers addressing related issues can be found in the literature.⁴ While all deal with financial data as the central element, the investigations by *Lev/Thiagarajan* (1993), *Lev/Sougiannis* (1996), and *Hand* (2000a) seek evidence solely of the value-relevance of financial variables with respect to listed corporations. Although dealing with the same issue, *Collins et al.* (1997) as well as *Francis/Schipper* (1999) shift their

³ In this context analysing the information content and the value-relevance of accounting information disclosed as opposed to factors not incorporated into standardised reporting regulations has become an important topic in empirical accounting research. See *Barth et al.* (2001) and *Holthausen/Watts* (2000) for a discussion.

⁴ A comparison of the empirical evidence with the findings of this study, which will be discussed at a later stage. The following studies – in order of their date of publication – are compared: *Easton* (1985), *Penman* (1992), *Lev/Thiagarajan* (1993), *Amir/Lev* (1996), *Lev/Sougiannis* (1996), *Arbanabell/Bushee* (1997), *Collins et al.* (1997), *Penman* (1998), *Collins et al.* (1999), *Francis/Schipper* (1999), *D'Arcy/Leuz* (2000), *Schwartz/Moon* (2000), *Rajgopal et al.* (2000), *Trueman et al.* (2001a), *Hand* (2000a, 2000b), *Demers/Lev* (2001).

focus towards the relative explanatory power of financial data vis-à-vis market capitalisation and changes therein, comparing these over a predefined time horizon.⁵ In contrast, *Amir/Lev* (1996), *Rajgopal et al.* (2000), *Trueman et al.* (2001a), *Hand* (2000b) and *Demers/Lev* (2001) concentrate their analyses on the value-relevance of accounting data compared with non-financial data. The aforementioned studies not only differ in the variables investigated as potential value drivers, but also in the subject of the empirical analysis, i.e. the respective industry and the capital market segment. Some studies seek to identify value drivers of listed corporations in general while others concentrate solely on Internet companies and value drivers of their market capitalisation. A study conducted by *D'Arcy/Leuz* (2000) analyses corporations listed on the Neuer Markt with regard to financial reporting and gives a detailed description of practices and characteristics, and hence does not seek to determine value drivers. The paper published by *Schwartz/Moon* (2000) is unique in this selection in that it develops a real option model which simulates a pricing for Internet stocks based on a variety of input variables.⁶ The empirical research by *Rajgopal et al.* (2000), *Trueman et al.* (2001a), *Hand* (2000a, 2000b) and *Demers/Lev* (2001) concentrates on Internet companies listed on Nasdaq and empirically investigates and identifies value drivers of stock market prices. While *Trueman et al.* (2001a), *Hand* (2000a) and *Demers/Lev* (2001) focus more on the value-relevance of accounting data, *Hand* (2000b) and *Rajgopal et al.* (2001) concentrate by contrast on the value-relevance of webmetrics.

Despite deliberate similarities to the aforementioned research, this study differs in two major aspects. Firstly, it investigates the value-relevance of a series of firm-specific variables of Internet companies, both financial and webmetrics, on the Neuer Markt in Germany and, secondly, it also analyses the effect of some moderating variables. The structure of this paper is as follows: Section two outlines the development and derivation of hypotheses regarding the value-relevance of firm-specific information. The third section explains the sampling procedure and the data collection and section

⁵ The time horizons are 40 and 42 years respectively.

⁶ In an example, amazon.com is valued employing the model. The results are compared to the existing capital market valuation of the company and implications are discussed.

four covers the statistical analysis and discusses the empirical evidence. In section five the empirical findings are compared to the results of other studies addressing similar issues and conducted for Nasdaq. The paper then concludes by giving a short summary and indicating possible areas of further research.

2 Hypothesis development

2.1 The relative value-relevance of financial information and webmetrics

Financial information, as defined for the purpose of this study, refers to data derived from financial statements, i.e. accounting data.⁷ Traditionally, financial information has been used in company valuation and, therefore, could be expected to provide significant empirical value-relevance.⁸ A connection that indeed seems plausible, since capital market participants are likely to base investment decisions on the evaluation of financial data and analysts also look, among other variables, at financials when recommending individual shares or entire industry segments. However, during the period of sharply increasing stock prices in the Internet segment, it seemed that such movements could no longer be explained solely by developments in financial variables and the application of financial valuation models, as has been postulated by current academic research.⁹ This suggests that, as far as this industry sector is concerned, the value-relevance of financial measurements which were traditionally important may have decreased, while alternative metrics have increased in importance – something that might imply that investors have also shifted focus away from financial information when evaluating investment

⁷ Due to the requirement to publish quarterly and annual financial statements that comply with international accounting standards (IAS or US-GAAP), this information is readily available in a standardised form, guaranteeing comparability across different companies. According to the regulatory framework of the Neuer Markt, quarterly financial statements in contrast to annual reports do not need to be audited before they are published.

⁸ See *Copeland et al. (1996)* and *Coenenberg (1997): 797*.

⁹ Such studies mainly investigate and discuss the value-relevance of financial data in contrast to other firm-specific information, with some empirical evidence indicating that financial data have lost some significance in explaining movements in stock prices. See *Francis/Schipper (1996)*, *Shevlin (1996)*, *Ittner/Larcker (1998)*, *Lee (1999)*, and *Lev (2000): 2*.

decisions. Therefore, additional and alternative measures should be sought and evaluated as to their value-relevance in order to contribute to the understanding of the developments leading to the Internet bubble.¹⁰

One such alternative measure is webmetrics, as at present analysts are increasingly employing measures of web-traffic in valuation models.¹¹ However, information on web-traffic is not included in the accounting standard frameworks and no standard definition exists; nor is there an obligation to publish such information. While the overriding objective of this paper is to determine the individual value drivers of Internet firms during the period between the second half of 1999 and the first half of 2000, it also aims to investigate the value-relevance of accounting data in comparison with webmetrics. The research design of this investigation has been chosen to describe and explain historical relationships of firm-specific measures and stock market valuation. However, caution is urged before extrapolating from any of these relationships future developments or general trends.

In accordance with empirical evidence obtained by prior empirical research conducted by *Demers/Lev* (2001), *Rajgopal et al.* (2000) and *Trueman et al.* (2001a), the following hypothesis is formulated:¹²

H_0^1 : *Webmetrics [WM] provide at least as much value-relevance for an Internet company as traditional financial measures [FI].*

¹⁰ In this context it is especially important to note that the majority of Internet companies considered in this study only exist for a relatively short period and in a rapid growth environment. This significant difference from firmly-settled companies operating in established markets will be important when discussing and interpreting the results of the empirical analysis. A generalisation of the findings is also not feasible for this reason. It should be noted furthermore that we do not intend to question the importance of financial statements in general or financial information for investors and the evaluation of investment opportunities.

¹¹ In the U.S. three companies provide such information. These are *Nielsen NetRatings*, *Media Metrix* and *PCData*, whereas in Germany a joint venture between the *Gesellschaft für Konsumforschung (GfK)* and *Media Metrix Europe* was the only provider. *Nielsen NetRatings* began observing private Internet use in the summer of 2000.

¹² While *Rajgopal et al.* (2000) as well as *Trueman et al.* (2001a) examine the value-relevance of webmetrics in addition to financial variables, *Demers/Lev* (2001) analyse the impact of webmetrics on market values alone. All studies find sufficient empirical evidence to support the value-relevance of webmetrics.

This paper investigates both financial information and webmetrics in a more detailed fashion by means of several individual sub-hypotheses, which will be elucidated in the following sections.

2.2 *The value-relevance of financial information*

Earnings have always played a crucial role in valuation models; current empirical evidence, however, suggests that over the past 50 years an increasing number of quarterly financial statements contained negative earnings.¹³ Current developments have shown that Internet companies in particular have rarely recorded any profits and tended rather to incur losses, yet their stock prices have increased enormously. Therefore, we predict that earnings do not provide much value-relevance and hence do not drive stock prices.¹⁴

H₀^{1a}: Earnings [EBIT] are not closely associated with the capital market valuation of an Internet company.

Internet firms' business operations were often accompanied by extremely high cash expenditures targeted for instance at acquiring customers and capturing market shares, a context in which the notion of a cash-burn rate has been introduced. Therefore, little if any cash can be expected to be generated from operations. As a result, operating cash-flow is not expected to be closely associated with market capitalisation.¹⁵ Thus, the following hypothesis is applicable:

H₀^{1b}: Operating cash-flow [CF] is not closely associated with the capital market valuation of an Internet company.

¹³ See *Hayn* (1995).

¹⁴ It is important to note, however, that some of the heavy losses are due to high marketing expenses.

¹⁵ A strict definition of cash-flow is lacking, because of differences in computing. To establish comparability across the sample, this study concentrates on the measure operating cash-flow according to IAS and US-GAAP. See *Baetge* (1998): 316-341 and *Pellens* (1999): pp. 303 and 471-476.

Returns to scale, the ability to become a standard setter and network effects are believed to be among critical success factors within the environment of the Internet. Growth in total sales may indicate an increase in the ability to generate future economic value and can hence be regarded as a potential value-driver. Another aspect can be seen in the shortcomings of 'proper' accounting in these rather small, but rapidly growing companies. Considering the obligation to publish financial reports complying with international accounting standards (IAS or US-GAAP) and the fast-changing environment, total sales as an aggregate figure can be expected to approximate success in extending business activities. Consequently, we predict a positive relationship between total sales and the market value and formulate the hypothesis accordingly:

H_0^{1c} : *Total sales [TS] are positively associated with the capital market valuation of an Internet company.*

Sales and marketing expenses as well as research and development expenses may be regarded as vital investments in the acquisition of customers and thus market share. It is generally recognised that Ecommerce firms are known for substantial advertising expenditures and extensive marketing campaigns aimed at extending and fostering market penetration, brand perception and brand awareness. Firms selling Ecommerce enabling technologies on the other hand commonly tend to spend more on research. Both may eventually translate into future value. The relevant work on advertising and marketing expenses as potential value drivers by *Demers/Lev (2001)*, *Hand (2000)* and *Trueman et al. (2001a)* supports the prediction of a positive relationship between sales and marketing expenses and market value. Accordingly, we predict a significant value-relevance of sales and marketing expenses for the Ecommerce firms and research and development expenses for the Enabler:

H_0^{1d} : *Sales and marketing expenses [SME]/research and development expenses [RD] are positively associated with the capital market valuation of an Internet company.*

2.3 The value-relevance of webmetrics

In the environment of the Internet customers are believed to be extremely valuable assets, as benefits from network effects can only be enjoyed once brand awareness and critical market share have been successfully established. In this context webmetrics represent a chance to learn about the behaviour of Internet users with respect to a particular business and thus offer information on the customer base of a company. An overview and definition of all used webmetrics is provided in Table 1.

Table 1: Definition of webmetrics

| Variable | Definition |
|------------------|--|
| Unique Visitors | Number of individual visits to a web-domain |
| Page Impressions | Number of unique visitors multiplied by the average number of pages visited per unique visitor and day |
| Reach | Number of unique visitors divided by the population of Internet users in Germany |
| Stickiness | Average time spend on visits to a web-domain in minutes per day and unique visitor |
| Customer Loyalty | Average number of visits to a web-domain in days per month and unique visitor |

'Page impressions' measure the number of visits to a particular website and therefore allow conclusions regarding the frequency of usage. This is an important measure for a company in the electronic commerce business and has been empirically tested as a potential value-driver by *Demers/Lev* (2001), *Hand* (2000b) and *Trueman et al.* (2001a). A positive relationship can be hypothesised and expressed as follows:

H_0^{1e} : *Page impressions [PI] are positively associated with the capital market valuation of an Internet company.*

'Unique visitors' refers to the number of individuals that visit a web-domain and hence approximates customer awareness. It allows conclusions to be drawn on the ability of the specific company to attract customers. Again, the predicted sign of the hypothesised relationship is positive and it follows:

H_0^{1f} : *Unique visitors [UV] are positively associated with the capital market valuation of an Internet company.*

‘Reach’ represents the number of individual visits to a particular web-domain as a percentage of the population of Internet users in Germany. Thus it refers to the awareness of a website among the Internet users. This allows conclusions regarding brand awareness and may thus also be deemed value-relevant. *Demers/Lev* (2001) have addressed this issue, supporting evidence for the following hypothesis, again predicting a positive relationship:

H_0^{1g} : *Reach [RE] is positively associated with the capital market valuation of an Internet company.*

‘Stickiness’ refers to the time an individual visit to a certain web-domain lasts. This measure could potentially be value-relevant, but is extremely dependent on the business model that in turn determines the average duration of a website visit. Accordingly, the significance of the measure stickiness as a value driver of Internet firms' stock prices has also been empirically tested by *Demers/Lev* (2001) and *Hand* (2000b), leading to the following hypothesis. In this instance, again a positive relationship is predicted:

H_0^{1h} : *Stickiness [ST] is positively associated with the capital market valuation of an Internet company.*

‘Customer loyalty’ offers insights as to the number of repeat visits to a web-domain, thus permitting conclusions regarding the ability of a company to generate repeat business and to bind customers. This is regarded as a critical success factor, particularly within the environment of the Internet, as switching costs for customers are extremely low; this leads to the following hypothesis of a positive relationship between the variables:

H_0^{1i} : *Customer loyalty [CL] is positively associated with the capital market valuation of an Internet company.*

2.4 The value-relevance of other qualitative information

To establish what might constitute other qualitative information, we will first cite some prior empirical research examples. *Lev/Thiagarajan* (1993) analyse the quality and sustainability of profits and the quality of the financial statements.¹⁶ *Francis/Schipper* (1999) compare their empirical findings for the financial data of two different sample groups¹⁷, whereas *D'Arcy/Leuz* (2000) describe the choice of the auditing firm¹⁸. *Rajgopal et al.* (2000) investigate the value-relevance of a strategic co-operation with AOL. *Demers/Lev* (2001) analyse the value-relevance of a strategic alliance with a 'top ten' Internet company.¹⁹

This study distinguishes between two groups of Internet firms. The division into Ecommerce and (Ecommerce-) Enabler firms aims at accounting for differences in business models and strategies of generating revenue.²⁰ As a consequence, value-relevant factors are expected to vary across the samples. In a market environment such as the Internet, which is characterised by high growth rates and rapid technological change, market values usually exceed book values for two major reasons. Firstly, the market incorporates growth potential and secondly, values intangibles, such as know-how, reputation, customers and key employees. In accordance with popular beliefs about the Internet industry, we expect a greater business risk for firms in the Ecommerce sample. This is due to the winner-takes-all nature of doing business on the net, which in turn results in a larger growth potential. Both are assumed to be priced into the market value. In summary, we expect a higher market-to-book ratio for firms in the Ecommerce group.

H_0^2 : *The market-to-book ratio is significantly higher for firms in the Ecommerce sample.*

¹⁶ See also *Abarbanell/Bushee* (1997).

¹⁷ *Francis/Schipper* (1999) distinguish between high-tech and low-tech companies.

¹⁸ *D'Arcy/Leuz* (2000) distinguish between the choice of employing a top-five auditing firm and any other.

¹⁹ A yes/no dummy was used if at least one alliance with one of the following firms existed: Lycos, Amazon, Yahoo!, Microsoft, Excite, Alta Vista, GO Network, Go2Net, Time Warner and C/NET.

²⁰ For a discussion of the definitions applied and the differences across the subgroups please see section 3.2.

The regulatory framework and set of rules that firms listed on the Neuer Markt have to comply with does not require quarterly financial statements to be audited. Nevertheless, investors are likely to value the reputation, experience and expertise of auditors when evaluating published financial information. This may be due to the fact that management often simply lacks time and experience in setting up financial statements properly according to international accounting standards. Therefore, annual financial statements can be regarded as being more value-relevant to investors, which results in the following hypothesis:

H_0^3 : *The information content and value-relevance of information derived from annual financial statements [AFS] is significantly higher compared to quarterly financial statements.*

Appointing an independent auditing firm to audit the annual financial statements leaves the firm with a wide choice between reputable 'big-five' and smaller, often regional, auditors. The choice of the auditor can be expected to have an impact on the financial reporting such that retaining the services of a 'big-five' firm may signal more information content to investors, because of their higher capital market expertise. Thus a value-relevance can be predicted, which leads to the following hypothesis:

H_0^4 : *The information content and value-relevance of information derived from annual financial statements audited by a 'big-five' firm [BFIVE] compared to a 'non big-five' firm is significantly higher.*

The international accounting principles IAS and US-GAAP which firms must comply with when publishing their financial statements allow different treatments of individual positions. IAS generally grants more options for treating individual positions, whereas US-GAAP is more restrictive. It follows that US-GAAP allows more comparability between firms and may lead to increased transparency:

H_0^5 : *The information content and value-relevance of information derived from financial statements complying with US-GAAP rules and regulations [USGAAP] is significantly higher compared to IAS.*

3 Sample selection and data collection

3.1 Sample companies and time frame of the analysis

As a standard definition for Internet companies does not exist and varying definitions can be found in the relevant literature, this study relies on a broadly accepted definition published by *internet.com* for the purpose of the sampling process.²¹ A total of 60 companies originating from the Internet Index of the Neuer Markt is considered for the sampling process and a further subdivision into Ecommerce and Enabler firms. The resulting Ecommerce sample group consists of 23 companies while the Enabler sample includes the remaining 37.²² The distinction between these two sample groups accounts for the heterogeneity of the business models and existing strategic positions.²³ At this point it is important to stress that an analysis of the value-relevance of webmetrics is only feasible for the Ecommerce sample due to the nature of the business operations and the webmetrics. The Enabler sample serves as a control group and offers the chance to compare the relationship between financial variables across both samples. Financial data is collected for the period from July 1998 to May 2000, while webmetrics data only covers October 1999 to May 2000, due to restrictions in the availability of such measures.

²¹ This classification serves as a basis for the Internet Stock Index (ISDEX), published by *internet.com*. According to the definition, firms are further subdivided into seven major categories, which are as follows: (1) Etailer and Ecommerce, (2) Software, (3) Enabler, (4) Security, (5) Content Provider and Portals, (6) High-Speed and Infrastructure and (7) Access and Internet-Service-Provider. See <<http://sites.stockpoint.com/internet/isdex.asp>> or <<http://kcbt.com/isdexfaq.htm>> for details.

²² The Ecommerce group includes the following segments: (1) Etailer and Ecommerce, (5) Content Provider and Portals, and (7) Access and Internet-Service-Provider, while the Enabler group contains the following segments: (2) Software, (3) Enabler, (4) Security, and (6) High-Speed and Infrastructure.

²³ Tables A1 and A3 in the Appendix show a complete list of firms contained in the respective sample groups.

3.2 Data sources and collection

This study is based solely on accounting information published in corporate reports.²⁴ Data for 229 firm-quarters was collected in accordance with the hypotheses derived under 2.2, covering total sales, earnings, operating cash-flow, sales and marketing expenses and research and development expenses. Necessary statistical adjustments to improve statistical robustness included log-transforming the data as a first step and subsequently eliminating outliers or unusual observations. The latter rests on a visual inspection of scatter plots in addition to the application of cook's distance measure as a statistical means to identify unusual observations.²⁵ The former required a linear transformation of the variable earnings and cash-flow to ensure all observation was positive so that log-transforming would not affect the number of observations to be included in the empirical analysis.²⁶

The empirical investigation relies on webmetrics data supplied by *Media Metrix Europe* [MMXI Europe] and the *Gesellschaft für Konsumforschung* [GfK].²⁷ Information on web-traffic was available only for 16 companies in the Ecommerce sample group.²⁸ In accordance with the hypotheses formulated in the preceding sections information on five variables, viz. page impressions, unique visitors, reach, stickiness and customer loyalty, was collected.²⁹ The statistical adjustment of the observations followed the

²⁴ Differences in accounting standards are present; approximately a quarter of the companies in question publish financial statements according to IAS, while the remainder comply with US-GAAP.

²⁵ See Table A5 in the Appendix for details of removed data points.

²⁶ Please note that the number of observations is dependent on the availability of data, resulting in differences in the sample size across the respective variables. Irrespective of extensive requirements on financial reporting and the timeliness of such reports set forth by the *Deutsche Börse AG* for companies listed on the *Neuer Markt*, including quarterly financial statement according to US-GAAP or IAS, there were notable differences between theoretical goals and prevailing practical implementations regarding both the information content of financial reporting and the timeliness of the publication. However, the *Deutsche Börse AG* has become increasingly reluctant to tolerate breaches of the regulatory rules and has in some instances imposed fines. See Table A2 and A4 in the Appendix for descriptive statistics on the financial variables and Table A7 and A8 for a correlation matrix.

²⁷ Access to information on web-traffic is generated in a standardised procedure and available in a monthly report at a certain cost. Therefore, it can safely be assumed that the market is semi-strong efficient, as analysts and investors do have access to such information and, hence, it could easily be incorporated into stock prices.

²⁸ Table A1 in the Appendix shows which companies are included in the analysis.

²⁹ For a definition of these items see Table 1.

treatment of the accounting data. However, no outliers or unusual observations could be identified. A correlation matrix of the webmetrics is included in the appendix.³⁰

Additionally, company-specific information according to the hypotheses derived under 2.4 was collected. This includes information on the auditor and the accounting standard, all of which were obtained from the companies. To test the hypotheses, dummy variables for the following characteristics needed to be introduced: (1) Annual Financial Statement [AFS], (2) Auditing Firm [BFIVE] and (3) Accounting Standard [USGAAP]. Datastream served as a source of information on market capitalisation. The figure for market capitalisation was taken on the day company reports were published.³¹

It is important to note that the empirical assessment of the value-relevance of the financial information subdivides into two stages. In the first step it concentrates on the assessment of the value-relevance of accounting data across the two samples. In the second step the value-relevance of accounting data is compared to the value-relevance of webmetrics solely for the Ecommerce sample. Consequently, two different sets of financial data for the Ecommerce sample were subject to the analysis. For two major reasons connected to restrictions in the availability of information on web-traffic these differ in both time span and in companies included. Firstly, webmetrics data was not available for all companies included in the Ecommerce sample and secondly, webmetrics were only available starting from October 1999.³² However, we do not explicitly discuss the empirical results concerning the second set separately as they do not substantially differ from the first, although the sample size is smaller.³³

³⁰ See Table A6 in the appendix.

³¹ Testing a two-week window surrounding this date did not show any deviation in the results.

³² Compare section 3.1 and Table A1.

³³ Descriptive statistics regarding Ecommerce and Enabler data used in this study is reported in Table A2 and A4, respectively. The correlations between the independent variables were tested regarding possible multicollinearity. Applying the variance inflation factor as a measure to test for multicollinearity [see Gujarati (1995): 328.], only reach and unique visitors show exposure. This has to be taken into account when interpreting multivariate regressions with webmetrics.

4 Empirical analysis and discussion of findings

4.1 Statistical methodology

This study applies statistical models to describe and analyse the sample data. To empirically evidence an association between firm-specific measures, univariate as well as multivariate regression models are applied. While violations of underlying assumptions are generally problematic in regression models, combining predicting variables of a different nature in a multivariate model is particularly difficult. In this context, the combination of webmetrics and accounting data may be considered an example.³⁴ A possible solution is to deflate all data as was done in several of the aforementioned studies, which used either the number of shares or the equity book value as deflators.³⁵ Deflating the sample data decreases scale effects that cause heteroscedasticity in cross-sectional data and furthermore reduces the number of outliers. An alternative is mentioned by *Barth/Kallapur* (1996), who suggest introducing equity book value as an additional explanatory variable.³⁶ *Hand* (2000a) offers another alternative, suggesting a log-linear regression model for two major econometric arguments. Firstly, a transformation using the logarithm function can reduce the number of possible outliers, which is especially important when dealing with small samples. Secondly, the results of a log-linear regression are generally less exposed to heteroscedasticity. In addition, there are also economic considerations which favour the use of log-linear regression models.³⁷ We follow the argument advanced by *Hand* (2000a) and apply a log-linear regression model to examine the relation between firm-specific measures and the market value accordingly.

Consequently, this study relies on the univariate regression model:

³⁴ See *Amir/Lev* (1996) and *Rajgopal et al.* (2000).

³⁵ See research by *Demers/Lev et al.*(2001) and *Trueman et al.* (2001a).

³⁶ See *Barth/Kallapur* (1996) and *Brown et al.* (1999).

³⁷ See *Hand* (2000b): 15-16. In addition, such models allow statements about the nature of the relationship between the dependent and the predictor variables, i.e. whether the relationship is linear, concave or convex. The coefficient can be interpreted as elasticity and thus determines the degree of non-linearity between the dependent and the independent variables.

$$\text{Market Value} = c_0 + c_1 \cdot \text{Variable}^{38},$$

and the multivariate regression model:

$$\text{Market Value} = c_0 + c_1 \cdot \text{Variable 1} + c_2 \cdot \text{Variable 2} + \dots + c_N \cdot \text{Variable N}$$

to identify value drivers and test the various sub-hypotheses of hypothesis H_0^1 . Market value and data for variables is log-transformed for econometric reasons as discussed above. All regressions are calculated using pooled data.³⁹

Hypothesis H_0^2 is assessed using a mean test to compare market-to-book-value-ratios of Ecommerce and Enabler firms. Hypotheses H_0^3 to H_0^5 are tested using multivariate regression models that contain one financial and one dummy variable. To assess each hypothesis, a set of four regressions containing one financial variable⁴⁰ at a time is estimated. In doing so, for each single hypothesis a series of regressions is obtained and the results are assessed and compared by summarizing these series.⁴¹ As the number of data points in some of the samples is very small, level data is used.⁴²

4.2 Evidence on the value-relevance of financial information

Table 2 summarises the results of the hypothesis testing for the Ecommerce sample and Table 3 for the Enabler sample.⁴³

³⁸ Variables are earnings before interest and taxes, operating cash-flow, total sales, sales and marketing expenses, research and development expenses and the five different webmetrics, respectively. See Table 1

³⁹ i.e., cross-sectional and time-series data is combined.

⁴⁰ See footnote 38.

⁴¹ Compare section 4.5.

⁴² As an alternative a difference or a return model could be employed. For a discussion of various methods see *Easton* (1999): 402 and *Kothari/Zimmerman* (1995): pp 165.

⁴³ Eviews statistic software was used to estimate all regressions. All tests apply a White-corrected covariance matrix to minimise heteroscedasticity. (see *White* (1980))

Table 2: Pooled regressions for Ecommerce sample on financial information

| Hypothesis | n | Constant | Financial Information | | | | adj. R ² |
|------------|----|--------------------|-----------------------|----------------|-------------------|-------------------|---------------------|
| | | | EBIT | CF | TS | SME | |
| H01a | 52 | 54,16 [1,97]* | -1,97 [-1,26] | | | | 1% |
| H01b | 36 | 7,37 [0,19] | | 0,67 [0,31] | | | 0% |
| H01c | 54 | 12,03 [8,15]*** | | | 0,50 [5,09]*** | | 32% |
| H01d | 32 | 13,36 [7,70]*** | | | | 0,40 [3,32]*** | 27% |

Regression coefficient and in brackets t-statistic. Significance level: *** = 1%, ** = 5%, * = 10%
[EBIT]: Earnings bef. Int. and Tax, [CF]: Cash-Flow, [TS]: Total Sales, [SME]: Sales and Marketing Expenses.

Table 3: Pooled regressions for Enabler sample on financial information

| Hypothesis | n | Constant | Financial Information | | | | adj. R ² |
|------------|-----|--------------------|-----------------------|-----------------|-------------------|-------------------|---------------------|
| | | | EBIT | CF | TS | RND | |
| H01a | 106 | 56,96 [3,85]*** | -2,10 [-2,50]** | | | | 5% |
| H01b | 103 | -12,60 [-0,69] | | 1,80 [1,77]* | | | 2% |
| H01c | 105 | 6,35 [4,57]*** | | | 0,88 [9,77]*** | | 48% |
| H01d | 48 | 11,87 [4,67]*** | | | | 0,57 [3,17]*** | 16% |

Regression coefficient and in brackets t-statistic. Significance level: *** = 1%, ** = 5%, * = 10%
[EBIT]: Earnings bef. Int. and Tax, [CF]: Cash-Flow, [TS]: Total Sales, [RND]: Research and Development Exp.

Hypothesis H_0^{1a} predicts that earnings before interest and taxes [EBIT] are not associated with the market value of Internet firms listed on the Neuer Markt. The empirical evidence of this study supports this notion across both samples and thus the hypothesis cannot be rejected. A value-relevance, however, may not be completely ruled out for the Enabler sample.⁴⁴ This is underlined by the regression coefficient being statistically significant on a 5% level and an adjusted R^2 of 5%, indicating that variations in earnings explain 5% of variations in market value. The sign of the coefficient is negative for both samples, which suggests a weak negative log-linear relationship, i.e. higher losses are associated with higher market values. However, since the evidence is extremely weak, it holds instead that within the context of this study, EBIT could not be identified as a value driver. Thus in 1999 and 2000, market participants did not seem to have based their evaluation of an equity investment in Internet companies on the respective earnings figures. Since this observation holds for both Ecommerce and Enabler firms, it seems to be independent of the business model.

Hypothesis H_0^{1b} assumes that cash-flow [CF] cannot be evidenced as providing any value-relevance for variations in stock prices of companies in either sample. As before, the findings of this study are not sufficient to reject the hypothesis. Therefore, cash-flow for both the Ecommerce and the Enabler sample could not be empirically verified as a value driver. In both instances the coefficients are not significant on a 5% level and, in addition, an adjusted R^2 of less than 2% does not suggest much value-relevance either. Consequently and according to the evidence found in this study, components and input variables of traditionally applied technical valuation methods such as profit measures and cash-flow do not to provide significant explanatory power regarding the capital market valuation of an Internet firm's equity in 1999 and 2000.

As predicted in hypothesis H_0^{1c} , a positive association of total sales [TS] with the market capitalisation is evidenced so that a significant impact of changes in total sales on movements in the market capitalisation can be assumed. For the Ecommerce (Enabler) sample, the regression model results in an adjusted R^2 of 32% (48%), with

⁴⁴ For the Ecommerce sample the coefficient is not significant and the adj. R^2 approximately 1%.

both the constant and the coefficients being highly significant. Total sales is thus identified as a value driver for Internet firms in 2000, which holds for both sample groups. The explanatory power, however, is slightly higher for the Enabler than for the Ecommerce sample. The reason total sales performs better in explaining variations in the market value of an Internet company than earnings or cash-flow-related figures may be due to the very nature of the environment, as turnover can be regarded as a proxy for market penetration, growth and hence success of the business model. Additionally, it is a reliable figure in the sense that it aggregates the performance over the business activities and is not influenced by the choice of the accounting standard.

Hypothesis H_0^{1d} states that changes in selling and marketing expenses [SME] for the Ecommerce sample and research and development expenses [RND] for the Enabler are expected to provide significant value-relevance with respect to market value. The empirical evidence of this study confirms that selling and marketing expenses and research and development expenses are value drivers. For both variables, the constant and the coefficient are significant on a 1% level and the model identifies a positive log-linear relationship with the market capitalisation across both sample groups. Since both figures are expenses but go into the model as positive figures, the empirical results show evidence that investors were prepared to pay more for a stock if the company chose to devote more resources to marketing or to research and development. For the Ecommerce (Enabler) firms the model ascribes 27% (16%) of variations in market capitalisation to changes in selling and marketing expenses and research and development expenses respectively. Comparably more explanatory power is attributed to selling and marketing expenses and the Ecommerce sample than to research and development expenses and the Enabler. It may follow that the capital markets seem to have regarded selling and marketing expenses as more of an investment in the generation of future economic value than research and development expenses and thus treated them as more relevant in the investment decision. Again this statement is only supported for the period of this study and permits no transfer to the future.

4.3 Evidence of the value-relevance of webmetrics information

In assessing hypothesis H_0^{1e} to H_0^{1i} , only the Ecommerce sample is subject to the analysis, due to the nature of the business model and, therefore, the availability of information on web-traffic. This study provides evidence that webmetrics were indeed relevant and related to the market value of an Internet firm. Changes in webmetrics explain in a positive log-linear manner movements in the valuation of an Internet firm and can thus be classified as value drivers in the tested period of time. Consequently, investors in the capital markets implicitly regarded web-traffic and thus information on customer behaviour as being important when evaluating an equity investment. Table 4 summarises the results of the univariate log-linear regressions.

Table 4: Pooled regressions for Ecommerce sample on webmetrics

| Hypothesis | n | Constant | Webmetrics | | | | | adj. R ² |
|------------|----|---------------------|-------------------|-------------------|-------------------|----------------|--------------------|---------------------|
| | | | PI | UV | RE | ST | CL | |
| H01e | 66 | 11,94 [9,03]*** | 0,57 [6,70]*** | | | | | 40% |
| H01f | 87 | 9,37 [6,36]*** | | 0,87 [7,54]*** | | | | 39% |
| H01g | 87 | 19,06 [88,20]*** | | | 0,93 [7,62]*** | | | 40% |
| H01h | 66 | 20,44 [37,27]*** | | | | 0,19 [0,61] | | 0% |
| H01i | 66 | 18,47 [75,38]*** | | | | | 2,10 [10,38]*** | 62% |

Regression coefficient and in brackets t-statistic. Significance level: *** = 1%, ** = 5%, * = 10%
 [PI]: Page Impressions, [UV]: Unique Visitors, [RE]: Reach, [ST]: Stickiness, [CL]: Customer Loyalty

The empirical evidence is not strong enough to reject sub-hypotheses H_0^{1e} to H_0^{1g} and H_0^{1i} , while H_0^{1h} on the other hand is not supported and must be rejected. Consequently, there is evidence of a value-relevance for customer loyalty, page impressions, reach and unique visitors as predicted by the corresponding hypotheses. In a regression with coefficients as well as constants being highly significant, variations in these measures explain in a positive log-linear manner 62%, 40%, 40% and 39% of the changes in the market value of Ecommerce firms during the Internet bubble, respectively. It was thus possible to empirically evidence and confirm the central importance of the customer as assumed in the hypotheses. Investors seem to have attached a high degree of relevance to measures of web-traffic when evaluating an investment opportunity during that time and were prepared to pay a higher price if a company was generating more traffic.

The strongest log-linear association with market values can be identified for customer loyalty, which approximates the firm's ability to bind customers and generate repeated business. Page impressions are also evidenced as being highly significant, indicating the attractiveness of a virtual shop by measuring the number of potential customers, and thus the obtained empirical evidence is hardly surprising. As discussed before, within the environment of the Internet market penetration along with brand awareness are believed to be critical for success. Consequently, this study identifies reach, which measures the market penetration and awareness of the population of Internet users of a particular website, as a value driver. By the same token, unique visitors is evidenced to be a value driver for Ecommerce firms. Stickiness, however, could not be identified as a value driver, which is probably due to there still being some heterogeneity in business models within the Ecommerce sample group. In this context it seems plausible that customers on average spend more time when shopping for items than when carrying out a search visiting a portal.

4.4 Evidence of the relative value-relevance of financial information and webmetrics

As formulated in hypothesis H_0^1 , the main objective in this study is to compare the value-relevance of financial information to the value-relevance of industry-specific data, which is not part of standardised corporate reporting schemes. Table 5 summarises the results for multivariate regressions to contrast financial and webmetrics data.

Table 5: Pooled regressions for Ecommerce and Enabler sample of financial information and webmetrics

| Model # | Sample | n | Constant | Financial Information | | | | | Webmetrics | | | adj. R ² | |
|---------|-----------|----|---------------------|-----------------------|-------------------|-------------------|-----------------|---------------------|----------------|----------------|------------------|---------------------|-----|
| | | | | EBIT | CF | TS | SME/RND | PI | UV | RE | ST | | CL |
| M1 | Enabler | 46 | -12,40 [-0,75] | -0,87 [-1,06] | 1,81 [1,63] | 1,04 [7,39]*** | 0,01 [0,05] | | | | | | 67% |
| M2 | Ecommerce | 29 | 136,46 [3,03]*** | -2,19 [-1,81]* | -4,68 [-1,78]* | 0,40 [1,92]* | -0,14 [-0,8] | | | | | | 51% |
| M3 | Ecommerce | 66 | 17,20 [3,31]*** | | | | | -0,79 [-3,49]*** | 0,89 [1,57] | 0,37 [0,68] | 0,44 [20,6]** | 2,52 [8,00]*** | 70% |
| M4 | Ecommerce | 50 | 12,27 [10,49]*** | | | 0,45 [5,40]*** | | | | | | 1,51 [6,94]*** | 73% |

Regression coefficient and in brackets t-statistic. Significance level: *** = 1%, ** = 5%, * = 10%

[EBIT]: Earnings bef. Int. and Tax., [CF]: Cashflow, [TS]: Total Sales, [SME]: Sales and Marketing Exp., [RND]: Research and Development Exp.
[PI]: Page Impressions, [UV]: Unique Visitors, [RE]: Reach, [ST]: Stickiness, [CL]: Customer Loyalty

As model 2 (M2) shows, the market value of firms in the Ecommerce group is negatively associated with earnings and cash-flow. It follows that higher losses and cash outflows are associated with a higher market valuation of the equity, i.e. investors were willing to pay a higher price irrespective of larger losses or negative cash-flows during that period. The same holds true for sales and marketing expenses; however, the coefficient is not significant.⁴⁵ The coefficient of total sales is positive and significant on a 10% level. The coefficients for cash-flow and sales and marketing expenses are negative and thus the opposite of univariate regression results. Furthermore cash-flow does not seem to explain market values when looking at the univariate model as the adjusted R^2 is zero; it does, however, seem to contribute marginally to the explanatory power when looking at the multivariate model, while the opposite holds for sales and marketing expenses. A possible explanation could be that those variables were not evaluated by investors on a stand alone basis, but rather in a combination.

If we compare M1 (Enabler) to M2 (Ecommerce), the results are as follows. Only the coefficient for total sales is significant in both samples and indicates a positive relation with market values, supporting results from univariate regression models. Earnings, cash-flow and research and development expenses on the other hand are not significant in the Enabler sample, while earnings and cash-flow are significant on a 10% level in the Ecommerce sample. The sign of the coefficient for earnings is identical for the univariate and multivariate regression models and both samples show earnings negatively related to market values. In the Enabler sample the coefficients of the variables research and development expenses and cash-flow are identical to the univariate regression models. The explanatory power of M1 and M2 results in an adjusted R^2 of 51% for the Ecommerce sample and 67% for the Enabler. Due to statistical restrictions⁴⁶ one must exercise caution when interpreting the results. However, the statistical evidence seems to support the notion that some financial information, in combination, was indeed value-relevant for Internet firms in both

⁴⁵ Sales and marketing as well as research and development costs are recorded as expenses, i.e. absolute figures, for the analysis of this study.

⁴⁶ I.e. the use of level data and small sample sizes.

samples during that time and hence likely to be used in the evaluation of an investment decision.

Model (M3), containing all webmetrics, provides an explanatory power of 70%, which is comparable to the degree of association that could be empirically evidenced for financial information. Customer loyalty and page impressions are highly significant on a 1% level, which is identical to the results obtained in the univariate models. The coefficients of reach and customer loyalty are not significant, while stickiness is significant on a 5% level. This contrasts with the results obtained in the univariate regressions. All coefficients apart from page impressions are positive, which again is in line with the results of the univariate models, only the latter differs in that its coefficient is negative. The evidence emphasises the earlier finding in the sense that customer loyalty is crucial to the valuation of an Internet firm. While an interpretation of the results and especially a comparison to univariate regression results must be carried out with caution, we believe it is safe to assume a value relevance of web-traffic data for Internet firms. Moreover, the findings suggest that investors did implicitly price information on web-traffic into Ecommerce companies stocks when evaluating an investment opportunity during the boom phase. Furthermore, the evidence obtained in this study suggests that the importance of such data to an investor may be regarded as being of equal significance to the information content provided by accounting data when evaluating an investment opportunity in Internet firms listed on Germany's Neuer Markt.⁴⁷

Combining financial data and webmetrics in one model is not statistically valid, as the sample size in relation to the number of independent variables becomes too small. Nevertheless, to demonstrate the explanatory power of such a combination of the most significant financial data and webmetrics, an example of such a model is given in M4. In this model, both coefficients are highly significant and a higher explanatory power of the model is obtained.

⁴⁷ See footnote 33 for limitations when interpreting the model due to some multicollinearity.

Therefore, according to the findings of this study, a strong association of a combination of financial, i.e. accounting, and industry-specific information, i.e. webmetrics, with the market value of Internet companies on the Neuer Markt during the Internet bubble may be assumed.

The empirical evidence is in accordance with our predictions in terms of hypothesis H_0^1 ; thus it follows that webmetrics provide at least as much value-relevance for investors as traditional financial measures. Accordingly, industry-specific information should be made available to investors in a standardised manner and be included in financial reporting of Internet firms.

4.5 Evidence of the value-relevance of other information

In hypothesis H_0^2 it is assumed that investors place a higher value on a company from the Ecommerce group than on one from the Enabler group. A mean test of the market-to-book-value-ratio of equity does not confirm this suspicion, as the average market-to-book-value is significantly different for the two samples but higher for the Enabler. While the ratio equals 10.7 for the Ecommerce sample, it is 27.1 for the latter, leading to a rejection of hypothesis H_0^2 . Detailed data of the t-test is given in Table 6. Therefore, investors in the capital markets do not price Ecommerce higher than Enabler firms; in fact, rather the contrary holds true. The results serve to emphasise that investors seem to price both growth potential and intangible assets on average more highly for Enabler than for Ecommerce companies. A possible reason for this might be the standard or network setting process in the field of web-based software solutions and the generation of know-how associated with it. To deduce that Enabler firms are more risky and thus are valued more highly in relation to their book value than originally suspected for the Ecommerce sample however does not necessarily follow.

Table 6: Results from Hypothesis Testing of H_0^2 and Difference of Means of Market-to-Book Ratios

| | T-Test Market-to-Book Value | | |
|-----------|-----------------------------|-------|-------|
| | n | Mean | STD |
| Ecommerce | 38 | 10,67 | 9,70 |
| Enabler | 103 | 27,07 | 53,02 |
| df | 119 | | |
| t-stat | 3,005 | | |
| t-crit | 2,617 | | |

[df]: Degrees of Freedom, iff t-stat > t-crit --> significant on 1%-level
[t-stat]: T-Statistic, [t-crit]: Critical T-Value on 1% level

Conclusions for hypotheses H_0^3 to H_0^5 are drawn by first comparing the significance levels of the dummies. If a dummy coefficient was at least on a 5% significance level, the difference in the adjusted R^2 with and without dummy was compared.⁴⁸ Results are summarised in Table 7.

Table 7: Results from hypotheses Testing of H_0^3 to H_0^5

| Hypothesis | # regressions w/ at least 5% significance level of dummy | # of regressions w/ significant higher adj. R2 after introducing dummy |
|------------|--|--|
| H03 | 0/4 | - |
| H04 | 4/4 | 4/4 |
| H05 | 0/4 | - |

The empirical evidence for hypothesis H_0^3 , which predicates a higher value-relevance of accounting information derived from annual [AFS] in contrast to quarterly financial statements, is not sufficient to reject the hypothesis. While annual statements must be audited, quarterly reports need not be, which may put them at a disadvantage regarding reliability and quality of the information disclosed. On the other hand, quarterly financial statements must be disclosed faster. In conclusion, both factors may be offsetting each other.

A noteworthy result is obtained in the empirical assessment of hypothesis H_0^4 . The evidence is strong enough to reject the hypothesis and to conclude that the choice of the auditing firm [BFIVE] does have a considerable impact on the information content and thus value-relevance of financial information, which is significantly increased when a

⁴⁸ If the adjusted R^2 is significant higher when the dummy is implemented in the regression can be shown with a F-test.

'big-five' auditor is retained.⁴⁹ Despite the auditing scandals involving e.g. *HypoVereinsbank* and *Philip Holzmann*, which have been subjects of considerable media coverage in the past, the findings of this study conclude that the capital markets, i.e. investors, consider financial statements audited by a 'big-five' firm more trustworthy.

The choice of the accounting standard IAS or US-GAAP [USGAAP] again is not sufficiently empirically confirmed to have a significant impact on the value-relevance of financial information, as is postulated in hypothesis H₀⁵, which is consequently rejected. This might be due to the kind of financial information identified to be value-relevant, as this comprises primarily aggregated figures, e.g. total sales, which are little affected by the choice of the accounting standard. As no authority like the SEC in the U.S. controls the compilation of financial statements in Germany and both the company as well as the auditor may require more practical experience in the application of international standards (IAS and US-GAAP), differences in reports according to German GAAP (HGB) might be traceable, but differences between international standards might not be evident.

⁴⁹ 4 out of 4 regressions show a significant higher adjusted R² for the regressions including that dummy.

5 Comparing the empirical findings with previous empirical evidence

Regarding the value-relevance of financial information, all studies addressing a similar issue apart from *Rajgopal et al. (2000)* arrive at similar conclusions to this study.⁵⁰ Some financial information is associated in a log-linear manner with market values of Internet firms and thus can be regarded as a value driver. The focus, however, differs across the relevant studies and while this study investigates a series of variables in a detailed manner, others only test financial variables in a multivariate regression model and compare the findings with a combination of webmetrics. However, the present study arrives at conclusions comparable to *Demers/Lev (2001)*, *Rajgopal et al. (2000)* and *Trueman et al. (2001a)*.

Unlike *Hand (2000a)*, this study finds measures of profit to be associated less with market value than total sales, while a similarly high value-relevance is supported for sales and marketing expenses in both studies. In a later study, *Hand (2000b)* empirically confirmed that financial information performs significantly better than webmetrics in explaining market values of Internet firms' equity observed on the capital markets. This contrasts with the evidence obtained in this study that suggests a similar value-relevance instead. *Rajgopal et al. (2000)* primarily investigate the value-relevance of web-traffic in combination with profits and equity book value. Both models evidence only slight relevance. In their study, *Trueman et al. (2001a)* find no conclusive evidence supporting earnings as a value driver, while total sales is confirmed as such, a conclusion similar to the results of this study. In summary, no unique results regarding the relative value-relevance of financial variables can be observed in the present academic discussion. Furthermore, the studies investigating the time consistency of the value-relevance of financial data⁵¹ conclude that the degree of explanatory power remains constant and does not, contrary to some recent suggestions, diminish.⁵² It is however remarkable that according to these studies, the importance of profit as a value driver has declined relative to book values.

⁵⁰ See section 1 and footnote 2 for details on relevant studies.

⁵¹ See *Collins et al. (1997)* and *Francis and Schipper (1999)*.

⁵² This refers only to a combination model of profit variables and equity book values.

Trueman et al. (2001a) and *Rajgopal et al. (2000)* also assess additional value-relevance of measures of web-traffic combined with accounting data, and find it highly significant, while *Hand (2000b)* does not. *Trueman et al. (2001a)* find significant evidence for unique visitors and page impressions as value drivers. *Rajgopal et al. (2000)* investigate reach and unique visitors, but do not further differentiate between the two. The same holds true for *Hand (2000b)*, who examines unique visitors, page impressions and stickiness, but concludes that neither of them is a highly significant value driver. *Demers/Lev (2001)* concentrate on the value-relevance of reach, unique visitors, page impressions, stickiness and customer loyalty, which are the factors analysed in this study. In contrast to this investigation, their empirical evidence shows the strongest association with the market valuation not for variable customer loyalty but for the variables reach and page impressions.

An investigation into the relative advantages of the IAS and US-GAAP accounting standards from a capital market point of view was also carried out by *D'Arcy/Leuz (2000)*, who concluded, in agreement with the evidence of this study, that no such advantage could be identified.

6 Concluding Remarks

This study aimed at relating firm-specific measures, both financial and industry-specific information, to the stock prices of Internet firms on the Neuer Markt in 1999 and 2000. In so doing, it was possible to examine the value-relevance of such variables and to seek explanations relating to investment behaviour in the phase when stock prices increased sharply. In summary, the study indicates that for the sample of Internet firms analysed, financial information based on past performance was not significantly better suited to explaining movements in stock prices than industry-specific information, i.e. measures of web-traffic. Moreover, webmetrics, in addition to financial variables, seem to have been of notable relevance for the investor when evaluating an investment opportunity. Since expectations about future performance are traded on capital markets, it seems reasonable that information relating to a firm's customer base and, hence, its potential to generate future value, proves to be value-relevant. While financial data are already subject to strict and standardised reporting regulations, webmetrics, although highly value-relevant, are not. Not only are reporting requirements lacking, but also generally accepted definitions. This translates into questioning how to include industry-specific information such as webmetrics for the Internet industry in the publication requirements. These findings suggest that further research is needed to determine whether and how webmetrics could be incorporated into financial reporting regulations for Internet companies, and also whether there are other industries with similarly influential industry-specific measures.

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Appendix

TABLE A1: Companies included in the Ecommerce sample group and availability of data

| Ecommerce Sample | | | |
|------------------|-------------------------------|-----------------|-----------------|
| No. | Company | Fi ^a | WM ^b |
| EC 1 | artnet.com AG | ✓ | ∅ |
| EC 2 | buch.de internetstores AG | ✓ | ✓ |
| EC 3 | buecher.de AG | ✓ | ✓ |
| EC 4 | ConSors Discount-Broker AG | ✓ | ✓ |
| EC 5 | CTS EVENTIM AG | ✓ | ∅ |
| EC 6 | Direkt Anlage Bank AG | ✓ | ✓ |
| EC 7 | ebookers.com PLC | ✓ | ✓ |
| EC 8 | Endemann!! Internet AG | ✓ | ∅ |
| EC 9 | ENTRIUM DIRECT BANKERS AG | ✓ | ✓ |
| EC 10 | fluxx.com AG | ✓ | ∅ |
| EC 11 | FortuneCity.com Inc. | ✓ | ✓ |
| EC 12 | freenet.de AG | ✓ | ✓ |
| EC 13 | Gigabell AG | ✓ | ∅ |
| EC 14 | Jobs & Adverts AG | ✓ | ✓ |
| EC 15 | Lycos Europe N.V. | ✓ | ✓ |
| EC 16 | musicmusicmusic inc. | ✓ | ∅ |
| EC 17 | OnVista AG | ✓ | ✓ |
| EC 18 | ricardo.de Aktiengesellschaft | ✓ | ✓ |
| EC 19 | TOMORROW Internet AG | ✓ | ✓ |
| EC 20 | T-Online International AG | ✓ | ✓ |
| EC 21 | Travel24.com AG | ✓ | ∅ |
| EC 22 | United Internet AG | ✓ | ✓ |
| EC 23 | WEB.DE AG | ✓ | ✓ |

a) [FI]: Financial Information, b) [WM]: Webmetrics

TABLE A2: Descriptive statistics for the Ecommerce sample group

| Variable | N | Min | Max | Mean | Median | STD |
|-------------------|----|--------|--------|-------|--------|-------|
| MV ^a | 54 | 39,38 | 46.610 | 1.351 | 263 | 6.322 |
| TS ^a | 54 | 0,14 | 173,80 | 10,77 | 3,62 | 25,04 |
| SME ^a | 32 | 0,05 | 31,60 | 3,70 | 1,94 | 5,69 |
| EBIT ^a | 53 | -27,83 | 4,64 | -3,76 | -2,64 | 5,11 |
| CF ^a | 49 | -11,69 | 12,33 | -2,36 | -2,21 | 4,12 |
| MV* ^a | 87 | 51,48 | 46.200 | 2.625 | 744 | 7.496 |
| UV ^b | 87 | 0,08 | 4,89 | 0,63 | 0,23 | 0,97 |
| PI ^b | 66 | 0,29 | 73,81 | 13,52 | 4,69 | 19,98 |
| RE ^c | 87 | 1,0 | 57,1 | 7,8 | 3,5 | 11,1 |
| ST ^d | 66 | 1,6 | 25,8 | 6,3 | 5,6 | 3,8 |
| CL ^d | 66 | 1,1 | 6,2 | 3,4 | 3,6 | 1,5 |

[STD]: Standard Deviation, [MV]: Market Value, [TS]: Total Sales, [SME] Selling and Marketing Exp.
 [EBIT]: Earnings before Interest and Taxes, [CF]: Cash-Flow

[UV]: Unique Visitors, [PI]: Page Impressions
 [RE]: Reach, [ST]: Stickiness, [CL]: Customer Loyalty

*) Adjusted Ecommerce sample [see Table A1], a) Million EURO, b) Million, c) Percent, d) Minutes

TABLE A3: Companies included in the Enabler sample group

| No. | Enabler Sample Company |
|-------|---|
| EN 1 | ABIT AG |
| EN 2 | AdLINK Internet Media AG |
| EN 3 | Adori AG |
| EN 4 | antwerpes ag |
| EN 5 | ARTICON Information Systems AG |
| EN 6 | BroadVision, Inc. |
| EN 7 | BROKAT Infosystems AG |
| EN 8 | Concept! AG |
| EN 9 | Cybernet Internet Services International Inc. |
| EN 10 | DataDesign AG |
| EN 11 | DCI Database for Commerce and Industry AG |
| EN 12 | digital advertising AG |
| EN 13 | FANTASTIC CORP. |
| EN 14 | Gauss Interprise AG |
| EN 15 | GEDYS Internet Products AG |
| EN 16 | GFT Technologies AG |
| EN 17 | I-D Media AG |
| EN 18 | i-FAO AG |
| EN 19 | INFOMATEC AG |
| EN 20 | Integra S.A. |
| EN 21 | InternetMediaHouse.com AG |
| EN 22 | Internolix AG |
| EN 23 | INTERSHOP COMMUNICATIONS AG |
| EN 24 | ISION Internet AG |
| EN 25 | Kabel New Media AG |
| EN 26 | Met@box AG |
| EN 27 | net AG |
| EN 28 | Netlife AG |
| EN 29 | Openshop Holding AG |
| EN 30 | Pixelpark AG |
| EN 31 | PopNet Internet AG |
| EN 32 | QS Communications AG |
| EN 33 | SinnerSchrader AG |
| EN 34 | teamwork information management AG |
| EN 35 | TRIA software AG |
| EN 36 | Trintech Group PLC |
| EN 37 | WWL Internet AG |

TABLE A4: Descriptive statistics for the Enabler sample group

| EN | N | Min | Max | Mean | Median | STD |
|-------------------|-----|--------|--------|-------|--------|-------|
| MV ^a | 106 | 60,00 | 13.310 | 1.051 | 389 | 2.138 |
| TS ^a | 105 | 0,52 | 67,45 | 7,41 | 4,00 | 9,22 |
| RND ^a | 48 | 0,14 | 9,72 | 1,84 | 1,31 | 1,82 |
| EBIT ^a | 106 | -23,73 | 10,08 | -2,94 | -1,80 | 5,41 |
| CF ^a | 104 | -55,83 | 31,86 | -2,98 | -2,02 | 8,26 |

[MV]: Market Value], [TS]: Total Sales, [RND] Research and Development Exp.
[EBIT]: Earnings before Interest and Taxes, [CF]: Cash-Flow
a) Million EURO, b) Million

TABLE A5: Removed Data Sets

| Outlier and Unusual Observations | | |
|----------------------------------|-----------|---------|
| Company | Data set | Quarter |
| Lycos | EBIT | [1/00] |
| Integra | Cash-Flow | [1/00] |
| Trintech | Cash-Flow | [3/99] |

TABLE A6: Correlation Matrix Webmetrics Information

| Variable | MV | PI | UV | RE | ST | CL |
|-----------------------|-------|-------|--------|--------|-------|----|
| MARKET VALUE [MV] | 1 | | | | | |
| PAGE IMPRESSIONS [PI] | 0,642 | 1 | | | | |
| UNIQUE VISITORS [UV] | 0,633 | 0,895 | 1 | | | |
| REACH [RE] | 0,637 | 0,857 | 0,977 | 1 | | |
| STICKINESS [ST] | 0,076 | 0,044 | -0,223 | -0,264 | 1 | |
| CUSTOMER LOYALTY [CL] | 0,792 | 0,760 | 0,548 | 0,522 | 0,158 | 1 |

TABLE A7: Correlation Matrix Financial Information Ecommerce Sample

| Variable | MV | TS | EBIT | SME | CF |
|------------------------------|--------|--------|--------|-------|----|
| MARKET VALUE [MV] | 1 | | | | |
| TOTAL SALES [TS] | 0,576 | 1 | | | |
| EARNINGS [EBIT] | -0,176 | -0,130 | 1 | | |
| SALES & MARKETING EXP. [SME] | 0,518 | 0,608 | -0,620 | 1 | |
| OPERATING CASH-FLOW [CF] | 0,053 | -0,226 | -0,094 | 0,120 | 1 |

TABLE A8: Correlation Matrix Financial Information Enabler Sample

| Variable | MV | TS | EBIT | SME | CF |
|--------------------------------|--------|--------|--------|-------|----|
| MARKET VALUE [MV] | 1 | | | | |
| TOTAL SALES [TS] | 0,694 | 1 | | | |
| EARNINGS [EBIT] | -0,238 | -0,195 | 1 | | |
| OPERATING CASH-FLOW [CF] | 0,174 | 0,073 | 0,277 | 1 | |
| RESEARCH & DEVELOP. EXP. [RND] | 0,423 | 0,494 | -0,290 | 0,105 | 1 |