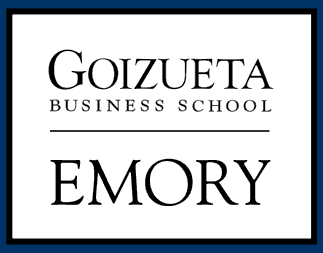

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ZIBS Technical Report

Linking Customer Metrics to Shareholder Value for Firms with Contractual Relationships

Thorsten Wiesel, Bernd Skiera

"Brand-Driven Business Performance"

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LINKING CUSTOMER METRICS TO SHAREHOLDER VALUE FOR FIRMS WITH CONTRACTUAL RELATIONSHIPS

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NBV => fair value

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LINKING CUSTOMER METRICS TO SHAREHOLDER VALUE FOR FIRMS WITH CONTRACTUAL RELATIONSHIPS

We develop a model for firms with contractual customer relationships to link customer metrics (such as customer cash flow, number of customers, and customer retention) to customer equity and shareholder value. This model allows to predict a firm's shareholder value and to evaluate the effect of changes in customer metrics on shareholder value. Our two empirical studies, our analytical solutions and our simulation study show that the customer base value is not a good proxi for shareholder value and that customer retention has by far the greatest impact on shareholder value. Furthermore, our results show that the effect of changes in retention rates is even stronger in situations where retention rates are already high. We propose a ratio of customer equity to shareholder value to identify firms in which changes in customer metrics have a particular strong impact on shareholder value. Our findings allow other researchers who analyze the impact of marketing investments on customer metrics to evaluate their results in terms of shareholder value.

1 Introduction

Financial markets consider shareholder value as a very important success measure for firms. The shareholder value concept aims to create value for the shareholders as the formal owners of a firm and any investment decision should be justified in the context of shareholder returns (e.g., Rappaport 1986). Consequently, firms should show how their marketing investments impact shareholder value. Since firms with contractual relationships (such as Internet service providers, the financial services industry, telecommunication firms, energy suppliers, software firms or pay TV broadcaster) can determine customer metrics (such as the number of customers and the cash flow per customer) rather easily, that task might be decomposed into two steps: The first step captures how marketing investments affect customer metrics and the second step shows how changes in customer metrics impact shareholder value.

Yet, while many papers focus on the first step by analyzing the effect of marketing activities on customer metrics (e.g., Bolton 1998; Reinartz and Kumar 2000; Reinartz and Kumar 2003; Anderson and Simester 2004; Thomas, Blattberg, and Fox 2004; Lewis 2004), hardly any concentrate on the second step. Notable exceptions are Srivastava, Shervani, and Fahey (1998) and Hogan et al. (2002) who provide a theoretical framework for linking customer value to shareholder value as well as Gupta, Lehmann, and Stuart (2004). The latter propose a model to calculate the value of a customer base as a proxi for shareholder value and validate their model in five empirical studies. While their model allows to parsimoniously calculate the value of a customer base, we show that the value of a customer base is not a good proxi for shareholder value.

In addition, event study methodology or vector-autoregressive models are used to assess the impact of marketing activities on changes in stock prices, thus shareholder value (e.g., Chaney, Devinney, and Winer 1991; Geyskens, Gielens, and Dekimpe 2002; Lane and Jacobson 1995; Pauwels et al. 2004; Joshi and Hanssens 2004). These studies provide very valuable

insights into the benefits of certain marketing activities on stock prices. However, they do not allow for the determination of the overall shareholder value and they have not been applied so far to evaluate the effect of changes in customer metrics on shareholder value.

The objectives of this paper are to propose a model for firms with contractual customer relationships that links customer metrics to shareholder value and to test the feasibility and validity of this model in two empirical studies. In addition, we analyze the influence of different customer metrics on shareholder value empirically and theoretically. Furthermore, we propose a new metric called *„CE1/SHV-ratio"* to identify firms for which changes in customer metrics have a particularly great impact on shareholder value.

Our key contribution to literature is as follows: We provide a model that links customer metrics to shareholder value. In doing so, we provide an answer to the recent calls of Hogan et al. (2002, p. 34), Rust et al. (2004, p. 79), and Boulding et al. (2005, p. 25) for examining the link between financial measures and customer metrics. Thereby, we extend the model of Gupta, Lehmann, and Stuart (2004) by including the non-operating value of a firm, indirect customer related expenditures as well as non-equity claims. Our two empirical studies show that not including those model components overestimates shareholder value by 77% (study 1) and 227% (study 2). In addition, we recommend using terminal values to facilitate model calibration and to ensure an infinite time horizon. Furthermore, we propose a simple heuristic to split marketing expenditures into expenditures for customer acquisition and retention if lack of data requires doing so. We also show how our model is linked to traditional discounted cash flow (DCF) models. Thereby, we demonstrate in our empirical studies that our model is able to deal with negative cash flows. In such situations, traditional DCF models are considered to have difficulties because historical cash flows only provide limited information about future cash flows (Damodaran 2001). Finally, our model allows other researchers who ana-

lyze the impact of marketing investments on customer metrics to evaluate their results in terms of shareholder value.

The remainder of this paper is organized as follows: Section 2 outlines the model. Section 3 reports the results of two empirical studies in which we use our model to determine the shareholder value of two Internet service providers. We show that the model is fairly easy to apply, provides valuable insights, can easily be linked to traditional DCF models and allows to examine the impact of changes in customer metrics on shareholder value. In Section 4, we analyze the influence of different customer metric on shareholder value under different circumstances. We conclude by summarizing our results, proposing implications, and discussing the limitations of our work.

2 Model

2.1 Structure of the Model

We propose a model to link customer metrics to shareholder value for firms with contractual relationships. Jackson (1985) categorizes relations of such firms as „lost-for-good" relationships, which means that the customer is either totally committed to the firm or totally lost. These contractual relations allow to rather easily determine the number of customers and the average cash flow per customer. We consider customers as the only source of operating cash flow and assume – in line with Hogan, Lemon, and Rust (2002) – that all tangible assets (e.g., equipment, buildings) as well as intangible assets (e.g., brands, knowledge, patents) support the generation of these customer cash flows. Thus, values of patents or brands are not explicitly modelled, but are reflected in customer cash flows. The sum of the present value of all customers' cash flows, which is the sum of all customer lifetime values, lead to customer equity as the measure for the firm's operating assets. In line with the principles of finance, we use cash flows instead of profitability measures as the numerator because cash flows better reflect the value of an asset (Brealey and Myers 2000; Pfeifer, Haskins, and Conroy 2004). In

many cases, both measures are rather similar, so our model should work equally well with the use of profitability measures instead of cash flows.

Calculating the cash-inflows per customers is fairly straight forward because it is usually easy to assign revenues to customers. However, assigning expenditures to individual customers is more complicated because not all expenditures are driven by individual customers. Other expenditures are driven by customer segments or all customers together. Examples for the latter are salaries for administrative personnel, investments, and corporate taxes. Consequently, we propose two metrics to measure customer equity. Customer Equity 1 (*CE1*) measures the present value of the difference between all customer cash inflows and all direct customer related cash outflows, i.e., expenditures that can be clearly linked to individual customers such as variable production costs or service costs. Customer Equity 2 (*CE2*) equals Customer Equity 1 minus the present value of all indirect customer related expenditures (*indE*), i.e., expenditures that can not be linked to individual customers.

The value of non-operating assets (*NOA*) such as the value of non-operating cash, marketable securities, and minority holdings reflect the non-operating side of a firm's business. Combining the operating and non-operating assets leads to the firm value (*FV*):

(1) $$FV = CE2 + NOA = CE1 - indE + NOA$$

Shareholder value (*SHV*) is the difference between firm value and non-equity claims (*NEC*). Non-equity claims usually include debt and preferred stock, although the latter is often treated as equity (e.g., Brealey and Myers 2000; Damodaran 2002).

(2) $$SHV = FV - NEC$$

Inserting (1) in (2) leads to:

(3) $$SHV = FV - NEC = CE2 + NOA - NEC = CE1 - indE + NOA - NEC$$

Dividing shareholder value by the number of outstanding shares leads to the value per share.

Figure 1 visualizes the structure of our model. In contrast to the shareholder value network proposed by Rappaport (1986) that summarizes all cash flows according to the period in which they occur, we summarize all firm's operating cash flows according to customer cohorts. Customer Equity 1 captures the present value of cash flows of those cohorts while subtracting the present value of the indirect customer related expenditures leads to Customer Equity 2. Figure 1 also shows that the use of Customer Equity 1 to estimate shareholder value is only appropriate if the value of non-operating assets is equal to the sum of the present value of indirect customer related expenditures and non-equity claims.

----- Insert Figure 1-----

2.2 Description of the Model

After visualizing the structure of our model, we subsequently describe the model in more detail. Customer Equity 1 (*CE1*) is the present value of the sum of customer lifetime values (CLV_i) of all current and future customers:

(4) $$CE1 = \sum_{i=1}^{I} CLV_i$$

This measure is equivalent to the customer equity measure frequently used in marketing (Berger and Nasr 1998; Berger et al. 2002; Blattberg, Getz, and Thomas 2001; Mulhern 1999; Reinartz and Kumar 2000; Rust, Zeithaml, and Lemon 2000). Unlike Gupta, Lehmann, and Stuart (2004), we use a discrete model instead of a continuous one to model Customer Equity 1 for the following reasons: *i*) discrete models are traditionally used in finance; *ii*) discrete models are easier to understand for managers; and *iii*) discrete models can easily be realized with standard user software packages (e.g., Microsoft Excel). However, these advantages come at the cost of having to decide about the exact time the cash flows occur since the present value of cash flows is influenced by this decision. We assume that all cash flows occur at

the beginning of each period. This assumption, however, could easily be modified in our model, basically by using a different discounting structure to calculate the present value. Because of the discrete model, we use terminal values as one way to ensure an infinite time horizon for the firm. As extensions of the ideas of Gupta, Lehmann, and Stuart (2004), we distinguish between acquisition and retention expenditures for the calculation of customer lifetime values, and also differentiate between the value of current customers and customers acquired in the current period. In addition, we propose a simple heuristic to split marketing expenditures into expenditures for customer acquisition and customer retention if lack of data requires doing so.

Starting with the cohort of customers that are acquired in the current period, we form cohorts of future customers according to the time period in which they will be acquired and consider all current customers as one additional cohort. Consequently, Customer Equity 1 is the present value of the sum of the lifetime values of the firm's current ($CE1_{current}$) and future customers ($CE1_{future}$). Thereby, the discount rate (k) is used to calculate the present value of Customer Equity 1 of future customer cohorts:

$$CE1 = CE1_{current} + CE1_{future} = CE1_{current} + \sum_{g=0}^{\infty} \frac{CE1_g}{(1+k)^g} \tag{5}$$

To facilitate model calibration, we estimate customer cash flows in detail for the cohorts up to a specified detailed planning period (G), and introduce the terminal value (TV) as a measure of value for all remaining future cohorts at the end of this period. Doing so and substituting Customer Equity 1 by the corresponding customer lifetime values yields:

$$CE1 = \sum_{i=1}^{N_{current}} CLV_{i,current} + \sum_{g=0}^{G} \frac{\sum_{i=1}^{N_g} CLV_{i,g}}{(1+k)^g} + \frac{TV_{G,CE1}}{(1+k)^G} \tag{6}$$

The customer lifetime value of a customer acquired in period g ($CLV_{i,g}$) is calculated by the present value of its cash flow ($CCF_{i,t}$) minus both its acquisition expenditures in period g ($ca_{i,g}$) and the present value of the retention expenditures ($cr_{i,g}$):

$$CLV_{i,g} = -ca_{i,g} + \sum_{t=g}^{T_{i,g}+g} \frac{CCF_{i,t}}{(1+k)^{t-g}} - \sum_{t=g+1}^{T_{i,g}+g} \frac{cr_{i,t}}{(1+k)^{t-g}} \tag{7}$$

The calculation of the customer lifetime value of a current customer differs from (7) because acquisition expenditures instead of retention expenditures occur in the current period:

$$CLV_{i,current} = \sum_{t=0}^{T_{i,current}} \frac{CCF_{i,t} - cr_{i,t}}{(1+k)^{t}} \tag{8}$$

Inserting (7) and (8) into (6) and the resulting equation into (1) leads to the following firm value in which indirect customer related expenditures (*indE*) are split up into an ongoing and terminal value as well:

$$FV = \sum_{i=1}^{N_{current}} \sum_{t=0}^{T_{i,current}} \frac{CCF_{i,t} - cr_{i,t}}{(1+k)^{t}} + \sum_{g=0}^{G} \frac{\sum_{i=1}^{N_g} \left[-ca_{i,g} + \sum_{t=g}^{T_{i,g}+g} \frac{CCF_{i,t}}{(1+k)^{t-g}} - \sum_{t=g+1}^{T_{i,g}+g} \frac{cr_{i,t}}{(1+k)^{t-g}} \right]}{(1+k)^{g}} + \frac{TV_{G,CE1}}{(1+k)^{G}} - \sum_{t=0}^{G} \frac{indE_t}{(1+k)^{t}} - \frac{TV_{G,indE}}{(1+k)^{G}} + NOA \tag{9}$$

Calibration of model (9) is very data intensive. Therefore, we propose a less data intensive model by assuming a common structure for all cohorts that can be described by an average customer. The basic idea is that the current customer mix remains constant in future periods (or the evolution in customer mix can be described appropriately) and the value of a cohort is obtained by multiplying the average customer lifetime value by the number of customers in that cohort. Therefore, we make the following assumptions: We assume (*i*) the same period-specific retention rates in all cohorts ($r_{i,t} = r_t$), (*ii*) the same average customer acquisition expenditures ($ca_{i,g} = ca_g$) and customer retention expenditures ($cr_{i,t} = cr_t$) in all cohorts,

and (*iii*) an average customer cash flow and an average growth rate that describe a pattern of customer cash flow across all cohorts ($CCF_{i,t} = CCF_0 \cdot \prod_{t'=0}^{t}(1+w_{t'}) \quad \wedge \quad w_0 = 0$).

Using these assumptions, (8) can be rewritten to describe the average lifetime value of a customer in the cohort of current customers:

$$CLV_{current} = \sum_{t=0}^{\infty} \frac{\left(CCF_0 \cdot \prod_{t'=0}^{t}(1+w_{t'}) - cr_t\right) \cdot \prod_{t'=0}^{t} r_{t'}}{(1+k)^t} \tag{10}$$

Hence, model (9) can be reformulated as:

$$\begin{aligned} FV = N_{current} \cdot \sum_{t=0}^{\infty} \frac{\left(CCF_0 \cdot \prod_{t'=0}^{t}(1+w_{t'}) - cr_t\right) \cdot \prod_{t'=0}^{t} r_{t'}}{(1+k)^t} \\ + \sum_{g=0}^{G} \frac{N_g \cdot \left[-ca_g + \sum_{t=g}^{\infty} \frac{\left(CCF_0 \cdot \prod_{t'=0}^{t-g}(1+w_{t'}) - cr_{t-g}\right) \cdot \prod_{t'=0}^{t-g} r_{t'}}{(1+k)^{t-g}} \right]}{(1+k)^g} \\ + \frac{TV_{G,CE1}}{(1+k)^G} - \sum_{t=0}^{G} \frac{indE_t}{(1+k)^t} - \frac{TV_{G,indE}}{(1+k)^G} + NOA \end{aligned} \tag{11}$$

Model (11) and Figure 1 reveal that our model needs information about five customer metrics. Three of these are on the revenue side: *i*) number of customers, *ii*) customer retention rate, *iii*) customer cash flow; and two are on the expenditure side: *iv*) customer retention expenditures and *v*) acquisition expenditures: Along with information about the indirect customer related expenditures and the discount rate, our model allows to determine the value of the firm's operating assets.

3 Empirical Assessment of the Model

3.1 Objectives

We estimate the shareholder value of two publicly traded German Internet service providers for January 1, 2003. T-Online International AG – T-Online – is the largest Internet service provider in Germany, and one of the leading providers in Europe. freenet.de AG – Freenet – is much smaller, but is one of the top five Internet service providers in Germany.

The business model of both firms is comparable to that of firms such as AOL. The objectives of the studies are to *i*) show that such an application is feasible by using publicly available data and expert judgments, *ii*) test if Customer Equity is a good approximation of shareholder value as proposed by Gupta, Lehmann, and Stuart (2004), *iii*) provide insights into the validity of our results, *iv*) compare the structure of shareholder value of two firms in the same industry, *v*) show how to transform the results of our model into those results usually displayed in traditional discount cash flow models, and *vi*) analyze the impact of changes in customer metrics on shareholder value empirically.

3.2 Estimation of Customer Metrics

Our studies are based on annual financial reports, other firm and analysts' reports as well as reports of online user surveys and data from financial information systems from 1997 to 2002. All information is publicly available.

Number of customers. The German Federal Statistical Office provides information concerning Germany's population size over age 14 and the annual growth rate of that population (about 1% until 2012, 0.5% from 2013 to 2016 and about 0.25% from 2017 to 2021). In addition, we use information on an estimated Internet usage rate of 93.4% of the population in 2008 and approximately 94% thereafter to calculate a decreasing growth rate of the number of Internet users in Germany. Based on past market share and expert judgements, we assume a long-term market share for T-Online of 30% and for Freenet of 15% respectively. This information enables us to forecast the overall number of Internet users in each period and the number of customers of each firm.

Retention rate. Firm reports reveal a retention rate of 89% for T-Online and of 80% for Freenet. Alternatively, retention rates might be estimated by using customer movement tables that provide information on the number of customers in subsequent periods and the number of new customers in these periods.

Discount rate. Various financial methods as well as expert judgements allow estimating discount rates. We use the weighted average cost of capital („wacc") as the most common approach in theory and practice to determine the discount rate (k). This composite cost of financing reflects the after-tax costs of debt (k_{debt}^{s}) and cost of equity (k_{equity}), and their relative weights in the financing structure (e.g., Brealey and Myers 2000; Damodaran 2002):

$$k = wacc = k_{equity} \cdot \frac{Equity}{(Debt + Equity)} + k_{debt}^{s} \cdot \frac{Debt}{(Debt + Equity)} \tag{12}$$

The capital asset pricing model (CAPM) allows estimating the cost of equity. CAPM requires three inputs: the risk-free rate, the risk premium on the market portfolio and the beta of the firms. We use the rate for a long-term government bond (4.32%) as the risk-free rate; betas from Bloomberg (T-Online: 1.056; Freenet: 1.211) and a risk premium of 5.50% for both firms. The cost of debt measures the firm's current cost of borrowing funds to finance projects. Since interest is tax deductible, the after-tax cost of debt (k_{debt}^{s}) is the pre-tax cost of debt (k_{debt}) multiplied by (1- tax rate). We use the average price of outstanding firms' long term bonds (6.32%) as a simplification for the value of the firms' bonds and a tax rate of 32.83% for T-Online and 33.38% for Freenet to calculate an after-tax cost of debt of 4.25%, respectively 4.21%.[1] Because T-Online has no interest bearing debt and Freenet only EUR 0.12 million, the relative weight of equity (equity ratio) is 100% for T-Online and 99% for Freenet. Based on this information, we calculate a (constant) discount rate of 8.62% for T-Online and 9.45% for Freenet.

Acquisition and retention expenditures. Unfortunately, most firms only report overall marketing expenditures ($MExp$), which are acquisition expenditures per customer ($ca_{i,g}$) times number of acquired customers (N_g) plus retention expenditures per customers ($cr_{i,g}$) times number of current customers ($N_{current,g}$).

$$(13) \qquad MExp_g = N_{current,g} \cdot cr_g + N_g \cdot ca_g \quad \wedge \quad ca_g = x \cdot cr_g$$

Subjective judgements concerning the relation *x* between acquisition expenditures and retention expenditures per customer allows rearranging (13) as follows:

$$(14) \qquad cr_g = \frac{MExp_g}{N_{current,g} + x \cdot N_g} \quad \wedge \quad ca_g = x \cdot \frac{MExp_g}{N_{current,g} + x \cdot N_g}$$

Based on a common statement that customer acquisition is five times more expensive than customer retention (e.g., Greenberg 2001), we assume $x = 5$. Hence, we get 2003's acquisition expenditures per customer of EUR 66.03 for T-Online and of EUR 8.30 for Freenet. Respectively, T-Online's retention expenditures per customer is EUR 13.21 and for Freenet is EUR 1.66. As a simplification, we keep these numbers constant over time.

Customer cash flows. We use firm's EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) reported in the annual financial statement to calculate customer cash flows. To avoid double counting (acquisition and retention expenditures are considered separately), we add marketing expenditures to EBITDA and divide the resulting cash flow by the number of customers in that year to calculate the average customer cash flow. We use past development of customer cash flow and publicly available predictions of analysts to forecast customer cash flows for future periods. For T-Online, customer cash flows for the first five years start with EUR 26.74 in 2003 and end with EUR 51.91 in 2007. In case of Freenet, we obtain lower customer cash flows of EUR 4.51 in 2003 which increase to EUR 11.18 in 2007. For the following years, we assume a (declining) growth of customer cash flows for both firms because of the firms' ability to migrate customers from the less profitable narrowband flat rate to other more profitable broadband rates (2002 financial report T-Online AG) and the higher usage of paid services.

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[1] Due to the German tax system, the tax rate used to calculate WACC differs from the tax rate we use to calculate the tax payments and across firms.

Terminal value of Customer Equity 1. We use terminal values to capture the value of all customers that are acquired after our 18 years long detailed planning period (i.e., all customer acquired after the year 2021). For these years, we assume that their Customer Equity 1 remains constant. Hence, the terminal value can be estimated as follows:

(15) $$TV_{G,CE1} = \frac{CE1_{G+1}}{k}$$

A slight modification of (15) would also allow capturing a constant growth of Customer Equity 1. For T-Online, we calculate a value for Customer Equity 1 for the cohort of year 2021 (last year of the detailed planning period) of EUR 604.07 million and for Freenet of EUR 52.21 million. Thus, the present value of the terminal value of T-Online results in EUR 1´582.00 million and of Freenet in EUR 108.82 million.

Indirect customer related expenditures. In our case, indirect customer related expenditures include investments and taxes because other indirect expenditures (e.g., salaries for administrative personnel) are already included in the customer cash flows, which were calculated on the base of EBITDA. To compute the tax payments, we use a tax rate of 39.28% for T-Online and 40.38% for Freenet and multiply the estimated earnings before interest and tax (EBIT, i.e., estimated EBITDA minus estimated depreciation and amortization) by this tax rate. We estimate the investments within the detailed planning periods as a percentage of revenues. Historical data shows that this percentage is only slightly higher for Freenet than for T-Online (T-Online: 2001 9%, 2002 9%; Freenet: 2001 25%, 2002 10%). Therefore, we assume investments to be 9% for both firms.

Cash and non-operating assets. We assume all cash as non-operating and add it to the non-operating asset. Furthermore, we regard minority holdings in other firms as non-operating assets, since the income from these holdings is not consolidated with those of the firm and are shown as financial investments in the balance sheet. The current value of Freenet´s non-operating assets, which include minority holdings, cash and marketable securi-

ties, is EUR 64.92 million. Compared with Freenet, T-Online has a much higher current value of non-operating assets. The value of T-Online's non-operating assets is EUR 3´731.83 million, mainly due to a cash reserve managed by Deutsche Telekom AG.

Value of non-equity claims. Both firms have no preferred stock and T-Online also has no interest bearing debt. Only Freenet has outstanding debt of EUR 0.12 million.

Table 1 lists all parameter values used in our studies:

----- Insert Table 1 -----

3.3 Results

Table 2 shows the results of our model. The average customer lifetime value for a current customer of T-Online is EUR 323.69. Multiplying that value with the number of current customers results in a Customer Equity 1 of EUR 2´866.43 million. The average customer lifetime value of a future customer of T-Online is EUR 257.66. Multiplication with the forecasted number of customers acquired in each period within the detailed planning period leads to a Customer Equity 1 of EUR 6´982.05 million. Adding the terminal value of Customer Equity 1 yields a Customer Equity 1 of all T-Online's future customers of EUR 8´564.05 million. Therefore, the overall value of T-Online's Customer Equity 1 is EUR 11´430.48 million. For Freenet, we get an average customer lifetime value of a current customer of EUR 33.05 and for a future customer of EUR 24.74. This amounts to a Customer Equity 1 for all current customers of EUR 97.29 million and for all future customers (including terminal value) of EUR 609.61 million. Therefore, the overall value of Freenet's Customer Equity 1 is EUR 706.90 million.

Subtracting the present value of indirect customer related expenditures leads to a Customer Equity 2 for T-Online of EUR 2´719.26 million and for Freenet of EUR 151.11 million.

Adding the liquidation value of non-operating assets leads to a firm value in case of T-Online of EUR 6´451.09 million and in case of Freenet of EUR 216.03 million. Substraction of non-equity claims leads to a shareholder value of EUR 6´451.09 million for T-Online and EUR 215.91 million for Freenet. Freenet's shareholder value is within the high-low range of market capitalization for 2001, 2002, and 2003, whereas T-Online´s shareholder value is within that range in 2001 and 2002 but slightly below the range for 2003.

----- Insert Table 2 -----

Gupta, Lehmann, and Stuart (2004) propose to use the value of the customer base as a proxi for shareholder value. To calculate the customer base value, they use expenditures that can be directly linked to customers from customer as it is usually done in literature (e.g., Berger and Nasr 1998; Berger et al. 2002; Blattberg, Getz, and Thomas 2001; Mulhern 1999; Reinartz and Kumar 2000; Rust, Zeithaml, and Lemon 2000). That suggests that Customer Equity 1 would be the appropriate measure for the customer base value. However, heuristics might also be used to assign indirect customer related expenditures to individual customers. In that case, the value of Customer Equity 1 would be equal to the one of Customer Equity 2. Therefore, we subsequently compare both Customer Equity measures, Customer Equity 1 and Customer Equity 2, with shareholder value to test the proposal of Gupta, Lehmann, and Stuart (2004) to use the value of the customer base (i.e., Customer Equity) as a proxi for shareholder value.

Table 2 shows that Customer Equity 1 deviates substantially from shareholder value. The difference in case of T-Online is EUR 4´979.40 million so that shareholder value would be overestimated by 77% if it has been approximated by Customer Equity 1. In case of Freenet that difference is EUR 490.99 million, which is equivalent to an overestimation of

shareholder value by 227%. Customer Equity 2 also deviates notably from shareholder value. The difference in case of T-Online is EUR 3´731.83 million and EUR 64.80 million in case of Freenet. For both firms, Customer Equity 2 is smaller than shareholder value so that shareholder value would be underestimated by 58% (T-Online), respectively 30% (Freenet). Hence, both measures of Customer Equity deviate strongly from shareholder value and cannot serve as a proxi.

----- Insert Table 3 -----

Table 3 presents the results of additional studies in different industries (three software firms and banks: details are not described here). Using Customer Equity 1 to approximate shareholder value would lead to an average overestimation of 103% for software firms and 98% for banks. Customer Equity 2 approximates better but still underestimates shareholder value on average by 15% for software firms and overestimates shareholder value by 8% for banks. Thus, our empirical results do not support the proposal of Gupta, Lehmann, and Stuart (2004) to approximate shareholder value by Customer Equity.

3.4 Comparison of the Structure of Shareholder Value

Figure 2 describes the structure of shareholder value. For both Internet Service Providers, the composition of Customer Equity 1 is fairly similar. The value of the current customer base is small (25% of total Customer Equity 1 at T-Online and 14% at Freenet) compared to the value of the customers acquired in the detailed planning period (61% of total Customer Equity 1 for T-Online and 71% for Freenet) and thereafter (terminal value: 14% of total Customer Equity 1 for T-Online and 15% for Freenet).

----- Insert Figure 2 -----

Compared to the results of the two other industries (see Table 3), the importance of future customers is much higher. The reason is that for both Internet Service Providers the numbers of future customer are relatively high and retention rates are relatively small. The present value of indirect customer related expenditures compared to Customer Equity 1 is large (76% of total Customer Equity 1 for T-Online and 79% for Freenet). Although those values are smaller for firms in the two other industries, it supports our previous finding that Customer Equity 1 is not a good proxy for shareholder value. Non-operating assets play a minor role in the other firms analyzed, but are of major importance for the two Internet service providers (T-Online: 32% of Customer Equity 1, Freenet: 9%). The reason is that both Internet service providers went public in 1999-2000 and received a significant amount of cash.

3.5 Traditional Discounted Cash Flow Model

Our results can easily be transformed to those of a traditional discounted cash flow model. The major difference is that we divide the overall cash flows into cash flows of cohorts, i.e., cash flows of groups of customers that are all acquired in the same period, whereas traditional cash flow models divide overall cash flows into cash flows of different periods. Therefore, we sum the cash flows in all cohorts that occur in the same period. That means that we sum the 0^{th} period cash flows of current customers and customers acquired in period 0 (g=0) and subtract the 0^{th} period indirect customer related expenditures to derive at the cash flow of period 0. Furthermore, we add together the 1^{st} period cash flows of current customers and those customers acquired in g=0 as well as the 0^{th} period cash flows of customers acquired in g=1 and subtract the 1^{st} period customer indirect expenditures to derive the cash flow of period 1, and so on. In doing so, negative aggregated customer cash flows result in the

first periods which become positive in the remaining periods. Since traditional DCF models are considered to have difficulties for firms with negative cash flows because historical cash flows only provide limited information about future cash flows (e.g., Damodaran 2001), our model helps overcoming these difficulties because it better captures the cash flows across a customer's lifetime. For T-Online, Figure 3 displays the results of the transformation of our results into those results that are usually displayed in a traditional discounted cash flow model:

----- Insert Figure 3-----

3.6 Empirical Analysis of the Impact of Customer Metrics on Shareholder Value

We analyze the impact of the five customer metrics on shareholder value empirically by varying each customer metric by $\pm 1\%$ and keeping all other parameters and variables of our model constant. Thus, we measure only the return of a change in customer metrics without taking the required marketing investment into account. In finance, discount rates are considered to have a major impact on shareholder value (e.g., Jensen and Johnson 1995). Therefore, we use the impact of the discount rate as a benchmark. In line with Gupta, Lehmann, and Stuart (2004), Table 4 shows that of the metrics noted above changes in customer retention rates always have the greatest impact on shareholder value. This impact is more than four times larger than the one of the discount rate. In addition, the effect of an increasing retention rate is greater than the comparable effect of a decreasing retention rate. Customer cash flow has a slightly greater impact than the discount rate in case of Freenet (4.57% versus 4.19%) and a slightly smaller impact in case of T-Online (2.01% versus 2.19%). Compared to these impacts, the ones of the remaining metrics are rather small. Furthermore, shareholder value of Freenet reacts more sensitively to changes in customer metrics than the shareholder value of

T-Online. This is due to the fact that non-operating assets of T-Online form a larger part of its shareholder value and that those assets are not influenced by changes in customer metrics.

----- Insert Table 4-----

3.7 Summary

Our empirical results in the previous sections indicate that an application of our model is feasible by using publicly available data and expert judgements. Our results for Freenet are within the high-low range of market capitalization for 2001, 2002 and 2003, whereas our results for T-Online are within that range in 2001 and 2002 but slightly below in 2003. Across all industries, using Customer Equity 1 to approximate shareholder value results in an average overestimation of 114% and using Customer Equity 2 to approximate shareholder value results in an average underestimation of 13%. Thus, we are not able to support the proposal of Gupta, Lehmann, and Stuart (2004) to approximate shareholder value by Customer Equity 1 unless the value of non-operating assets is equal to the sum of the present value of indirect customer related expenditures and non-equity claims. Using Customer Equity 2, as an alternative measure of Customer Equity, leads to a smaller deviation, but still does not approximate shareholder value well.

Comparing the structure of shareholder value among firms and industries helps visualizing the importance of the current customer base relative to future customers. Furthermore, it illustrates the value of indirect customer related expenditures. We show that the structure of shareholder value differs over industries, but the importance of future customers is rather large for the two Internet service providers. Additionally, our results could easily be transformed into those results usually used in traditional discounted cash flows models.

Our empirical analysis of the impact of customer metrics on shareholder value shows that, of the metrics noted above, changes in customer retention rates always have the greatest impact on shareholder value. Moreover, the effect of an increasing retention rate is greater than the comparable effect of a decreasing retention rate and the effect of changes in customer metrics seems to be systematically different between firms.

Yet, the latter findings might be driven by the particular characteristics of the firms being investigated in the empirical studies. Therefore, we want to examine whether these findings could be further generalized. In doing so, we develop a slightly simpler model than the one we used in the empirical studies and derive analytical solutions for the impact of all customer metrics on shareholder value. We examine how customer metrics impact Customer Equity 1 and how Customer Equity 1 impacts shareholder value. We also combine these two effects and show how customer metrics impact shareholder value. Finally, we use a simulation study to analyze the stability of our results, examine when Customer Equity 1 deviates more substantially from shareholder value then Customer Equity 2, and identify the average overestimation when using Customer Equity 1 respectively Customer Equity 2 to approximate shareholder value.

4 Theoretical Analysis of the Impact of Customer Metrics on Shareholder Value

4.1 Description of the Model

To be able to derive closed-form solutions, we slightly modify equation (10) to calculate customer lifetime value by assuming a constant growth and retention rate over time and capturing the retention expenditures via the customer cash flows. That allows calculating customer lifetime value as follows (see also Gupta and Lehmann 2003):

$$(16) \qquad CLV = \sum_{t=0}^{\infty} \frac{CCF_0 \cdot (1+w)^t \cdot r^t}{(1+k)^t} = \frac{CCF_0 \cdot (1+w)^0 \cdot r^0}{(1+k)^0} + \frac{CCF_0 \cdot (1+w)^1 \cdot r^1}{(1+k)^1} + \ldots$$

(16) is an infinite geometric series for $\left|\frac{r\cdot(1+w)}{1+k}\right|<1$, which can be written as:

$$CLV = CCF_0 \cdot \frac{1+k}{1+k-r\cdot(1+w)} \quad \wedge \quad [1+k-r\cdot(1+w)]>0 \tag{17}$$

We further assume that the firm is able to acquire the same number of customers in all future periods ($N_g = N_{future}$). Therefore, Customer Equity 1 can be calculated as follows:

$$CE1 = N_{current}\cdot\left(CCF_0\cdot\frac{1+k}{1+k-r\cdot(1+w)}\right)+\sum_{g=0}^{\infty}\frac{N_{future}\cdot\left(CCF_0\cdot\frac{1+k}{1+k-r\cdot(1+w)}-ca\right)}{(1+k)^g} \tag{18}$$

The second term on the right of (18) is also an infinite geometric series for $\left|\frac{1}{1+k}\right|<1$.

Consequently, (18) can be written as:

$$CE1 = N_{current}\cdot\left(CCF_0\cdot\frac{1+k}{1+k-r\cdot(1+w)}\right)+\frac{N_{future}\cdot\left(CCF_0\cdot\frac{1+k}{1+k-r\cdot(1+w)}-ca\right)\cdot(1+k)}{k} \tag{19}$$

Adding the value of non-operating assets and subtracting the present value of indirect customer related expenditures as well as non-equity claims allows calculating shareholder value:

$$\begin{aligned} SHV = {} & N_{current}\cdot\left(CCF_0\cdot\frac{1+k}{1+k-r\cdot(1+w)}\right) \\ & +\frac{N_{future}\cdot\left(CCF_0\cdot\frac{1+k}{1+k-r\cdot(1+w)}-ca\right)\cdot(1+k)}{k} \\ & + NOA - indE - NEC \end{aligned} \tag{20}$$

4.2 Impact of Customer Metrics on Customer Equity 1

The impact of customer metrics on Customer Equity 1 can easily be analyzed by using Equation (19) to calculate the corresponding partial derivatives (Table 5) and elasticities (Table 6) with respect to the customer metrics. The results, which are also illustrated for three numerical values, indicate that, of the metrics noted above, retention rate *r* has by far the

greatest impact on Customer Equity 1 and that the impacts of discount rates *k* and customer cash flow *CCF* on Customer Equity 1 are about the same, but smaller than the one of the retention rate. The partial derivatives shown in Table 5 indicate the reason. The term $(1+k-r-r\cdot w)$ is very close to zero if retention rates *r* are high and discount rates *k* are either small or close to the product of growth rate *w* and retention rate *r*. The squared term forms the denominator of the partial derivative with respect to the discount rate *k*, the retention rates *r* and the customer cash flow *CCF* which explains why those variables have a great impact on Customer Equity 1. This impact even rises with higher values for the retention rate *r*.

----- Insert Table 5-----

----- Insert Table 6-----

4.3 Impact of Customer Equity 1 on Shareholder Value

The ratio α, which we label as *„CE1/SHV – ratio"*, expresses the importance of Customer Equity 1 for the firm's shareholder value.

(21)

$$\alpha = \frac{CE1}{SHV} = \frac{CE1}{CE1 - indE + NOA - NEC} \quad \wedge \quad SHV \neq 0, CE1 - indE + NOA - NEC \neq o$$

This *„CE1/SHV – ratio"* increases with a decrease of non-operating assets and an increase of indirect customer related expenditures and non-equity claims. Calculating the elasticity of shareholder value with respect to Customer Equity 1 leads to:

$$(22)\ \varepsilon_{SHV,CE1} = \left(1 - \frac{\partial indE}{\partial CE1}\right) \cdot \alpha = \left(1 - \frac{\partial indE}{\partial CE1}\right) \cdot \left(\frac{CE1}{CE1 + NOA - indE - NEC}\right) \quad \wedge \quad \frac{\partial indE}{\partial CE1} \neq 1$$

Thus, increases in Customer Equity 1 have a positive effect on shareholder value if indirect customer related expenditures do not increase more than Customer Equity 1. This effect also increases with higher values of the *„CE1/SHV – ratio"*. Consequently, the effect of changes in Customer Equity 1 is higher if non-operating assets are small and indirect customer related expenditures and non-equity claims are high. The latter effect is also known in finance as "leverage effect" (Brealey and Myers 2000).

4.4 Impact of Customer Metrics on Shareholder Value

The elasticity of shareholder value with respect to customer metrics captures both effects, the impact of customer metrics on Customer Equity 1 and the impact of Customer Equity 1 on shareholder value:

$$(23)\qquad \varepsilon_{SHV,CM} = \frac{\partial SHV}{\partial CM} \cdot \frac{CM}{SHV}$$

Deriving the partial derivative of shareholder value with respect to customer metrics and rearranging terms leads to:

$$(24)\qquad \begin{aligned} \varepsilon_{SHV,CM} &= \varepsilon_{SHV,CE1} \cdot \varepsilon_{CE1,CM} \\ &= \left(1 - \frac{\partial indE}{\partial CE1}\right) \cdot \left(\frac{CE1}{CE1 + NOA - indE - NEC}\right) \cdot \varepsilon_{CE1,CM} \end{aligned}$$

Thus, the impact of a customer metric on shareholder value increases with an increase of its elasticity with regard to Customer Equity 1 and higher indirect customer related expenditures as well as non-equity claims. The impact decreases with higher non-operating assets and the impact of Customer Equity 1 on indirect customer related expenditures. Table 7 lists the elasticities of shareholder value with regard to the different customer metrics under the assumption that an increase in Customer Equity 1 has no impact on the indirect customer related expenditures, i.e. $\frac{\partial indE}{\partial CE1} = 0$. Such values occur for firms with very scalable business

models. If that assumption is not valid, all values in Table 7 have to be multiplied by the factor $\left(1-\frac{\partial indE}{\partial CE1}\right)$.

----- Insert Table 7----

In Section 3.6 we found that Freenet's shareholder value reacts more sensitively to changes in customer metrics than T-Online. The value of the „*CE1/SHV-ratio*" (1.77 for T-Online and 3.27 for Freenet) explains why this is the case. The huge amount of non-operating assets for T-Online is not influenced by changes in customer metrics and, thus, dilutes the overall relative effect. Hence, the „*CE1/SHV-ratio*" (α) allows to identify: *i)* if changes in customer metrics have a greater (α>1), equal (α=1), or smaller (α<1) effect on shareholder then on Customer Equity 1, *ii)* firms in which changes in customer metrics have a strong impact on shareholder value, *iii)* the amount of over- or underestimation of shareholder value if shareholder value is approximated by Customer Equity 1.

4.5 Simulation Study

We run a Monte Carlo simulation study to analyze the stability of our results in Table 7 and determine as well as compare the deviation of Customer Equity 1 and Customer Equity 2 from shareholder value. Therefore, we draw for each variable 50.000 times a random number from the uniform distribution in the intervals shown in Table 8 and use a linear regression model to analyze the impact of all variables on shareholder value. Table 8 shows that all parameters are highly significant and the coefficients for non-operating assets and non-equity claims have the expected absolute value of 1. Retention rate has the highest beta value (i.e., standardized coefficient), followed by customer cash flow and discount rate. The values of the elasticities also indicate that retention rate has the greatest impact on shareholder value, followed by customer cash flows and discount rate. On average, the elasticity of the retention

rate is about four times higher. Compared to those values, all other variables have a minor impact.

----- Insert Table 8 -----

The use of Customer Equity 1 to approximate shareholder value leads to an average overestimation of 44.25% (with a standard deviation of 63.13%). 95% of those cases are within an interval of [2%; 109%]. Customer Equity 2 underestimates shareholder value on average by 14.94% (with a standard deviation of 12.64%). 95% of those cases are within an interval of [-36%; 0%]. In 97.10% of all cases, the deviation of Customer Equity 1 from shareholder value is larger than the one of Customer Equity 2. Thus, those results underline that both measures of Customer Equity might deviate strongly from shareholder value.

5 Conclusion

We develop a model for firms with contractual customer relationships to link customer metrics to shareholder value. This model allows us to predict a firm's shareholder value and to evaluate the effect of changes in customer metrics on shareholder value. The use of Customer Equity 1 to approximate shareholder value lead to an overestimation of 77% (study 1) and 227% (study 2). These deviations are smaller in our simulation study, but still high (44.25%). Customer Equity 2 approximates shareholder value better, but still deviates by 13% in our empirical studies and by 14.94% in our simulation study. Those deviations might be avoided by taking indirect customer related expenditures as well as non-operating assets and non-equity claims into account.

The model indicates that five customer metrics, three on the revenue side: number of customers, customer cash flow and retention rates, and two on the expenditure side: acquisition as well as retention expenditures, are key performance indicators to evaluate the market

success of a firm with contractual customer relationships. We show that publicly available data allows for the application of our model and that our model is able to deal with situations where firms make losses (i.e., have negative cash flows). The reason is that our model captures the development of cash flows over the lifetime of a customer.

Our empirical study, our analytical model, and the simulation study show that of the metrics noted above customer retention has by far the greatest impact on shareholder value. This impact is even stronger in industries that have high customer retention rates such as the financial services industry. Our so called *„CE1/SHV-ratio"* enables the identification of what impact changes in customer metrics have on shareholder value compared to the effect on Customer Equity 1. Furthermore, it allows to determine for which firms changes in customer metrics have a stronger impact on shareholder value compared to other firms and to detect the amount of over- or underestimation of shareholder value if shareholder value is approximated by Customer Equity 1.

We confirm several limitations of our study: First, we have no strong test for the validity of our results, especially the prediction of shareholder value, thus stock prices. Even if our prediction is within the range of highest and lowest stock prices in one year, this criteria is not very strong because stock prices fluctuated substantially. However, this also indicates that markets considerably adjust their expectation about shareholder value within a year. Second, a lack of data availability might limit the feasibility of our model. Especially retention rates are seldom reported by firms, but should be available within a firm. An application within a firm might also facilitate the estimation of acquisition and retention expenditures more accurately. In addition, our model is intended for firms that have contractual customer relationships which can be categorized as „lost-for-good" relationships. This kind of relationship allows an easier determination of the number of customers and the retention rate (or customer

lifetime). Further research might want to examine how our model has to be adjusted to link customer metrics to shareholder value for firms with non-contractual relationships.

In conclusion, our model should contribute to linking marketing metrics to financial metrics. It shows that such a link is rather easy to accomplish and that marketing models which allow predicting customer equity can also be linked to shareholder value. Our model should be readily applicable to other firms with contractual relationships so that it might form a sound foundation for valuing marketing investments in terms of shareholder value. Such ability should allow marketing playing an even more crucial role in board rooms.

Tables and Figures

Table 1:
Data and Parameter used in Studies

		T-Online	Freenet
Retention Rate (*r*)		89%	80%
Customer Cash Flow (CCF_0)		26.74 €	4.51 €
Acquisition Expenditures (*ca*)		66.03 €	8.30 €
Retention Expenditures (*cr*)		13.21 €	1.66 €
Discount Rate (*k*)		8.62%	9.47%
	Equity Ratio (equity/(equity+debt))	100%	99%
	Riskfree interest rate (r_f)	4.32%	4.23%
	Risk premium (r_f- r_m)	5.50%	5.50%
	Beta (β)	1.056	1.211
	After-tax debt rate ($(1-s)k_{debt}$)	4.25%	4.21%
Value of Indirect Customer Related Exp. (*indE*)		8´711.22	555.79
Value of Non-Operating Assets (*NOA*)		3´731.83	64.92
Non-Equity Claims (*NEC*)		0.00	0.12
***indE*, *NOA* and *NEC* in million €**			

Table 2:
Results of Studies

			T-Online (in €)	Freenet (in €)
Average CLV of Current Customers ($CLV_{current}$)			323.69	33.05
Average CLV of Future Customers (CLV_{future})			257.66	24.74
CE1 of Current Customers ($CE1_{current}$) - in million			2´866.43	97.29
CE1 of Future Customers ($CE1_{future}$) – in million			8´564.05	609.61
thereof TV - in million			1´582.00	108.82
Total CE1 (in million) [1)]			**11´430.48**	**706.90**
Value of Indirect Customer Related Exp. (*indE*) –in million			8´711.22	555.79
Total CE2 (in million)			**2´719.26**	**151.11**
Value of Non-Operating Assets (*NOA*) – in million			3´731.83	64.92
Firm Value - in million			**6´451.09**	**216.03**
Non-Equity Claims (*NEC*) - in million			0.00	0.12
Shareholder Value (*SHV*) (in million)			**6´451.09**	**215.91**
MarketCap (in million)	**2001**	**High**	**20´439.13**	**659.75**
		Low	**5´935.92**	**86.63**
	2002	**High**	**16´583.85**	**232.75**
		Low	**6´290.85**	**61.60**
	2003	**High**	**14´625.61**	**1´085.98**
		Low	**6´486.67**	**87.60**

[1)] used by Gupta, Lehmann, and Stuart 2004 to approximate shareholder value

Table 3:
Comparison of Shareholder Value Structure (all studies)

		$CE1^{current}$		$CE1^{02\text{-}20}$		$CE1^{TV}$		CE1		indE		CE2		NOA		FV		NEC		SHV		Deviation (CE1)		Deviation (CE2)		Alpha
Industry	**Firm**	**Value**	**% of CE1**	**Value**	**% of CE1**	**Value**	**% of CE1**	**Value**	**% of CE1**	**Value**	**% of CE1**	**Value**	**% of CE1**	**Value**	**% of CE1**	**Value**	**% of CE1**	**Value**	**% of CE1**	**Value**	**% of CE1**	**Value**	**Over-estimation**	**Value**	**Under-estimation**	
Software	**SAP AG**	15808,7	27%	23630,7	41%	18259,3	32%	57698,7	100%	25828,6	45%	31870,1	55%	2126,6	4%	33996,7	59%	686,2	1%	33310,5	58%	24388,2	73%	1440,4	4%	1,7
	JD Edwards Inc.	367,5	15%	614,8	26%	1398,0	59%	2380,3	100%	807,9	34%	1572,4	66%	429,3	18%	2001,7	84%	16,3	1%	1985,4	83%	394,9	20%	413,0	21%	1,2
	Peoplesoft Inc.	7896,2	34%	8162,0	35%	7212,8	31%	23271,0	100%	17315,7	74%	5955,3	26%	1430,5	6%	7385,8	32%	37,7	0%	7348,1	32%	15922,9	217%	1392,8	19%	3,2
	Mean		26%		34%		40%		100%		51%		49%		9%		58%		1%		58%		103%		15%	
	Standard Deviation		8%		6%		13%		0%		17%		17%		6%		21%		0%		21%		83%		7%	
Bank	**Postbank AG**	8850,1	54%	4647,2	29%	2799,8	17%	16297,2	100%	8619,1	53%	7678,0	47%	1650,0	10%					6028,0	37%	10269,1	170%	-1650,0	-27%	2,7
	DAB Bank AG	421,1	40%	402,8	38%	241,8	23%	1065,7	100%	533,8	50%	531,9	50%	15,1	1%					547,0	51%	518,7	95%	15,1	3%	1,9
	Comdirect AG	1164,3	43%	1037,2	38%	530,9	19%	2732,4	100%	612,6	22%	2119,8	78%	1,8	0%					2121,6	78%	610,9	29%	1,8	0%	1,3
	Mean		45%		35%		20%		100%		42%		58%		4%						55%		98%		-8%	
	Standard Deviation		6%		4%		2%		0%		14%		14%		4%						17%		58%		14%	
ISP	**T-Online AG**	2866,4	25%	6982,1	61%	1582,0	14%	11430,5	100%	8711,2	76%	2719,26	24%	3731,8	32%	6451,1	56%	0,0	0%	6451,1	56%	4979,4	77%	3731,80	58%	1,8
	Freenet AG	97,3	14%	500,8	71%	108,8	15%	706,9	100%	555,8	79%	151,12	21%	64,9	9%	216,0	30%	0,1	0%	215,9	30%	490,99	227%	64,80	30%	3,3
	Mean		19%		66%		15%		100%		77%		23%		21%		43%		0%		43%		121%		34%	
	Standard Deviation		6%		5%		1%		0%		1%		1%		11%		13%		0%		13%		76%		18%	
Because of the characteristics of financial institutions, we used a Flow-to-Equity approach to value the three banks.																										

Table 4:
Empirical Impact of Customer Metrics on Shareholder Value

		T-Online (in %)	Freenet (in %)
Retention Rate (*r*)	**+1%**	18.24	22.61
	-1%	-15.90	-20.83
Customer Cash Flow (CCF_0)	**+1%**	2.01	4.57
	-1%	-2.01	-4.57
Discount Rate (*k*)	**+1%**	-2.19	-4.10
	-1%	2.24	4.19
Acquisition Expenditures (*ca*)	**+1%**	-0.38	-1.35
	-1%	0.38	1.35
No. of Customers (*N*)	**+1%**	1.30	2.86
	-1%	-1.30	-2.86

Table 5:
Impact of Customer Metrics on Customer Equity 1: Partial Derivatives

Customer Metric (CM)	**Partial Derivative**	**Value of Partial Derivative (80%; 100%; 120%)**
Customer Cash Flow (CCF_0)	$\frac{(1+k)\cdot\left[N_{future}+k\cdot\left(N_{current}+N_{future}\right)\right]}{k\cdot(1+k-r-r\cdot w)}$	48´996.14; 88´846.15; 253´750.00
Discount Rate (k)	$\frac{ca\cdot N_{future}\cdot\left(-(1+k-r-r\cdot w)\right)^2-CCF_0\cdot\left[k^2\cdot N_{current}\cdot r\cdot(1+w)+(1+k)\cdot N_{future}\cdot\left[1+k-r+k\cdot r+r\cdot w\cdot(-1+k)\right]\right]}{k^2\cdot\left(-(1+k-r-r\cdot w)\right)^2}$	-26´891´146.52; -63´402´366.86; -374´550´781.25
Retention Rate (r)	$\frac{CCF_0\cdot(1+k)\cdot\left[N_{future}+k\cdot\left(N_{current}+N_{future}\right)\right]\cdot(1+w)}{k\cdot\left(-(1+k-r-r\cdot w)\right)^2}$	9´837´062.66; 35´880´177.51; 315´205´078.13
Customer Cash Flow Growth Rate (w)	$\frac{CCF_0\cdot(1+k)\cdot\left[N_{future}+k\cdot\left(N_{current}+N_{future}\right)\right]\cdot r}{k\cdot\left(-(1+k-r-r\cdot w)\right)^2}$	6´053´577.02; 27´337´278.11; 285´468´750
Acquisition Expenditures (ca)	$-\frac{(1+k)\cdot N_{future}}{k}$	-10´800.00; -11´000.00; -11´200.00
No. of Current Customers ($N_{current}$)	$CCF_0\cdot\frac{1+k}{1+k-r\cdot(1+w)}=CLV_{current}$	208.49; 423,08; 1´312.50
No. of Future Customers (N_{future})	$\frac{(1+k)\cdot\left[CCF_0\cdot\frac{1+k}{1+k-r\cdot(1+w)}-ca\right]}{k}=\frac{(1+k)\cdot CLV_{future}}{k}$	2´274.67; 4´103.85; 11´690.00
Value of Variables to calculate Elasticities: $N_{current}$ =10.000; N_{future} =1.000; CCF_0=EUR 100; w=5%; ca=EUR 50 ; r=80%; k=10%; PV_indE=EUR 3.000.000 ; NOA=EUR 2.000.000 ; NEC=EUR 100.000 Elasticities are calculated by varying all variables to a 80%, 100% or 120% level		

Table 6:
Impact of Customer Metrics on Customer Equity 1: Elasticities

Customer Metric (CM)	Elasticity	Value of Elasticity (80%; 100%; 120%)
Customer Cash Flow (CCF_0)	$\frac{CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right]}{CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(-\left(1 + k - r - r \cdot w\right)\right)}$	1.12; 1.07; 1.02
Discount Rate (k)	$-\frac{1}{(1+k)} + \frac{k}{\left(-\left(1+k-r-r\cdot w\right)\right)} + \frac{k \cdot \left(-ca \cdot N_{future} + CCF_0 \cdot \left(N_{future} + N_{current}\right)\right)}{CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(-\left(1 + k - r - r \cdot w\right)\right)}$	-0.62; -0.76; -1.51
Retention Rate (r)	$\frac{CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] \cdot r \cdot (1+w)}{\left(1 + k - r - r \cdot w\right) \cdot \left[CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(-\left(1 + k - r - r \cdot w\right)\right)\right]}$	1.81; 3.44; 10.17
Customer Cash Flow Growth Rate (w)	$\frac{CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] \cdot r \cdot w}{\left(1 + k - r - r \cdot w\right) \cdot \left[CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(-\left(1 + k - r - r \cdot w\right)\right)\right]}$	0.07; 0.16; 0.58
Acquisition Expenditures (ca)	$\frac{N_{future} \cdot ca \cdot \left(1 + k - r - r \cdot w\right)}{-CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(1 + k - r - r \cdot w\right)}$	-0.12; -0.07; -0.02
No. of Current Customers ($N_{current}$)	$\frac{CCF_0 \cdot k \cdot N_{current}}{CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(-\left(1 + k - r - r \cdot w\right)\right)}$	0.48; 0.51; 0.53
No. of Future Customers (N_{future})	$1 - \frac{CCF_0 \cdot k \cdot N_{current}}{CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(-\left(1 + k - r - r \cdot w\right)\right)} = 1 - Elas_{CE1,N_{current}}$	0.52 ;0.49; 0.47
Value of Variables to calculate Elasticities: $N_{current}$ =10.000; N_{future} =1.000; CCF_0=EUR 100; w=5%; ca=EUR 50 ; r=80%; k=10%; PV_indE=EUR 3.000.000 ; NOA=EUR 2.000.000 ; NEC=EUR 100.000 Elasticities are calculated by varying all variables to a 80%, 100% or 120% level		

Table 7:
Impact of Customer Metrics on Shareholder Value: Elasticities

Customer Metric (CM)	Elasticity	Value of Elasticity (80%; 100%; 120%)
Customer Cash Flow (CCF_0)	$\frac{CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right]}{\left[CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(-\left(1 + k - r - r \cdot w\right)\right)\right]} \cdot \alpha$	0.82; 1.23; 1.07
Discount Rate (k)	$-\frac{1}{(1+k)} + \frac{k}{\left(-\left(1+k-r-r \cdot w\right)\right)} + \frac{k \cdot \left(-ca \cdot N_{future} + CCF_0 \cdot \left(N_{future} + N_{current}\right)\right)}{\left[CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(-\left(1 + k - r - r \cdot w\right)\right)\right]} \cdot \alpha$	-0.45; -0.88; -1.58
Retention Rate (r)	$\frac{CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] \cdot r \cdot (1+w)}{\left(1 + k - r - r \cdot w\right) \cdot \left[CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(-\left(1 + k - r - r \cdot w\right)\right)\right]} \cdot \alpha$	1.32; 3.97; 10.63
Customer Cash Flow Growth Rate (w)	$\frac{CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] \cdot r \cdot w}{\left(1 + k - r - r \cdot w\right) \cdot \left[CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(-\left(1 + k - r - r \cdot w\right)\right)\right]} \cdot \alpha$	0.05; 0.19; 0.60
Acquisition Expenditures (ca)	$\frac{N_{future} \cdot ca \cdot \left(1 + k - r - r \cdot w\right)}{-CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(1 + k - r - r \cdot w\right)} \cdot \alpha$	-0.09; -0.08; -0.02
No. of Current Customers ($N_{current}$)	$\frac{CCF_0 \cdot k \cdot N_{current}}{CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(-\left(1 + k - r - r \cdot w\right)\right)} \cdot \alpha$	0.34; 0.58; 0.55
No. of Future Customers (N_{future})	$\left(1 - \frac{CCF_0 \cdot k \cdot N_{current}}{CCF_0 \cdot \left[N_{future} + k \cdot \left(N_{current} + N_{future}\right)\right] + ca \cdot N_{future} \cdot \left(-\left(1 + k - r - r \cdot w\right)\right)}\right) \cdot \alpha$	0.38 ;0.57; 0.49
Value of Variables to calculate Elasticities: $N_{current}$ =10.000; N_{future} =1.000; CCF_0=EUR 100; w=5%; ca=EUR 50 ; r=80%; k=10%; PV_indE=EUR 3.000.000 ; NOA=EUR 2.000.000 ; NEC=EUR 100.000 Elasticities are calculated by varying all variables to a 80%, 100% or 120% level		

Table 8:
Variation of Variables and Results of Simulation Study

Variable		Low	High	Parameter	Beta	Elasticity
No. of Current Customers	$N_{current}$	8´000	12´000	508.452	0.105	0.637
No. of Future Customers	N_{future}	800	1200	5173.605	0.107	0.648
Customer Cash Flow	CCF_0	80	120	106670.83	0.221	1.337
Customer Cash Flow Growth Rate	w	0.04	0.06	55761315.1	0.058	0.349
Acquisition Expenditures	ca	40	60	-8379.817	-0.009	-0.053
Retention Rate	r	0.64	0.96	50387648.5	0.836	5.051
Discount Rate	k	0.08	0.12	-99125680.2	-0.206	-1.242
PV Indirect Customer Related Expenditures	PV_indE	2´400´000 €	3´600´000 €	-0.995	-0.062	-0.374
Non-operation assets	NOA	1´600´000 €	2´400´000 €	1.004	0.042	0.252
Non-Equity Claims	NEC	800´000 €	1´600´000 €	-1.001	-0.042	-0.151

Dependent Variable: SHV; R^2 is 0.824; All parameters are significant on the <0.0001 level; N=50´000

Figure 1:
Structure of the Model

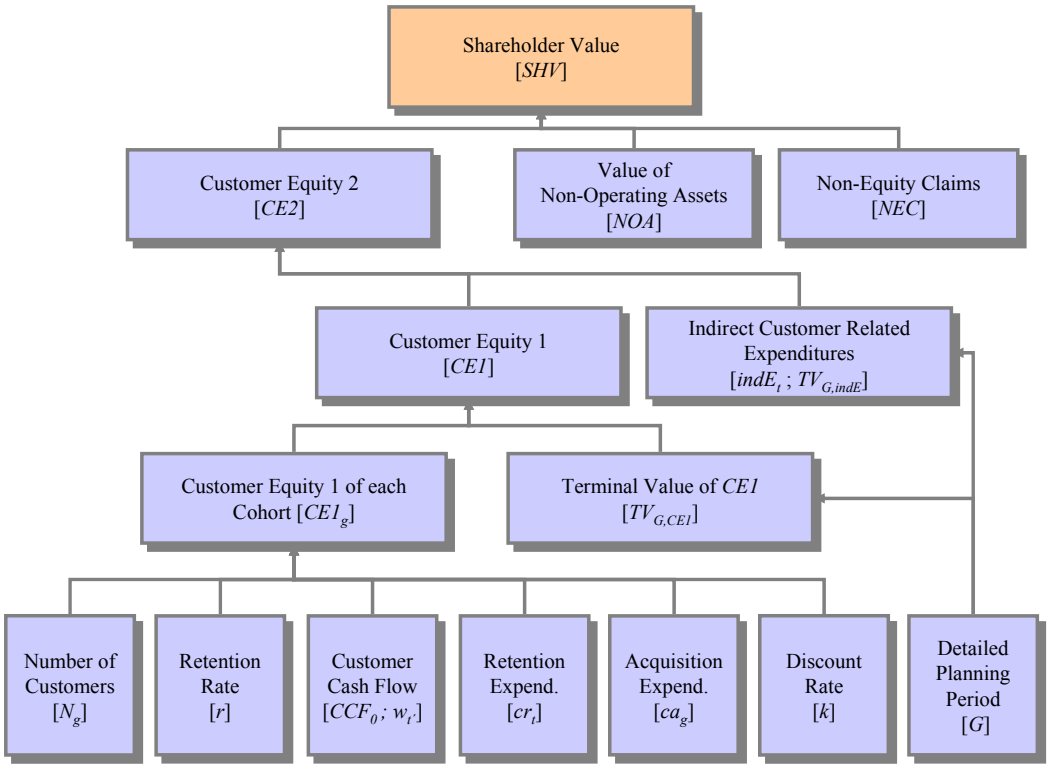
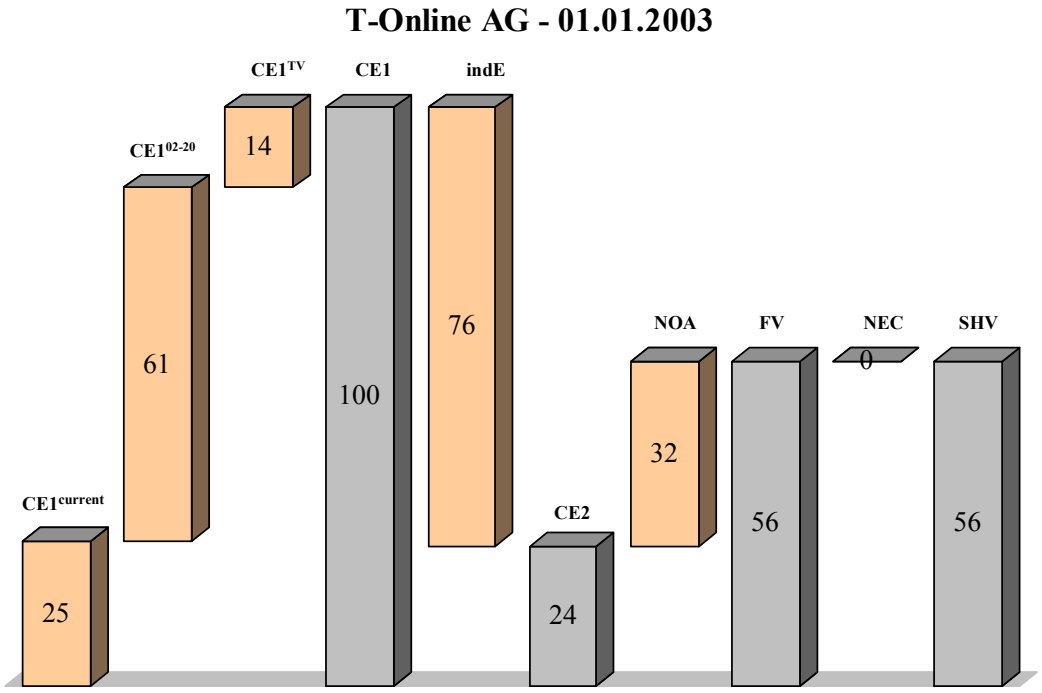
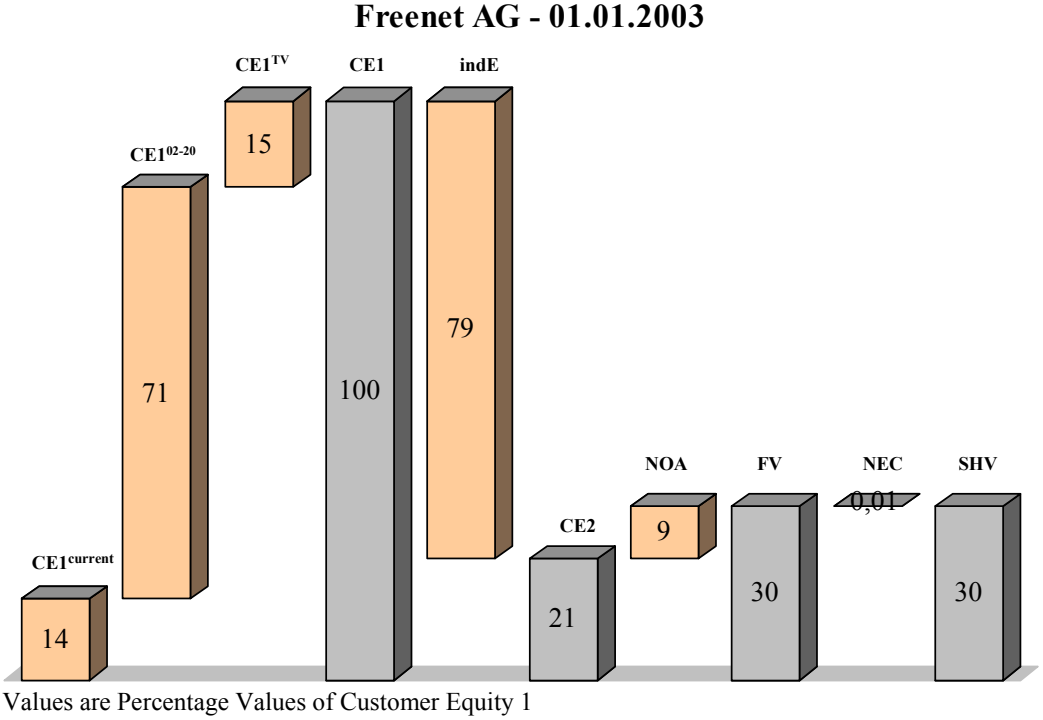


Figure 2:
Comparison of Shareholder Value Structure (T-Online and Freenet)

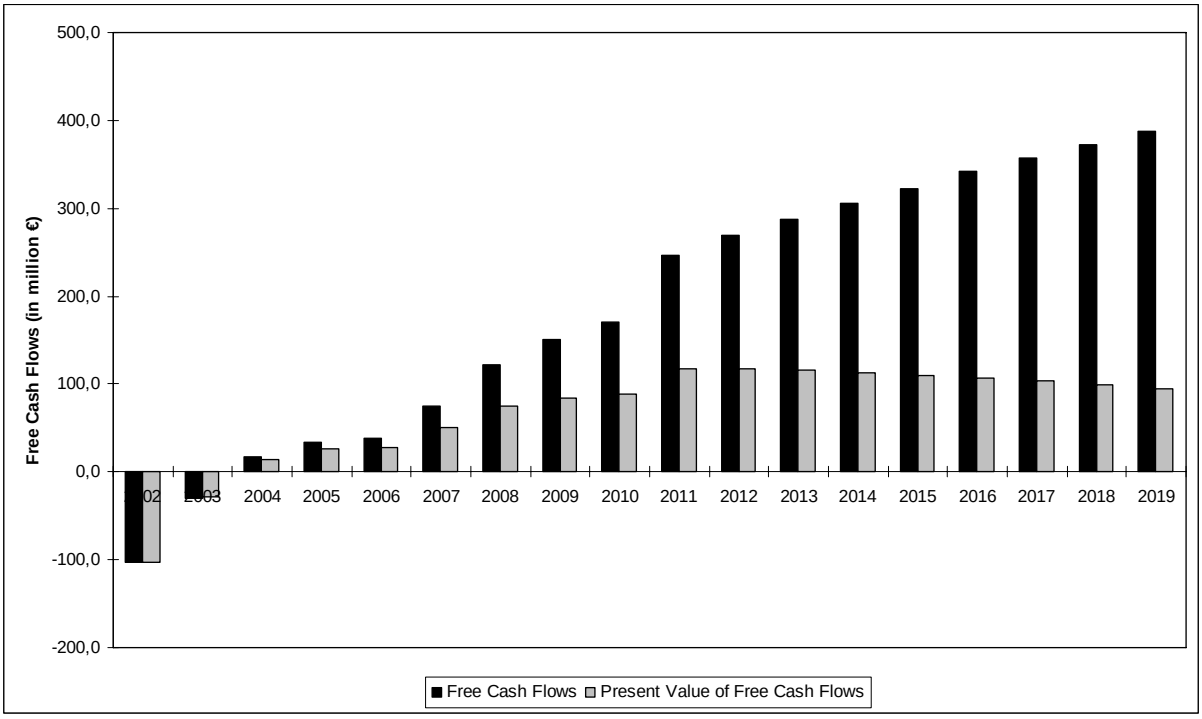


Values are Percentage Values of Customer Equity 1



Values are Percentage Values of Customer Equity 1

Figure 3:
Free Cash Flow per Period of T-Online AG



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