Working Paper No. 50/03

The value relevance of financial reporting on the Oslo Stock Exchange

by

Øystein Gjerde
Kjell Henry Knivsflå
Frode Sættem

THE ECONOMICS OF TELECOMMUNICATIONS
This report is one of a series of papers and reports on telecommunication economics published by the Institute for Research in Economics and Business Administration (SNF) as part of its telecommunication economics program. The main focus of the research program is to study the deregulation process of the telecommunication industry, and the economic and organizational consequences of changes in markets, technology and regulation. Being started in 1992, the program is now in its fourth period ending in 2005/2006. The program is financed by Telenor AS.

SNF- project No. 7885: "Immateriell verdiskapning – verdsettelse og finansiering av IKT-virksomhet"
The project is funded by Telenor ASA

INSTITUTE FOR RESEARCH IN ECONOMICS AND BUSINESS ADMINISTRATION
BERGEN, JULY 2004
ISSN 1503-2140

The value relevance of financial reporting on the Oslo Stock Exchange

ABSTRACT

This paper focuses on the value relevance of accounting numbers in Norway over the period 1968–2002. This period covers a number of large, and distinct, changes in Norwegian accounting practice, which so far has culminated in the earnings oriented Accounting Law of 1998. Although there is no overall significant increase (or decrease) in value relevance of financial statements over time, it is high and found to increase when earnings are negative and stock market returns are low. Industrial sector turns out to be an important factor explaining value relevance, as a negative relationship exists between value relevance and the amount of intangible assets. Our paper also demonstrates that methodological difficulties are very likely to appear in regression based value relevance analyses and have to be dealt with very carefully.

1. INTRODUCTION

This paper contributes to an increased understanding of the value relevance of accounting numbers over time and in relation to underlying explanatory factors. Norway is an interesting test arena for a number of reasons. Our data are from a fairly long period of time, 1968–2002, which covers a number of large, and distinct, changes in Norwegian accounting practice. The Oslo Stock Exchange (OSE) has undergone substantial changes and the activity on the exchange has increased significantly over the last two decades. Furthermore, Norway is a representative, small, open economy, where intangibles are playing an increasingly dominant role. We examine the development in value relevance over time and investigate the relationship between value relevance and the sign of earnings, market return and market volatility, respectively. An important issue in our study is to carry out sector analyses, primarily in order to analyse a possible relationship between value relevance and intangible assets. We carry out regressions inspired by Ohlson (1995) and Feltham and Ohlson (1995), and perform diagnostic control of the models along with necessary adjustments to obtain maximum reliability in results, an approach surprisingly rarely found in value relevance studies.

The rest of the paper is organized as follows. In Section 2, we give a brief summary of important contributions in value relevance research. In Section 3 and 4, we explain the development of the Norwegian accounting system and include some basic information about the Norwegian stock market and our data set. These sections contain the foundation of our empirical analyses. In Section 5, we explain our methodological approach and present our results. In Section 6, we offer some concluding remarks.

2. VALUE RELEVANCE OF FINANCIAL STATEMENTS

In the last decade, we have observed an increasing interest in connecting a set of accounting variables to a price-based variable in order to investigate significant relationships between them, i.e. whether accounting variables are value relevant or not. In itself, it is important to find out if such relationships indeed exist and to measure how much of the variation in the dependent price-based variable that can be explained by accounting variables, usually on the cross-section of companies. Furthermore, revealing changes over time, i.e. to demonstrate an

increase or a decrease in the value relevance of accounting figures, as well as to study the value relevance of various accounting items, such as intangible assets, are heavily focused issues in financial accounting research. Beaver (2002) points out that value relevance is one of five areas in which accounting-based capital market research has made its greatest contribution.

Two features of value relevance studies are to use price or return data and to identify value drivers that influence prices or returns over a much longer period of time than what typically is the case in a short-window event study, originating from Ball and Brown (1968) and Beaver (1968). The approaches to value firms by accounting variables have changed over time, starting out with the present value of permanent future earnings, cf. Miller and Modigliani (1966), and developing through the residual income approach by Ohlson (1995) and Feltham and Ohlson (1995), who use a linear function of equity book value and the present value of expected future abnormal earnings. Another interesting model is the abnormal earnings growth model of Ohlson and Juettner-Nauroth (2000/2003), see also Penman (2003, Ch. 6). These models can be seen as a theoretical framework for the empirical studies explaining value by accounting numbers.

Holthausen and Watts (2001) split value relevance studies into three categories. The first one contains relative association studies and focuses on the relationship between stock market value or return and alternative bottom line accounting numbers. Values of R^2 from standard regression techniques are utilized to perform difference tests between these alternative specifications based on the view that the larger the (adjusted) R^2, the greater the value relevance. Incremental association studies are the second category, where regression models are utilized to examine if a specific accounting variable is useful in explaining values or returns over a long window, given several other variables. Value relevance is then achieved when a regression coefficient is significantly different from zero. The third category comprises marginal information content studies, which are concerned with the relationship, if any, between a particular accounting number and investors' available information set. Short-window event studies based on returns are employed to decide whether a new accounting number conditioned on other released information influences value or not. If a price or a volume reaction is observed, value relevance is established, cf. Ball and Brown (1968) and Beaver (1968).

The major concern of Holthausen and Watts (2001) is the usefulness of the value relevance literature for standard-setting purposes. Although numerous studies have been made, they claim that their importance on guiding standard-setters is very limited, simply because the focus on equity valuation is so dominant and goes at the expense of other stakeholders. Since value relevance research is motivated from the assumption that financial statements are an important input for investors' calculation of value, the empirical tests are naturally concerned with investor values. This is inconsistent both with the IASB's and FASB's view about the functioning of accounting and the accounting practice of various countries, where a stakeholder view of the purpose of accounting is emphasized. Holthausen and Watts (2001) also point out that a number of significant econometric issues have to be dealt with.

However, the view of Holthausen and Watts (2001) is controversial. In fact, Barth, Beaver and Landsman (2001) claim the opposite, that value relevance research are important for both equity investors and standard setters. Although a primary focus is equity investment, they conclude that other uses of financial statement information do not reduce the importance of this research. And in their opinion, a number of value relevance studies do address econometric issues in a proper way.

Collins, Maydew and Weiss (1997) examine changes in value relevance over time. They are concerned with the validity of the assumption that a decline in value relevance has taken place as a consequence of the shift from an industrialized to a high-tech, service oriented economy. Using US data from 1953–1993, they are unable to confirm this hypothesis, on the contrary, a small increase is observed. This conclusion can also be drawn for industries where a high proportion of intangibles can be assumed. Consequently, historical cost financial statements have not lost their value relevance. Lev and Zarowin (1999) reach the opposite conclusion, using US data from 1964–1996. Their finding is driven by the increasing degree and impact of change on firms' operations and economic conditions, leading to consequences that are inadequately reflected in the current reporting system. Their analyses are founded on a classification of firms according to the level of change and the use of R&D. Francis and Schipper (1999), employing US data from 1952–1994, arrive at different conclusions, depending on which accounting variable has been used. They find that the explanatory power of earnings and of change in security returns has significantly decreased over time. On the other hand, modelling market value of equity as a function of asset and liability book values, the ability of these variables to explain market equity values has increased.

The value-relevance literature also addresses the questions of how various accounting numbers are priced. E.g. Barth (1994) demonstrates that the ease with which bank management is able to estimate fair values has an impact on pricing multiples. Financial assets will typically have an accounting value close to their market value and thus be highly value relevant. There is evidence, e.g. Barth, Beaver and Landsman (1992), that unrecorded pension assets and liabilities are priced consistent with the capital market view of these items as liabilities. Nonfinancial intangible assets, R&D and advertising expenditures, unbooked environmental liabilities and (other) footnote information are other examples of items being priced, see, e.g. Lev and Sougiannis (1996), Aboody and Lev (1998), Chambers, Jennings and Thompson (1999), Joos (2000) and Hughes (2000).

The above studies are performed on US data. Harris, Lang and Möller (1994) compare the value relevance for US and German firms over the period 1982–1991. While the explanatory power of shareholder's equity was significantly lower in Germany, the explanatory power of earnings was comparable to that in the US. Furthermore, the explanatory power of accounting data was found to be increasing and unconsolidated data performed poorly relative to consolidated data, and the coefficients linking stock price return or level to earnings or equity were generally higher in Germany than in the US, although the explanatory power of the regressions were lower. King and Langli (1998) look for differences in value relevance among three European countries, Germany, Norway and the UK, based on data from 1982–1996. Accounting numbers in UK have the highest correlation coefficient with stock prices, while they have the lowest in Germany. Book values are more important in Germany and Norway than in UK. The diversity in international accounting practice is put forward as the major explanation of these findings.

To perform our value relevance tests, regression models based on the theoretical foundation of Ohlson (1995) and Feltham and Ohlson (1995) are employed in this paper. The dependent variable is stock price, while earnings and book value are independent variables. However, there are some methodological issues, especially heteroskedasticity stemming from scale effects, which have to be dealt with. As pointed out by Brown, Lo and Lys (1999), cross-sample comparisons of R^2 can only be made if differences in the coefficient of variation across samples are controlled for. Replicating the studies of Collins, Maydew and Weiss (1997) and Francis and Schipper (1999), they found a decline in value relevance when scale effects are controlled for, which is consistent with the findings of Lev and Zarowin (1999).

3. THE TEST ARENA – IMPORTANT ASPECTS ABOUT THE NORWEGIAN ACCOUNTING SYSTEM, THE MARKET PLACE AND THE ECONOMY

The Norwegian accounting system has undergone several substantial changes during the last decades. Up to the Company Act of 1976 and the Accounting Act of 1977, financial statements were linked to tax statements and based on tax rules. The new Accounting Act of 1977 introduced a tax link model, and was an attempt to present financial statements that satisfied the information requirements of both investors and the tax authorities, cf. Johnsen (1993) and Eilifsen (1996). The model made a link at the end of the income statement where the difference between accounting income and taxable income was reported. These differences are known as untaxed reserves, and a change in untaxed reserves was reported as an adjustment to accounting income immediately preceding the bottom line in the income statement. This format was gradually adopted for various timing differences. In particular, following a major change in the tax rules for depreciation in 1984, timing differences in the depreciation of fixed assets were also addressed by this format. Tax considerations continued in practice during several years to play an important role in measuring profits, assets and equity. For example, most large firms did not disclose information about tax-induced reserves until 1984–1985, cf. King and Langli (1998).

In 1990, an Accounting Act Committee was appointed by the Ministry of Finance to draft proposals to revise existing accounting legislation, cf. Johnsen and Eilifsen (2003). In 1992, the Committee submitted a report on accounting for income taxes. As a consequence of the Tax reform of 1992, which changed the relationship between financial reporting and tax accounting, the accounting legislation was changed to introduce deferred tax liabilities and assets into Norwegian financial statements, beginning in 1992. Hoogendoorn (1996) concludes that Norway then belongs to the group of European countries that have the highest degree of independence between accounting and taxation. Hope (1999) is concerned about the effects of introducing deferred tax accounting in Norway. He uses data from 1980–1996 and finds that the value relevance of net income has increased after 1992, and this effect is strongest for small and medium sized firms. This can be explained by the fact that large firms typically disclose more information, implying that users of their financial statements would be able to infer items when they are not explicitly disclosed.

In 1995, the Committee presented its main report, and a new Accounting Act is effective from the beginning of 1999. As noted by Johnsen and Eilifsen (2003), the new act represents continued adherence to a legal framework of regulation. The general requirement of the EU directives that annual accounts shall give a true and fair view is implemented by a general requirement that annual accounts shall be prepared in accordance with good accounting practice. It is assumed that this practice, Norwegian Generally Accepted Accounting Principles (NGAAP), should also be developed by the Norwegian Accounting Standards Board (established in 1989) in line with IASB standards.

An important feature of the Norwegian Accounting Law of 1998 is the fact that it is based on an earnings oriented conceptual framework, and the matching principle is stated as one of the basic accounting principles. This is in contrast to the balance-sheet oriented framework of IASB and FASB, where the definitions of assets and liabilities have priority to the matching principle. An example of how this choice between an earnings and a balance sheet oriented conceptual framework could affect accounting numbers in practice, is accounting for periodic maintenance expenditures. According to the matching principle, periodic maintenance expenditures could be accounted for as a provision, which could be built up over the period until the next periodic maintenance. The yearly provision is an expense taken to the income statement. But according to a balance sheet oriented framework, a maintenance provision is not a liability and could therefore not be recorded in the balance sheet. Instead, the maintained assets are considered to have two components, where the maintained component is depreciated over the period until the next periodic maintenance, and the core components are depreciated over the economic life of the asset. The capitalized maintenance expenditures are thus expensed through depreciations instead of yearly provisions.

As an overall impression, there is no doubt that Norwegian legislation has changed from a tax-based, relatively conservative continental inspired model of legislation to a model closer to the US/UK investor-oriented model during the last decades. However, the matching principle is still important according to the Norwegian Accounting Law. Changes have been made continuously in accordance with changes in international financial accounting regulations, while the tax link model in 1977 and the deferred tax model in 1992 may be seen as accounting revolutions. With respect to accounting rules, we would hypothesise that the value relevance of financial statements in the Norwegian capital market in general would be expected to increase over time. In addition, we would specifically hypothesise that the value

relevance is higher in the period after major accounting changes relative to the pre-periods, cf. Hope (1999). Hence, the accounting framework presented above makes Norway an interesting case for evaluating the value relevance of financial accounting information, based on both temporal and event driven effects.

In an international perspective, the Oslo Stock Exchange (OSE) is a small stock market. However, OSE has undergone substantial changes during the last decades, and the activity on the stock exchange has increased significantly during the years of analysis. At the year end of 1983 the total market value of equity capital instruments was NOK 35.5 billions, while the corresponding figure in 2002 was NOK 502.9 billions. The proportion of stocks owned by Norwegian private individuals has fallen over the last 10–15 years, whereas foreign investors have increased their share of the market from 15 % to some 27 % over the same period. The total number of firms listed at the year end was 163 in 1985 and 203 in 2002, with a peak of 235 in 1998. The turnover value was NOK 29.9 billions in 1986 and NOK 444.4 billions in 2002, with the climax of NOK 609.1 billions in 2000. The turnover velocity, measured as the average of annualized turnover per month divided by market value at the end of each month, was 74.7 in 2002, with a top of 96.7 in 2000. However, increased investor and market activity as well as maturity will not per see be an unambiguous argument for either increased or decreased value relevance of financial statements.

A stock exchange is a reflector of the underlying conditions in the economy. Several characteristics of the Norwegian economy underscore that its stock exchange may be an interesting test subject for analyzing the value relevance of financial statements. Norway represents a small, open economy in Europe, and it is sensitive to the world market prices of its natural resources. The traditional industry structure, characterized by processing intermediate products rather than final goods, increases this commodity price risk dependency. Moreover, one of the recent characteristics in the global economy, including Norway, is the shift from physical assets to intangibles. For example, the number of OSE listed firms in the Information technology and Telecommunication sectors has increased rapidly during the last decade. The market value of these firms was 0.7 % of the total OSE market value at the end of 1993, while the corresponding value was 12.9 % by the year end of 2002. They reached their highest proportion of 21.5 % at the end of 2000. The claim that the shift from an industrialized economy to a high-tech, service-oriented economy has rendered traditional financial statements less relevant for assessing shareholder value is well known, cf.

e.g. Lev and Zarowin (1999) and Lev (2001). With respect to shifts in the operating risk exposure of listed firms, we would hypothesize that the value relevance of financial statements in the Norwegian capital market in recent years would decrease, since the market now contains a higher ratio of firms controlling intangibles assets. Nevertheless, the net effect on value relevance of our two groups of arguments, the positive effect of increased investor oriented accounting rules versus the negative effect of the shift in underlying economy, is not obvious.

Failing to control for changes in the volatility of market return over time could affect the interpretation of value relevance results. Following e.g. Francis and Schipper (1999), if the absolute amount of value relevant financial statement information is constant through time, but the volatility of market returns is increasing (decreasing) for reasons that cannot be traced to accounting information sources, a less (larger) portion of the variability of the dependent price or return variable will be explained by the independent accounting information variables. In that case, the explained variation tests will be biased toward the result that relevance is decreasing (increasing) over time. Consequently, we start out by performing an explicit test for possible changes in market volatility over time. Table 1, Panel A reports for each year annual returns on the Oslo Stock Exchange market index for the period 1968–2002, as well as the associated standard deviation.

[Table 1 about here]

Annual market returns vary from about -39 % in 1974 to about 127 % in 1979, while market volatility varies from about 8 % in 1977 to about 35 % in 1987. In Panel B, a test of the development of market volatility, proxied by the standard deviation (Sd), regressed on time (t = 1(1968), 2(1969), …, 35(2002)) is performed:

$$Sd_t = d_0 + d_1 \cdot t + \varepsilon_t \,. \tag{1}$$

We observe that the slope coefficient is positive, but insignificant (*p* value is 0.329), i.e. market volatility has not changed significantly over time. Consequently, we expect that potential problems associated with changes in the volatility of market returns during our sample period do not bias our value relevance tests and results.

4. DATA

Annual firm stock market prices, earnings and book values from 1968–2002 are collected from various sources. Stock market prices are obtained from the Stock Market Data Base at the Norwegian School of Economics and Business Administration (NHH). Earnings, book values and the number of outstanding shares are collected from the annual publication Kiærulff's Handbook of Corporate Information as well as directly from annual/interim reports published by the firms. At NHH, there is a large collection of annual reports from Norwegian share listed companies.

Earnings per share are defined as the reported net income (excluding dirty surplus, but including other transitory items) divided by the number of outstanding shares. Book value per share is the equity value reported in the financial statement (including 72 % of untaxed reserves and excluding the current year's earnings per share) divided by the number of outstanding shares. Note that the current year's earnings have been subtracted from the book value in order to reduce the possible problem of multicollinearity. The stock price is the price on the OSE at the year end (or at the end of the reporting period).

Our selection yields 4,497 firm-year observations from the years 1968–2002. To control for the effects of extreme values, we remove observations that are in the top or in the bottom one-half percent of the time series of prices, earnings per share and book values per share, respectively (3x2x0.5 % = 3 % removed). The final sample then comprises 4,365 firm-year observations for each time series, which is a substantial number of observations in a Norwegian financial accounting study. The final sample covers 512 individual firms, spanning from 1 to 35 years of observations. In turn, these time series are utilized to calculate firm Price/Earnings and Price/Book ratios. We eliminate negative earnings and book values when those ratios are calculated, which results in 3,189 Price/Earnings and 4,339 Price/Book firm-year observations. Table 2 presents descriptive statistics and correlations for the sample.

[Table 2 about here]

We learn from Panel A of Table 2 that the empirical distributions of prices, earnings and book values per share are typically skewed with fat right-hand tails, making the median a better indicator of the centre of the distribution than the mean. In addition, all variables are typically

characterized by large standard deviations. Furthermore, we observe that the median of the Price/Book and the median of the Price/Earnings ratio for the total period 1968–2002 are about 1.2 and 14.2, respectively. The latter is relatively close to that of Shiller (2000), who calculates the average Price/Earnings ratio in the US to be about 15 for the period 1888–2000. Panel B of Table 2 contains the last ten years of observations and we observe an increase in the Price/Book ratio and a decrease in the Price/Earnings ratio. The former development is consistent with the fact that intangible assets have become more important in recent years. Finally, we expect earnings and book values to be positively correlated with price and with each other, and the results of Panel C of Table 2 demonstrate that they do so.

5. METHODOLOGY AND EMPIRICAL RESULTS

We start this section by examining the relationship between stock prices and book values and earnings, and investigate how the measure of value relevance has developed over time. However, as severe methodological difficulties may appear, we explain how we have corrected our models to take care of this shortcoming. Next, we demonstrate how the sign of earnings, stock market return and stock market volatility affect value relevance, and thereafter, we are especially concerned to which extent value relevance differs between firms belonging to various industrial sectors.

Value relevance over the period 1968–2002

We apply the following cross-sectional regression to estimate the relationship between stock prices and book values and earnings:

$$P_{it} = a_0 + a_1 B_{it} + a_2 E_{it} + \varepsilon_{it}\,, \tag{2}$$

where P_{it} is the price of a share of firm i at fiscal year-end t (t=1 for 1968), B_{it} is the book value per share of firm i at the year-end t, E_{it} is the earnings per share of firm i during the year t, and ε_{it} is other value-relevant information of firm i for year t, independent of earnings and book values.

Next, following the technique of decomposing the total explanatory power into several components, cf. Theil (1971), we estimate the separate explanatory power of book values and earnings, respectively, by:

$$P_{it} = b_0 + b_1 B_{it} + \varepsilon_{it} \tag{3}$$

$$P_{it} = c_0 + c_1 E_{it} + \varepsilon_{it}\,. \tag{4}$$

We denote the coefficient of determination from the three models $\overline{R}^2_{BE}$, $\overline{R}^2_{B}$ and $\overline{R}^2_{E}$, respectively, and use the coefficient as a metric to measure value relevance. Moreover, $\overline{R}^2_{BE} - \overline{R}^2_{E} = \Delta\overline{R}^2_{B}$ is the incremental explanatory power provided by book values, and $\overline{R}^2_{BE} - \overline{R}^2_{B} =$

$\Delta\overline{R}^2_E$ is the incremental explanatory power provided by earnings. Within this framework, $\overline{R}^2_{BE} - \Delta\overline{R}^2_B - \Delta\overline{R}^2_E$ will then represent the explanatory power common to both earnings and book values.

As pointed out in the Section 2, the empirical findings about the development in value relevance of mainly historical cost financial statements over time are not unambiguous. Several studies indicate that the value relevance of earnings has declined over time while the value relevance of book values has increased, i.e. they move inversely to each other. To examine whether the value relevance of earnings and book values, as well as of the incremental value of earnings and book values, has changed over time in Norway, we run five time trend regressions; expressing the explanatory power $\overline{R}^2_{BE}$, $\overline{R}^2_B$, $\overline{R}^2_E$, $\Delta\overline{R}^2_B$ and $\Delta\overline{R}^2_E$, respectively, as a function of a time trend variable *t*:

$$\overline{R}^2_t = d_0 + d_1 \cdot t + \varepsilon_t, \tag{5}$$

where *t*=1,...,35 covers our period of analysis 1968–2002. The explanatory power has decreased (increased) over time if d_1 is significantly negative (positive). To test significance, we utilize a 5 per cent confidence level.

In addition, we explicitly test for value relevance effects related to changes in legislations as well as changes in practice during the period of analysis, cf. Section 3. We split the data set into five sub-periods; 1968–1977 (financial statements linked to tax statements and based on tax rules), 1978–1983 (the tax link model/mainly no disclosure on tax induced reserves), 1984–1991 (the tax link model/disclosure on tax induced reserves), 1992–1998 (the deferred tax model) and 1999–2002 (the new accounting act of 1998). We run the following dummy variable time trend regression:

$$\overline{R}^2_t = d_0 + (d_1 + d_2 D_{78\text{-}83} + d_3 D_{84\text{-}91} + d_4 D_{92\text{-}98} + d_5 D_{99\text{-}02}) \cdot t + \varepsilon_t, \tag{6}$$

where $D_{78\text{-}83}$, $D_{84\text{-}91}$, $D_{92\text{-}98}$ and $D_{99\text{-}02}$ equals 1 for observations over 1978–1983, 1984–1991, 1992–1998 and 1999–2002, respectively, and 0 otherwise. If the value relevance metric is stable over time, the coefficients d_2, d_3, d_4 and d_5 are required to be 0. Estimating Equation 6, the term (d_1+d_2) represents the time trend over the period 1978–1983, (d_1+d_3) represents the

time trend over the period 1984–1991, (d_1+d_4) represents the time trend over the period 1992–1998, and (d_1+d_5) represents the time trend over the period 1999–2002, while d_1 alone represents the time trend over the period 1968–1977.

Panel A of Table 3 presents the cross-sectional regression of price on book values and earnings. We observe that both coefficient estimates are highly significant and that the value relevance score measured by the associated adjusted coefficient of determination is close to 60 %, out of which book values alone can account for about 56 %, i.e. the incremental explanatory power of earnings is quite low.

[Table 3 about here]

[Figure 1 about here]

Panel B of Table 3 summarizes the annual cross-sectional regression results and we learn that all (adjusted) R^2-values are volatile with no distinct pattern over time. For the total, $\overline{R}^2_{BE}$, the average value is also 60 % when an observation-weighted average is used. The corresponding values related to each sub-period presented at the bottom of Panel B show no clear pattern, and this is further confirmed both by Figure 1 and by the results for each of the five variables in Panel C of Table 3. No time trend coefficient estimate is significantly different from zero, and all $\overline{R}^2$-values are low. Although accounting data, represented by book values and earnings, are highly value relevant, our preliminary conclusion is that no significant increase (or decrease) in value relevance has taken place over the period 1968–2002 in Norway.

However, comparing the relative importance of book value and earnings, we are again struck by the dominance of the former component. Panel B of Table 3 shows that on average, more than 90 % of the score on our value relevance measure is accounted for by the book value variable separately, and the incremental explanatory power by earnings is only about 0.04. This result is fairly stable in all sub-periods, which is especially notable since Norwegian financial accounting regulations have focused on the importance of earnings (the matching principle), and not on the balance sheet (definitions of assets and liabilities), when appropriate accounting procedures have been designed. In fact, our finding indicates that heavy focus on the matching principle, which is contrary to the international development of a stronger focus on the balance sheet, has not paid off by a higher value relevance of earnings. This may explain a substantial part of why we were unable to reveal an increase in value relevance of

accounting numbers of Norwegian firms in our period of analysis.

Panel D of Table 3 gives some more details on this issue. It contains the results of our five time trend regressions for all value relevance measures. The value relevance of book values and earnings together as well as of book values separately is significantly increasing in the first sub-period. Thereafter, the time trend estimate is close to zero, for the model based on $\overline{R}^2_{BE}$ it is 0.004 (0.043–0.039), 0.007 (0.043–0.036), 0.005 (0.043–0.038) and 0.008 (0.043–0.035) for the second, third, fourth and fifth sub-period, respectively. This finding is consistent with the insignificant, close to zero time trend coefficient in Panel C of Table 3. A similar pattern is observed for $\overline{R}^2_B$ and our data indicate that a significant positive increase in value relevance has taken place only in the first ten years of our period of data.

Potential methodological problems

Brown, Lo and Lys (1999) show that the R^2-metric is biased upwards for value relevance studies in the presence of scale effects, i.e. for changes in units of measurement. A related issue is the fact that the presence of a scale factor is likely to cause the error term in the regressions to be heteroskedastic, cf. Easton and Sommers (2000) and Barth and Clinch (1999). Brown, Lo and Lys (1999) conclude that making cross-sectional or temporal comparisons of the R^2-metric is not valid, unless these effects are controlled for. In particular, they find the results of Collins, Maydew and Weiss (1997) and Francis and Schipper (1999) to be biased. By controlling for temporal increases in the coefficient of variation of scale and by using lagged price as a scale proxy to deflate per share values, those two studies are replicated. This adjustment procedure changes the conclusion in the original papers to the opposite, i.e. the explanatory power of book values and earnings has decreased during the period of analyses when one properly adjusts for the presence of scale effects. A very large number of value relevance studies running price level regressions do not model, or even discuss, this potential methodological problem.

To handle it, we start by employing a Glejser test for detecting heteroskedasticity, cf. e.g. Maddala (2001, Ch. 5). This test indicates that error variances increase significantly with the value of price (P), but insignificantly with the level of book values (B) and earnings (E). This difference in value is the major source of scale problems. We implement a two-step weighted

least squares (WLS) procedure and illustrate it by the model in Equation 2. First, the coefficients, $\hat{a}_0, \hat{a}_1$ and $\hat{a}_2$, are estimated by OLS. Next, we regress $P_{it}/(\hat{a}_0 + \hat{a}_1 B_{it} + \hat{a}_2 E_{it})$ on $1/(\hat{a}_0 + \hat{a}_1 B_{it} + \hat{a}_2 E_{it})$, $B_{it}/(\hat{a}_0 + \hat{a}_1 B_{it} + \hat{a}_2 E_{it})$ and $E_{it}/(\hat{a}_0 + \hat{a}_1 B_{it} + \hat{a}_2 E_{it})$. Hence, the adjusted regression models, all without a constant term, become:

$$\frac{P_{it}}{(\hat{a}_0 + \hat{a}_1 B_{it} + \hat{a}_2 E_{it})} = a_0 \frac{1}{(\hat{a}_0 + \hat{a}_1 B_{it} + \hat{a}_2 E_{it})} + a_1 \frac{B_{it}}{(\hat{a}_0 + \hat{a}_1 B_{it} + \hat{a}_2 E_{it})} + a_2 \frac{E_{it}}{(\hat{a}_0 + \hat{a}_1 B_{it} + \hat{a}_2 E_{it})} + \varepsilon_{it}' \quad (7)$$

$$\frac{P_{it}}{(\hat{a}_0 + \hat{a}_1 B_{it})} = b_0 \frac{1}{(\hat{a}_0 + \hat{a}_1 B_{it})} + b_1 \frac{B_{it}}{(\hat{a}_0 + \hat{a}_1 B_{it})} + \varepsilon_{it}' \quad (8)$$

$$\frac{P_{it}}{(\hat{a}_0 + \hat{a}_2 E_{it})} = c_0 \frac{1}{(\hat{a}_0 + \hat{a}_2 E_{it})} + c_1 \frac{E_{it}}{(\hat{a}_0 + \hat{a}_2 E_{it})} + \varepsilon_{it}'. \quad (9)$$

Note that the coefficients of determination in the original and in the adjusted models are not comparable, although running OLS regressions under the presence of heteroskedasticity imply unbiased estimates. However, they are inefficient, which implies that value relevance conclusions based on the R^2-metric may be invalid.

In Panel A of Table 4, we report the results of the Glejser test before and after our WLS procedure for the total period 1968–2002, and in Panel B we do the same for the period for which we have industrial sector data, 1993–2002. The Glejser test no doubt discovers a heteroskedastic data set. A visual impression of the heteroskedasticity before the WLS adjustment is given in Figure 2, in which the residuals are plotted against the values of the predicted price from our model for the total period. Although the value of the coefficient of determination has dropped from 34.4 % to 0.6 % after the WLS procedure in Panel A of Table 4 and from 14.3 % to 2.2 % in Panel B, we have not completely eliminated our problem. The value of a_1 is significantly above zero in both cases. Trying to circumvent this difficulty, we iterate the WLS procedure further by constructing new weights. However, as pointed out by Maddala (2001, Ch. 5) there is no gain in efficiency by iteration, and in addition, our estimates of the book and earnings variables then become quite meaningless with respect to their economic content. Thus, our WLS procedure reported above seems all in all to be an appropriate way of dealing with heteroskedasticity in our case. The problem is

reduced, although not completely eliminated.

[Table 4 about here]

[Figure 2 about here]

After having corrected for heteroskedasticity, the corresponding results to Table 3 are much the same, as can be seen from Table 5 (later results, however, would have been strongly affected). Adjusted coefficients of determination in the two tables are not comparable. We still observe in Panel A volatile value relevance scores with no specific pattern for any sub-period, a fact that also was present in Panel B of Table 3. It is once more clearly visualized in Figure 3. The dominance of book values over earnings with respect to value relevance is consistent with previous findings. Furthermore, like in Panel C of Table 3, there are no significant time trend coefficients in Panel B of Table 5. On the other hand, Panel C of Table 5 demonstrates that the significant increase in total value relevance and book value relevance in the first ten years from Panel D of Table 3 is no longer valid. Only the incremental explanatory power of book values turns out to be significant in the first ten years of analysis.

[Table 5 about here]

[Figure 3 about here]

The impact of underlying factors on value relevance

Although we observe no significant change in value relevance of Norwegian financial statements for the total period 1968–2002, investigating possible underlying explanatory factors may bring forward important information about the fundamental forces driving value relevance. A number of international studies are concerned with this issue. For example, Lev and Zarowin (1999) identify the increasing rate and impact of business change and the inadequate accounting treatment of change and its consequences, as major reasons for a decline in value relevance. Francis and Schipper (1999) repeat some of their analyses on two samples of firms, belonging to low- and high-technology industries, respectively, to test whether the current reporting model differentiate value relevance between traditional and new tech firms. Collins, Pincus and Xie (1999) argue that much of the observed shift in value relevance can be explained by the increasing frequency and magnitude of one-time items, the increasing frequency of negative earnings, and changes in average firm size and intangible intensity across time. In our study, we shall concentrate on four factors.

First, Collins, Pincus and Xie (1999) claim that the increased frequency of negative earnings observed over time could contribute to a temporal decline in the incremental value relevance of earnings. Based on Hayn (1995) and Basu (1997), as well as the cross-sectional evidence in e.g. Burgstahler and Dichev (1997), one may conclude that value relevance shifts from earnings to book values when earnings are negative or as firms face financial distress. In such situations, a firm's abandonment or liquidation value becomes more relevant for measuring shareholder value. The incremental explanatory power of book values will then increase relative to earnings, since book values are more closely related to abandonment values, cf. Berger, Ofek and Swary (1996) and Burgstahler and Dichev (1997). To test the hypothesis that negative earnings may have an impact on value relevance, we split the sample into two groups based on profitability. Positive (negative) earnings are those firm-year observations for which the earnings variable is positive (negative).

Panel A of Table 6 illustrates that the value relevance of both book values and earnings is dramatically higher for firms with negative earnings (e.g. 66.0 % versus 39.9 % for $\overline{R}^2_{BE}$, the associated *p* value of the *F* test for differences is 0.000), and such that the incremental explanatory power of both book values and earnings are lower in case of negative earnings.

Consequently, our data support the view that value relevance of accounting numbers increases when we go from positive to negative earnings, irrespective of which accounting number, book value or earnings, has been used.

[Table 6 about here]

Second, we analyze the hypothesis that value relevance varies with market returns. According to the discounted dividend model under constant growth, $P_0 = DIV_1/(r-g)$, i.e. the current stock market price (P_0) is a function of next year's dividend (DIV_1), the required return on equity (r) and the anticipated growth rate (g). By decomposing this model, the market price can be expressed as the present value of a level stream of earnings (E_1/r) and the present value of (abnormal) growth opportunities (PVGO), cf. e.g. Penman (2003, Ch. 6). The latter component is reflected in stock market prices, but not in next period's level of earnings. In bull (bear) markets, one would expect an increasing (decreasing) divergence between market prices and reported financial accounting numbers, which are more important when the economy is in recession. Therefore, value relevance would be high (low) in those fiscal years when stock market returns are low (high).

Panel B of Table 6 supports this hypothesis. We have selected the five years with the highest and the five years with the lowest market returns, cf. Panel A of Table 1. The total explanatory power is significantly higher for the group of low market returns (48.6 % versus 32.9 %, the associated *p* value from the test for differences is 0.000). Thus, value relevance is higher for Norwegian firms when the economy as a whole performs poorly.

Third, we focus on market risk, measured by the standard deviation of market returns. Given a highly volatile stock market, the correlation between accounting numbers and prices will in general become less stable. Furthermore, more trading takes place, investors' expectations fluctuate strongly and more noise is incorporated in market prices. In this situation, one would expect less focus on historical accounting information and a decline in value relevance. Thus, we hypothesize that value relevance is high (low) in years of low (high) market volatility.

Panel C of Table 6 does not support this hypothesis. Again, we have selected the top and the bottom five years from Panel A of Table 1, now with respect to market volatility. The total explanatory power is in fact slightly higher for the group of high market volatility (57.9 %

versus 56.0 %). We may speculate that this result appears as a net effect of two forces: the one which is the basis for our hypothesis above may be outbalanced by a number of investors finding fundamental values, proxied by accounting variables, in highly volatile stock markets to be a safe haven for them. This, however, requires that high stock market volatility is attributed to high underlying volatility, and not volatility induced by investor sentiment.

Fourth, following the idea of Francis and Schipper (1999), who investigate differences between high-tech and low-tech industries, we would like to examine the importance of business activity. Our data sample is split into ten industrial groups, following the official OSE classification codes. We strongly believe that value relevance varies between industrial sectors due to differences in the underlying real economic activity, i.e. intangible-intensive high-technology and service firms render less value relevant accounting numbers than firms in other sectors. The prevailing historical cost financial reporting model is not well suited to report intangible resources related to R&D, human capital, brand development etc. Furthermore, certain assets are not reported in the financial accounting system, and certain expenditures are expensed, even though capitalization would be preferred from an economic theory point of view, cf. Høegh-Krohn and Knivsflå (1999). As noted earlier, the importance of OSE listed firms in the Information technology and Telecommunication sectors has increased rapidly during the last decade, which *per se* could imply a decline in value relevance over time due to an increasing magnitude of intangibles in the economy. In order to investigate this issue, our different value relevance metrics for the various industrial sectors are reported in Panel A of Table 7. Note that we have official classification codes only for firms listed from 1993, and hence, the number of firm-year observations is now down to 1,892.

[Table 7 about here]

Panel A of Table 7 shows a significantly lower value relevance score (37.0 %) in the IT and Telecommunication sector than in all the others (the second lowest is 70.0 % in the Offshore sector, and the associated *p* value from a difference test between the two sectors' value relevance estimate is 0.000). We observe at the bottom of Panel A that the weighted R^2-metrics are much higher than the pooled ones, i.e. sectors differ and therefore deserve individual attention. Panel B of Table 7 demonstrates that no significant time trend appears for the sample of all firms over 1993–2002 except for earnings alone, which is negative.

In addition to the IT and Telecommunication sector, we would like to take a closer look at the Finance (including PCC), the Manufacturing and the Shipping sectors, the three remaining largest industrial sectors. Financial assets are to a large extent priced according to their market value, and thus we would expect high value relevance in the Finance sector. This is confirmed by e.g. the sector's total value relevance score of 93.1 % in Panel A of Table 7. Panel A of Table 8 shows an increase in the first two years of observations and thereafter it remained at a high level. Panel B of Table 8 shows that this development is sufficient to obtain a significant estimate for the associated time trend coefficient. An increased weight on market value accounting is consistent with that finding.

[Table 8 about here]

We would expect both the Manufacturing and the Shipping sector to achieve value relevance scores between the two we have found for the Finance and for the IT and Telecommunication sectors. Firms in the Manufacturing sector contain a considerable amount of intangible assets, while the Shipping sector largely consists of physical assets, whose market values are very sensitive to freight rates and the state of world economy. Panel A of Table 7 confirms this view, total value relevance scores are 76.6 % and 77.9% in Manufacturing and Shipping, respectively. Panel C of Table 8 shows a decline in value relevance for Manufacturing over our ten years' period, and in Panel D of Table 8 we see that all time trend coefficient estimates for book values and earnings, both in their common model and in the individual models, are significantly negative, which indicates an increased importance of intangible assets in this sector. Furthermore, it is also interesting to observe the increased importance of the incremental explanatory power of book values and earnings, the associated coefficient estimates are both significantly positive. Going back to Panel C of Table 8, we observe that in the beginning of the 1990s, most of the information content in earnings was incorporated in book values. However, in recent years, this picture is completely different. In 2002, the incremental explanatory power of earnings is in fact higher than value relevance from book values alone. The recent increase in focus on the matching principle in Norwegian accounting may also explain this result. Although earnings become more value relevant, total value relevance of financial statements in the Manufacturing sector has dropped, and thus, no reward has been received for this approach.

This finding of a growing importance of earnings (and a reduced importance of book values) can also be traced in the Shipping sector. In Panel E of Table 8, we observe no decline in total value relevance over 1993–2002, but in the last two years the incremental explanatory power of earnings jumps substantially upwards. Furthermore, we learn from Panel F of Table 8 that this increase is significant, and in addition, the value relevance of book values alone has significantly dropped.

Finally, Panel G of Table 8 shows the development in our R^2-metrics for the IT and Telecommunication sector over 1993–2002. We observe that value relevance from both the multiple regression model and the two simple regression models has decreased in this period, especially after 1998, and in Panel H of Table 8 we observe that this development is statistically significant. Overall, our analyses have demonstrated that a decomposition of firms into industrial sectors is required to get a thorough understanding of the development of value relevance for a given economy.

6. CONCLUDING REMARKS

This study of value relevance of accounting numbers has demonstrated that there is no overall significant increase (or decrease) in our R^2-metrics in Norway over the period 1968–2002. With respect to the development of increased investor oriented accounting rules, this result is somewhat surprising. Furthermore, this paper has demonstrated that value relevance in Norway has been greater for firms with negative earnings and when stock market returns have been low, while stock market volatility has had no substantial impact when explaining value relevance. In addition, the firm's amount of intangible assets has an impact on value relevance, as we measure a significantly lower score for IT and Communication than for all the other industrial sectors over the period 1993–2002. The growing importance of intangible assets, cf. our sector analyses, may contribute to explain the neutral net effect of value relevance over time. Our findings underscore the importance of a sector analysis to obtain a more detailed picture of the overall level of and development in value relevance. This study has also demonstrated that methodological difficulties are very likely to appear in these types of regression models and that they have to be dealt with very carefully.

REFERENCES

Aboody, D., and Lev, B. (1998), 'The value-relevance of intangibles: The case of software capitalization', *Journal of Accounting Research*, 36 (Supplement): 161-191.

Ball, R., and Brown, P. (1968), 'An empirical evaluation of accounting income numbers', *Journal of Accounting Research*, 6: 159-178.

Barth, M. E. (1994), 'Fair value accounting: evidence from investment securities and the market valuation of banks', *The Accounting Review*, 69: 1-25.

Barth, M., Beaver, W. H. and Landsman, W. R. (1992), 'The market valuation implications of net periodic pension cost components', *Journal of Accounting and Economics*, 15: 27-62.

Barth, M. E., Beaver, W. H. and Landsman, W. R. (2001), 'The relevance of the value relevance literature for financial accounting standard setting: another view', *Journal of Accounting and Economics*, 31: 77-104.

Bart, M. E. and Clinch, G. (1998), 'Revalued financial, tangible, and intangible assets: associations with share price and non market-based value estimates', *Journal of Accounting Research*, 36: 199-233.

Basu, S. (1997), 'The conservatism principle and the asymmetric timeliness of earnings', *Journal of Accounting and Economics*, 24: 3-37.

Beaver, W. H. (1968), 'The information content of annual earnings announcements', *Journal of Accounting Research*, 6 (Supplement): 67-92.

Beaver, W. H. (2002), 'Perspectives on recent capital market research', *The Accounting Review*, 77: 453-474.

Berger, P., Ofek, I. and Swary, I. (1996), 'Investor valuation of the abandonment option', *Journal of Financial Economics*, 42: 257-287.

Brown, S., Lo, K. and Lys, T. (1999), 'Use of R2 in accounting research: measuring changes in value relevance over the last four decades', *Journal of Accounting and Economics*, 28: 83-115.

Burgstahler, D. C. and Dichev, I. D. (1997), 'Earnings, adaptation and equity value', *The Accounting Review*, 72: 187-215.

Chambers, D., Jennings, R. and Thompson, R. B. (1999), 'Evidence on the usefulness of capital expenditures as an alternative measure of depreciation', *Review of Accounting Studies*, 4: 169-195.

Collins, D. W., Maydew, E. L. and Weiss, I. S. (1997), 'Changes in the value-relevance of earnings and book values over the past forty years', *Journal of Accounting and Economics*, 24: 39-67.

Collins, D. W., Pincus, M. and Xie, H. (1999), 'Equity valuation and negative earnings: The role of negative earnings', *The Accounting Review*, 74: 29-61.

Easton, P. D. and Sommers, G. A. (2000), 'Scale and scale effects in market-based accounting research'. Working Paper, Ohio State University.

Eilifsen, Aa. (1996), 'The relationship between accounting and taxation in Norway', *The European Accounting Review*, 5: 835-844.

Feltham, G. A. and Ohlson, J. A. (1995), 'Valuation and clean surplus accounting for operating and financial activities', *Contemporary Accounting Research*, 11: 689-732.

Francis, J. and Schipper, K. (1999), 'Have financial statements lost their relevance?', *Journal of Accounting Research*, 37: 319-352.

Harris, T. S., Lang, M. and Möller, H. P. (1994), 'The value relevance of German accounting measures: An empirical analysis', *Journal of Accounting Research*, 32: 187-209.

Hayn, C. (1995), 'The information content of losses', *Journal of Accounting and Economics*, 20: 125-154.

Holthausen, R. W. and Watts, R. L. (2001), 'The relevance of the value relevance literature for financial accounting standard setting', *Journal of Accounting and Economics*, 31: 3-75.

Hoogendoorn, M. N. (1996), 'Accounting and taxation in Europe - a comparative overview', *The European Accounting Review*, 5: 783-794.

Hope, O. K. (1999), 'Value relevance effects of the introduction of interperiod tax allocation: The case of Norway', *Advances in International Accounting*, 12: 157-191.

Hughes, K. (2000), 'The value relevance of nonfinancial measures of air pollution in the electric utility industry', *The Accounting Review*, 75: 209-228.

Høegh-Krohn, N. E. J. and Knivsflå, K. H. (1999), 'Accounting for intangible assets in Scandinavia, the UK, the US, and by the IASC: Challenges and a solution', *The International Journal of Accounting*, 35: 243-265.

Johnsen, A. (1993), 'Accounting regulation in Norway', *The European Accounting Review*, 3: 617-626.

Johnsen, A. and Eilifsen, Aa. (2003), 'Norway' in Alexander, D. and Archer, S. (eds) *European Accounting Guide*. New York: Aspen Law & Business.

Joos, P. (2000), 'Explaining cross-sectional differences in unrecognized net assets', Working Paper, Stanford University.

King, R. D. and Langli, J. C. (1998), 'Accounting diversity and firm valuation', *The International Journal of Accounting*, 33: 529-567.

Lev, B. (2001), *Intangibles - Management, measurement, and reporting*. Washington, D. C.: The Brookings Institution.

Lev, B. and Sougiannis, T. (1996), 'The capitalization, amortization, and value-relevance of R&D', *Journal of Accounting and Economics*, 21: 107-138.

Lev, B. and Zarowin, P. (1999), 'The boundaries of financial reporting and how to extend them', *Journal of Accounting Research*, 37: 353-385.

Maddala, G. S. (2001), *Introduction to Econometrics*. London: Wiley.

Miller, M. H. and Modigliani, F. (1966), 'Some estimates of the cost of capital to the electric utility industry, 1954-57', *The American Economic Review*, 56:333-391.

Ohlson, J. A. (1995), 'Earnings, book values, and dividends in security valuation', *Contemporary Accounting Research*, 11: 661-688.

Ohlson, J. A. and Juettner-Nauroth, B. E. (2000/2003), 'Expected EPS and EPS growth as determinants of value', Unpublished manuscript, New York University.

Penman, S. H. (2003), *Financial Statement Analysis and Security Valuation*. New York: McGraw-Hill/Irwin.

Shiller, R. J. (2000), *Irrational Exuberance.* Princeton: Princeton University Press.

Theil, H. (1971), *Principles of Econometrics*. New York: Wiley.

Table 1: Yearly stock market returns and annualized standard deviations based on monthly return observations for the years 1968–2002

Panel A: Yearly stock market returns (Return) and annualized standard deviations (Sd) in percent based on monthly return observations

Year	Return	Sd	Year	Return	Sd	Year	Return	Sd	Year	Return	Sd	Year	Return	Sd
			1970	32.27	14.88	**1980**	-7.31	27.71	**1990**	-10.98	22.47	**2000**	3.18	15.03
			1971	-0.28	24.59	**1981**	5.72	19.19	**1991**	-11.80	28.93	**2001**	-14.61	23.90
			1972	10.10	13.21	**1982**	-17.00	15.97	**1992**	-9.23	22.78	**2002**	-31.09	24.81
			1973	65.63	28.28	**1983**	94.49	18.42	**1993**	60.42	18.19			
			1974	-39.01	24.36	**1984**	24.41	25.57	**1994**	10.16	21.40			
			1975	-9.59	19.25	**1985**	32.53	17.81	**1995**	6.82	12.61			
			1976	6.19	21.70	**1986**	-5.06	15.45	**1996**	32.43	10.85			
			1977	-22.37	7.91	**1987**	-3.56	35.26	**1997**	32.20	13.83			
1968	30.50	9.27	**1978**	6.84	19.01	**1988**	40.09	16.67	**1998**	-26.98	32.19			
1969	23.31	14.21	**1979**	127.24	18.30	**1989**	47.57	25.98	**1999**	48.45	17.61			
Mean	**26.91**	**11.74**		**17.70**	**19.15**		**21.19**	**21.80**		**13.15**	**20.09**		**-14.17**	**21.25**

Panel B: Time trend regression 1968–2002

Regression: $Sd_t = d_0 + d_1 \cdot t + \varepsilon_t$ t = 1–35

(p-values in parentheses)

Dependent variable	d_0	d_1	$\overline{R}^2$
Sd_t	18.023** (0.000)	0.106 (0.329)	-0.001

** Significant at the 1% level

Table 2: Descriptive statistics and correlations for firm-year observations

Panel A: Descriptive statistics 1968–2002

Variable	No. of observations	Mean	Standard deviation	Lower quartile	Median	Upper quartile
Price (P)	4,365	288.57	730.56	35.00	100.00	200.00
Book value (B)	4,365	284.32	768.11	22.17	86.80	195.63
Earnings (E)	4,365	17.26	69.53	-0.10	3.86	14.51
Price/Book (P/B)	4,339	3.40	37.93	0.70	1.15	1.95
Price/Earnings (P/E)	3,189	358.64	11,324.69	8.26	14.17	27.33

Panel B: Descriptive statistics 1993–2002

Variable	No. of observations	Mean	Standard deviation	Lower quartile	Median	Upper quartile
Price (P)	1,892	76.40	90.33	11.40	44.00	114.00
Book value (B)	1,892	48.48	62.95	7.73	21.77	76.96
Earnings (E)	1,892	4.60	12.65	-0.27	1.60	8.12
Price/Book (P/B)	1,876	2.65	6.25	0.94	1.48	2.41
Price/Earnings (P/E)	1,312	35.11	150.44	8.50	13.23	23.20

Panel C: Correlations among independent and dependent variables 1968–2002 and 1993–2002

	1968–2002			**1993–2002**		
Variable	**Price (P)**	**Book value (B)**	**Earnings (E)**	**Price (P)**	**Book value (B)**	**Earnings (E)**
Price (P)	1.000	0.746	0.598	1.000	0.736	0.573
Book value (B)		1.000	0.602		1.000	0.510
Earnings (E)			1.000			1.000

Figure 1: Value relevance measured by R^2 1968–2002

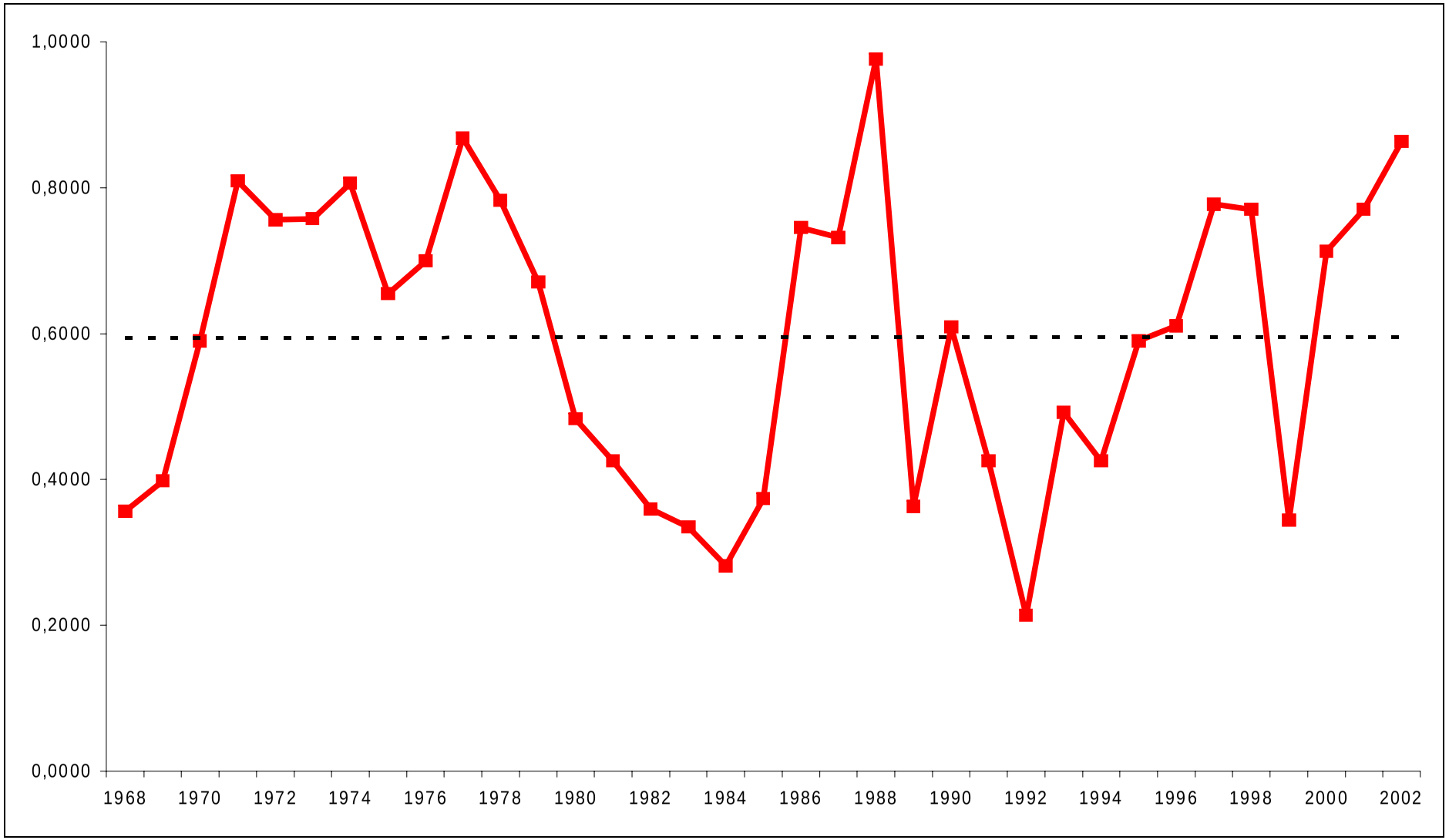

Table 3: Cross-sectional regressions of price (P) on book values (B) and earnings (E) 1968–2002

Panel A: Pooled Value Relevance 1968–2002

Regression: $P_i = a_0 + a_1 \cdot B_i + a_2 \cdot E_i + \varepsilon_i$ i = 1–4365

(p-values in parentheses)

$\mathbf{a_0}$	$\mathbf{a_1}$	$\mathbf{a_2}$	$\overline{\mathbf{R}}^2$
82.421** (0.000)	0.577** (0.000)	2.444** (0.000)	0.592
86.707** (0.000)	0.710** (0.000)		0.557
180.149** (0.000)		6.282** (0.000)	0.357

** Significant at the 1% level

Panel B: Value relevance over time

Year	No. obs.	Total $\overline{R}^2_{BE}$	Book value $\overline{R}^2_{B}$	Earnings $\overline{R}^2_{E}$	Incr. B $\Delta\overline{R}^2_{B}$	Incr. E $\Delta\overline{R}^2_{E}$
1968	65	0.357	0.366	0.261	0.095	-0.010
1969	72	0.398	0.400	0.189	0.209	-0.003
1970	71	0.590	0.347	0.570	0.020	0.244
1971	93	0.809	0.749	0.610	0.199	0.060
1972	96	0.756	0.688	0.572	0.184	0.068
1973	93	0.757	0.704	0.643	0.114	0.054
1974	98	0.806	0.781	0.502	0.304	0.025
1975	100	0.655	0.521	0.568	0.086	0.133
1976	104	0.699	0.700	0.131	0.568	-0.001
1977	100	0.868	0.854	0.506	0.362	0.014
1978	95	0.782	0.758	0.347	0.435	0.025
1979	97	0.671	0.670	0.355	0.315	0.000
1980	96	0.483	0.408	0.260	0.223	0.075
1981	94	0.425	0.403	0.152	0.273	0.022
1982	101	0.360	0.366	0.213	0.147	-0.006
1983	107	0.335	0.341	0.088	0.247	-0.006
1984	115	0.282	0.288	0.089	0.193	-0.006
1985	117	0.373	0.277	0.151	0.222	0.096
1986	129	0.745	0.691	0.366	0.379	0.054
1987	127	0.732	0.691	0.106	0.626	0.041
1988	117	0.976	0.976	-0.005	0.982	0.000
1989	98	0.363	0.330	0.052	0.312	0.033
1990	99	0.609	0.536	0.053	0.556	0.073
1991	91	0.425	0.403	0.152	0.273	0.022
1992	98	0.214	0.148	0.134	0.080	0.066
1993	133	0.492	0.263	0.490	0.002	0.229
1994	145	0.425	0.346	0.114	0.311	0.079
1995	164	0.590	0.580	0.228	0.363	0.010
1996	172	0.611	0.579	0.423	0.188	0.032
1997	216	0.778	0.679	0.620	0.157	0.098
1998	234	0.770	0.762	0.303	0.467	0.008
1999	217	0.344	0.339	0.166	0.178	0.005
2000	211	0.713	0.702	0.326	0.387	0.010
2001	208	0.770	0.730	0.249	0.521	0.040
2002	192	0.863	0.841	0.472	0.391	0.023
Pooled	***4,365***	***0.592***	***0.557***	***0.357***	***0.234***	***0.034***
Weighted		**0.613**	**0.569**	**0.302**	**0.311**	**0.044**
1968–1977	892	0.600	0.535	0.440	0.160	0.065
1978–1983	590	0.451	0.436	0.209	0.242	0.015
1984–1991	893	0.524	0.515	0.104	0.420	0.009
1992–1998	1,162	0.489	0.451	0.284	0.205	0.038
1999–2002	828	0.573	0.553	0.253	0.320	0.020

Panel C: Time trend regression 1968–2002

Regression: $\bar{R}_t^2 = d_0 + d_1 \cdot t + \varepsilon_t \quad t = 1–35$
(p-values in parentheses)

Dependent variable	d_0	d_1	$\bar{R}^2$
$\bar{R}^2_{BE}$	0.595** (0.000)	0.000 (0.994)	-0.030
$\bar{R}^2_{B}$	0.542** (0.000)	0.000 (0.909)	-0.030
$\bar{R}^2_{E}$	0.390** (0.000)	-0.005 (0.115)	0.045
$\Delta\bar{R}^2_{B}$	0.204** (0.004)	0.005 (0.120)	0.044
$\Delta\bar{R}^2_{E}$	0.053* (0.015)	-0.000 (0.704)	-0.026

* Significant at the 5% level; ** significant at the 1% level

Panel D: Time trend regression with dummy variables for sub-periods

Regression: $\bar{R}_t^2 = d_0 + (d_1 + d_2 \cdot D_{78–83} + d_3 \cdot D_{84\text{-}91} + d_4 \cdot D_{92\text{-}98} + d_5 \cdot D_{99\text{-}02}) \cdot t + \varepsilon_t$
t = 1–35 (p-values in parentheses)

Dependent variable	d_0	d_1	d_2	d_3	d_4	d_5	$\bar{R}^2$
$\bar{R}^2_{BE}$	0.436** (0.001)	0.043* (0.044)	-0.039* (0.011)	-0.036* (0.028)	-0.038* (0.031)	-0.035 (0.051)	0.097
$\bar{R}^2_{B}$	0.356* (0.011)	0.046* (0.038)	-0.038* (0.018)	-0.038* (0.028)	-0.041* (0.026)	-0.037 (0.050)	0.085
$\bar{R}^2_{E}$	0.402** (0.000)	0.010 (0.545)	-0.023 (0.062)	-0.023 (0.076)	-0.012 (0.386)	-0.012 (0.384)	0.347
$\Delta\bar{R}^2_{B}$	0.034 (0.769)	0.033 (0.085)	-0.016 (0.227)	-0.013 (0.374)	-0.026 (0.100)	-0.023 (0.159)	0.204
$\Delta\bar{R}^2_{E}$	0.080* (0.047)	-0.004 (0.567)	-0.001 (0.831)	0.002 (0.733)	0.003 (0.521)	0.002 (0.733)	-0.012

* Significant at the 5% level; ** significant at the 1% level

Figure 2: Residuals in the price regression plotted against the predicted price 1968–2002

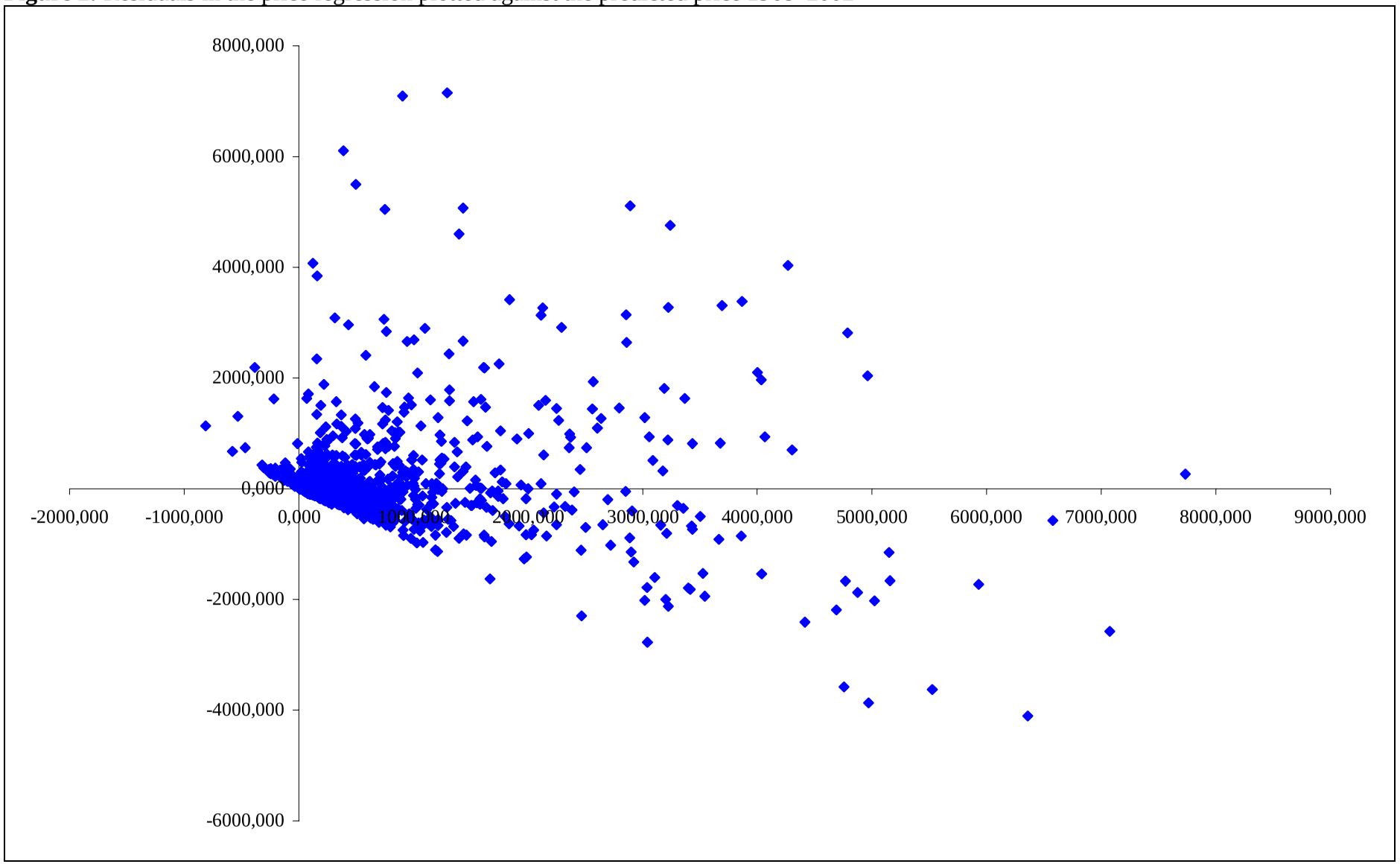

Table 4: Glejser test for detection of heteroskedasticity (and scale problems)

Panel A: 1968–2002

Regression: $|u_i| = a_0 + a_1 \hat{P}_i + \varepsilon_i$ i = 1–4365
(p-values in parentheses)

	$\hat{a}_0$	$\hat{a}_1$	$\overline{R}^2$
Before the WLS procedure	38.879** (0.000)	0.454** (0.000)	0.344
After the WLS procedure	0.789** (0.000)	0.097** (0.000)	0.006

* Significant at the 5% level; ** significant at the 1% level

Panel B: 1993–2002

Regression: $|u_i| = a_0 + a_1 \hat{P}_i + \varepsilon_i$ i = 1–1892
(p-values in parentheses)

	$\hat{a}_0$	$\hat{a}_1$	$\overline{R}^2$
Before the WLS procedure	10.193** (0.000)	0.324** (0.000)	0.143
After the WLS procedure	0.429* (0.013)	0.288** (0.000)	0.022

* Significant at the 5% level; ** significant at the 1% level

Figure 3: Value relevance measured by R^2 1968–2002 (WLS procedure)

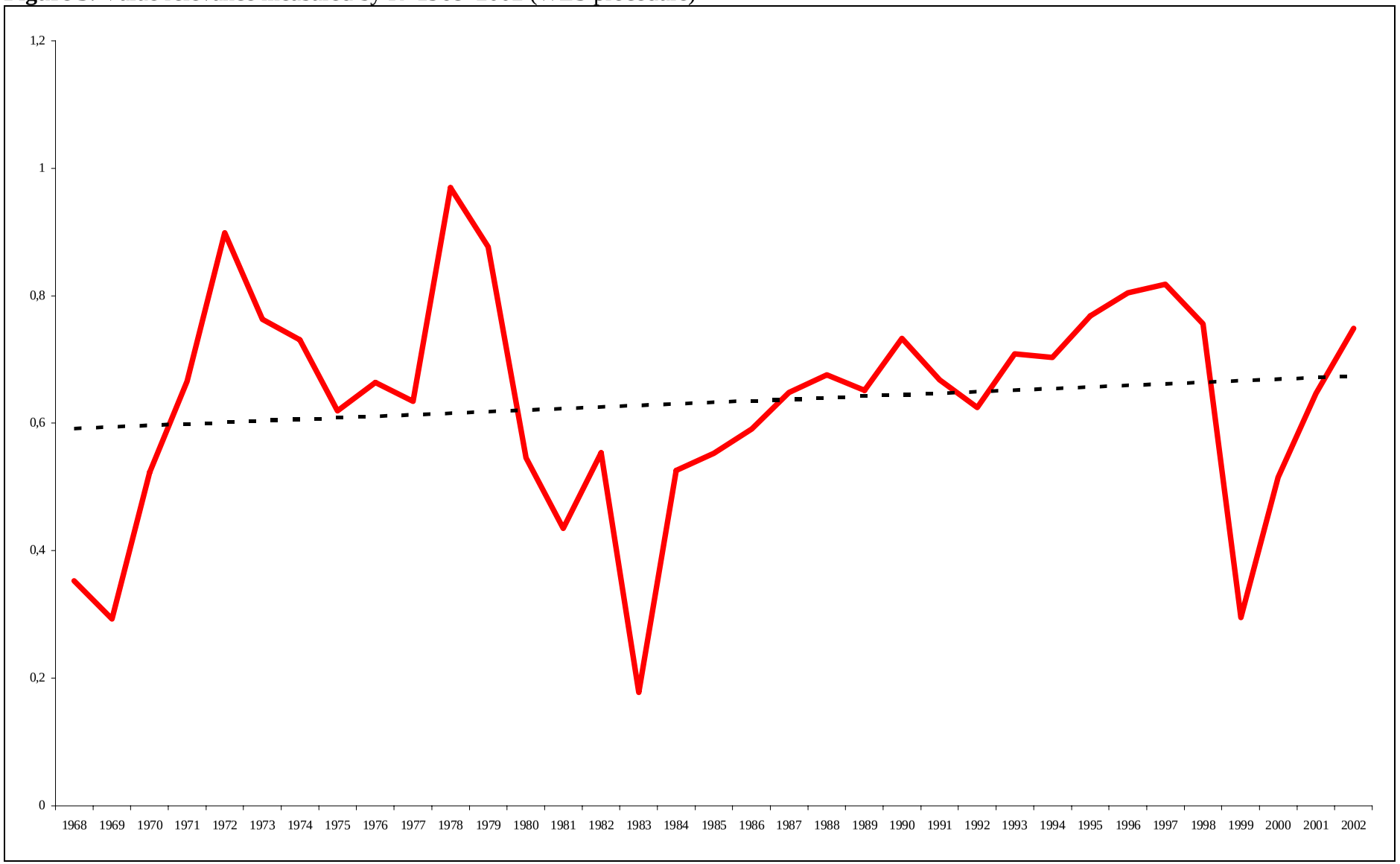

Table 5: Yearly cross-sectional regressions of price (P) on book values (B) and earnings (E) estimated by the WLS procedure 1968–2002

Panel A: Value relevance over time

Year	No. obs.	Total $\overline{R}^2_{BE}$	Book value $\overline{R}^2_B$	Earnings $\overline{R}^2_E$	Incr. B $\Delta\overline{R}^2_B$	Incr. E $\Delta\overline{R}^2_E$
1968	65	0.353	0.359	0.261	0.092	-0.006
1969	72	0.293	0.273	0.239	0.054	0.020
1970	71	0.523	0.426	0.415	0.108	0.097
1971	93	0.666	0.660	0.449	0.217	0.006
1972	96	0.899	0.877	0.773	0.126	0.022
1973	93	0.763	0.738	0.615	0.148	0.025
1974	98	0.731	0.733	0.297	0.434	-0.002
1975	100	0.620	0.576	0.437	0.183	0.044
1976	104	0.664	0.624	0.380	0.284	0.040
1977	100	0.635	0.601	0.359	0.276	0.034
1978	95	0.970	0.967	0.956	0.014	0.003
1979	97	0.877	0.872	0.839	0.038	0.005
1980	96	0.546	0.541	0.428	0.118	0.005
1981	94	0.435	0.421	0.344	0.091	0.014
1982	101	0.554	0.558	0.554	0.000	-0.004
1983	107	0.178	0.185	0.156	0.022	-0.007
1984	115	0.526	0.500	0.450	0.076	0.026
1985	117	0.553	0.508	0.413	0.140	0.045
1986	129	0.591	0.495	0.416	0.175	0.096
1987	127	0.648	0.618	0.444	0.204	0.030
1988	117	0.676	0.628	0.377	0.299	0.048
1989	98	0.652	0.645	0.451	0.201	0.007
1990	99	0.733	0.478	0.566	0.167	0.255
1991	91	0.668	0.587	0.517	0.151	0.081
1992	98	0.625	0.493	0.436	0.189	0.132
1993	133	0.709	0.657	0.579	0.130	0.052
1994	145	0.703	0.704	0.473	0.230	-0.001
1995	164	0.768	0.753	0.469	0.299	0.015
1996	172	0.805	0.770	0.529	0.276	0.035
1997	216	0.818	0.784	0.674	0.144	0.034
1998	234	0.756	0.757	0.343	0.413	-0.001
1999	217	0.295	0.295	0.216	0.079	0.000
2000	211	0.515	0.514	0.291	0.224	0.001
2001	208	0.647	0.539	0.299	0.348	0.108
2002	192	0.749	0.720	0.261	0.488	0.029
Pooled	***4,365***	***0.466***	***0.425***	***0.346***	***0.120***	***0.041***
Weighted		**0.641**	**0.606**	**0.437**	**0.204**	**0.035**
1968–1977	892	0.483	0.469	0.340	0.143	0.014
1978–1983	590	0.576	0.564	0.551	0.025	0.012
1984–1991	893	0.518	0.467	0.422	0.096	0.051
1992–1998	1,162	0.721	0.648	0.438	0.283	0.073
1999–2002	828	0.388	0.382	0.213	0.175	0.006

Panel B: Time trend regression 1968–2002

Regression: $\overline{R}_t^2 = d_0 + d_1 \cdot t + \varepsilon_t$ Time = 1–35

(t-values in parentheses)

Dependent variable	d_0	d_1	$\overline{R}^2$
$\overline{R}^2_{BE}$	0.589** (9.794)	0.002 (0.829)	-0.009
$\overline{R}^2_{B}$	0.568** (9.327)	0.002 (0.528)	-0.021
$\overline{R}^2_{E}$	0.489** (8.143)	-0.002 (-0.772)	-0.012
$\Delta\overline{R}^2_{B}$	0.100* (2.613)	0.005* (2.513)	0.135
$\Delta\overline{R}^2_{E}$	0.021 (1.198)	0.001 (0.992)	-0.000

* Significant at the 5% level; ** significant at the 1% level

Panel C: Time trend regression with dummy variables for sub-periods

Regression: $\overline{R}_t^2 = d_0 + (d_1 + d_2 \cdot D_{78–83} + d_3 \cdot D_{84–91} + d_4 \cdot D_{92\text{-}98} + d_5 \cdot D_{99\text{-}02}) \cdot t + \varepsilon_t$

t = 1–35 (p-values in parentheses)

Dependent variable	d_0	d_1	d_2	d_3	d_4	d_5	$\overline{R}^2$
$\overline{R}^2_{BE}$	0.482** (0.000)	0.026 (0.148)	-0.021 (0.112)	-0.019 (0.179)	-0.017 (0.254)	-0.024 (0.123)	0.060
$\overline{R}^2_{B}$	0.465** (0.000)	0.024 (0.188)	-0.018 (0.180)	-0.020 (0.166)	-0.016 (0.299)	-0.023 (0.153)	0.033
$\overline{R}^2_{E}$	0.451** (0.000)	-0.002 (0.899)	0.007 (0.584)	0.003 (0.850)	0.004 (0.787)	-0.003 (0.838)	0.034
$\Delta\overline{R}^2_{B}$	0.030 (0.600)	0.029** (0.005)	-0.028** (0.000)	-0.022** (0.006)	-0.021* (0.011)	-0.021* (0.014)	0.447
$\Delta\overline{R}^2_{E}$	0.016 (0.610)	0.002 (0.711)	-0.003 (0.422)	0.001 (0.806)	-0.001 (0.773)	-0.001 (0.758)	0.103

* Significant at the 5% level; ** significant at the 1% level

Table 6: Value relevance categorized by possible underlying explanatory factors (WLS procedure)

Panel A: Value relevance categorized by positive or negative earnings 1968–2002

Earnings	No. obs.	Total $\overline{R}^2_{BE}$	Book value $\overline{R}^2_{B}$	Earnings $\overline{R}^2_{E}$	Incr. B $\Delta\overline{R}^2_{B}$	Incr. E $\Delta\overline{R}^2_{E}$
Negative (and 0)	1,176	0.660	0.660	0.640	0.020	0.000
Positive	3,189	0.399	0.380	0.327	0.072	0.019

Panel B: Value relevance categorized by low, medium or high yearly stock market returns 1968–2002

Market returns	No. obs.	Total $\overline{R}^2_{BE}$	Book value $\overline{R}^2_{B}$	Earnings $\overline{R}^2_{E}$	Incr. B $\Delta\overline{R}^2_{B}$	Incr. E $\Delta\overline{R}^2_{E}$
Highest 5 years	647	0.329	0.325	0.293	0.036	0.004
Lowest 5 years	725	0.486	0.480	0.338	0.148	0.006

Panel C: Value relevance categorized by low, medium or high monthly stock market volatility 1968–2002

Market volatility	No. obs.	Total $\overline{R}^2_{BE}$	Book value $\overline{R}^2_{B}$	Earnings $\overline{R}^2_{E}$	Incr. B $\Delta\overline{R}^2_{B}$	Incr. E $\Delta\overline{R}^2_{E}$
Highest 5 years	641	0.579	0.577	0.372	0.207	0.002
Lowest 5 years	597	0.560	0.554	0.408	0.152	0.006

Table 7: Cross-sectional regression of price (P) on book values (B) and earnings (E) for all industrial sectors 1993–2002 (WLS procedure)

Panel A: Value relevance categorized by industrial sector 1993–2002

Industrial sector	No. obs.	Total $\overline{R}^2_{BE}$	Book value $\overline{R}^2_{B}$	Earnings $\overline{R}^2_{E}$	Incr. B $\Delta\overline{R}^2_{B}$	Incr. E $\Delta\overline{R}^2_{E}$
Property	57	0.908	0.868	0.543	0.365	0.040
Finance, PCC	257	0.931	0.913	0.662	0.269	0.018
Commerce	67	0.874	0.730	0.438	0.436	0.144
Manufacturing	517	0.766	0.617	0.394	0.372	0.149
IT, Comm.	262	0.370	0.363	0.336	0.034	0.007
Media, Publ.	58	0.878	0.776	0.647	0.231	0.102
Offshore	150	0.700	0.590	0.489	0.211	0.110
Shipping	315	0.779	0.742	0.311	0.468	0.037
Transport	76	0.856	0.833	0.542	0.314	0.023
Other	133	0.734	0.561	0.435	0.299	0.173
Pooled	***1,892***	***0.518***	***0.508***	***0.272***	***0.246***	***0.010***
Weighted		**0.743**	**0.662**	**0.439**	**0.305**	**0.082**

Panel B: Oslo Stock Exchange: Time trend regression 1993–2002

Regression: $\overline{R}^2_t = d_0 + d_1 \cdot t + \varepsilon_t \quad t = 1–10$

(p-values in parentheses)

Dependent variable	d_0	d_1	$\overline{R}^2$
$\overline{R}^2_{BE}$	0.773** (0.000)	-0.018 (0.350)	-0.002
$\overline{R}^2_{B}$	0.757** (0.000)	-0.020 (0.278)	0.038
$\overline{R}^2_{E}$	0.621** (0.000)	-0.038* (0.013)	0.505
$\Delta\overline{R}^2_{B}$	0.154 (0.103)	0.020 (0.164)	0.130
$\Delta\overline{R}^2_{E}$	0.016 (0.536)	0.002 (0.606)	-0.086

* Significant at the 5% level; ** significant at the 1% level

Table 8: Cross-sectional regressions of price (P) on book values (B) and earnings (E) for selected industries 1993–2002: WLS procedure

Panel A: Finance (including PCC)

Year	No. obs.	Total $\overline{R}^2_{BE}$	Book value $\overline{R}^2_{B}$	Earnings $\overline{R}^2_{E}$	Incr. B $\Delta\overline{R}^2_{B}$	Incr. E $\Delta\overline{R}^2_{E}$
1993	18	0.845	0.831	0.589	0.256	0.014
1994	20	0.938	0.934	0.693	0.245	0.004
1995	25	0.951	0.948	0.572	0.379	0.003
1996	23	0.970	0.971	0.762	0.208	-0.001
1997	25	0.949	0.945	0.753	0.196	0.004
1998	29	0.960	0.957	0.818	0.142	0.003
1999	30	0.941	0.928	0.886	0.055	0.013
2000	29	0.983	0.967	0.955	0.028	0.016
2001	29	0.978	0.960	0.830	0.148	0.018
2002	29	0.953	0.906	0.552	0.401	0.047
Pooled	***257***	***0.931***	***0.913***	***0.662***	***0.269***	***0.018***
Weighted		**0.951**	**0.938**	**0.752**	**0.199**	**0.013**

Panel B: Time trend regression 1993–2002 for finance

Regression: $\overline{R}^2_t = d_0 + d_1 \cdot t + \varepsilon_t \quad t = 1–10$

(p-values in parentheses)

Dependent variable	d_0	d_1	$\overline{R}^2$
$\overline{R}^2_{BE}$	0.902** (0.000)	0.008* (0.050)	0.325
$\overline{R}^2_{B}$	0.907** (0.000)	0.005 (0.298)	0.029
$\overline{R}^2_{E}$	0.642 (0.083)	0.018 (0.257)	0.052
$\Delta\overline{R}^2_{B}$	0.261* (0.016)	-0.001 (0.492)	-0.056
$\Delta\overline{R}^2_{E}$	-0.005 (0.560)	0.003* (0.037)	0.367

* Significant at the 5% level; ** significant at the 1% level

Panel C: Manufacturing

Year	No. obs.	Total $\overline{R}^2_{BE}$	Book value $\overline{R}^2_{B}$	Earnings $\overline{R}^2_{E}$	Incr. B $\Delta\overline{R}^2_{B}$	Incr. E $\Delta\overline{R}^2_{E}$
1993	35	0.831	0.815	0.550	0.281	0.016
1994	38	0.865	0.821	0.695	0.170	0.044
1995	47	0.788	0.758	0.673	0.115	0.030
1996	48	0.829	0.756	0.691	0.138	0.073
1997	61	0.846	0.783	0.756	0.090	0.063
1998	65	0.656	0.610	0.393	0.263	0.043
1999	55	0.788	0.735	0.532	0.256	0.053
2000	54	0.652	0.591	0.353	0.299	0.061
2001	59	0.687	0.439	0.246	0.441	0.248
2002	55	0.742	0.362	0.143	0.599	0.380
Pooled	***517***	***0.766***	***0.617***	***0.394***	***0.372***	***0.149***
Weighted		**0.760**	**0.652**	**0.489**	**0.271**	**0.108**

Panel D: Time trend regression 1993–2002 for manufacturing

Regression: $\overline{R}^2_t = d_0 + d_1 \cdot t + \varepsilon_t \quad t = 1–10$

(p-values in parentheses)

Dependent variable	d_0	d_1	$\overline{R}^2$
$\overline{R}^2_{BE}$	0.870** (0.000)	-0.018* (0.024)	0.426
$\overline{R}^2_{B}$	0.928** (0.000)	-0.047** (0.001)	0.767
$\overline{R}^2_{E}$	0.811** (0.002)	-0.056** (0.005)	0.606
$\Delta\overline{R}^2_{B}$	0.058 (0.479)	0.038* (0.018)	0.466
$\Delta\overline{R}^2_{E}$	-0.058 (0.335)	0.029* (0.013)	0.503

* Significant at the 5% level; ** significant at the 1% level

Panel E: Shipping

Year	No. obs.	Total $\overline{R}^2_{BE}$	Book value $\overline{R}^2_{B}$	Earnings $\overline{R}^2_{E}$	Incr. B $\Delta\overline{R}^2_{B}$	Incr. E $\Delta\overline{R}^2_{E}$
1993	33	0.820	0.823	0.315	0.505	-0.003
1994	36	0.845	0.840	0.477	0.368	0.005
1995	38	0.907	0.900	0.384	0.523	0.007
1996	31	0.885	0.888	0.455	0.430	-0.003
1997	36	0.883	0.855	0.420	0.463	0.028
1998	38	0.837	0.744	0.417	0.420	0.093
1999	32	0.811	0.759	0.230	0.581	0.052
2000	26	0.840	0.843	0.281	0.559	-0.003
2001	24	0.800	0.676	0.555	0.245	0.124
2002	21	0.868	0.752	0.588	0.280	0.116
Pooled	***315***	***0.779***	***0.742***	***0.311***	***0.468***	***0.037***
Weighted		**0.851**	**0.816**	**0.406**	**0.446**	**0.037**

Panel F: Time trend regression 1993–2002 for shipping

Regression: $\overline{R}^2_t = d_0 + d_1 \cdot t + \varepsilon_t \quad t = 1–10$

(p-values in parentheses)

Dependent variable	d_0	d_1	$\overline{R}^2$
$\overline{R}^2_{BE}$	0.866** (0.000)	-0.003 (0.479)	-0.052
$\overline{R}^2_{B}$	0.894** (0.000)	-0.016* (0.040)	0.358
$\overline{R}^2_{E}$	0.352** (0.002)	0.011 (0.416)	-0.030
$\Delta\overline{R}^2_{B}$	0.514** (0.000)	-0.014 (0.289)	0.031
$\Delta\overline{R}^2_{E}$	-0.028 (0.295)	0.013* (0.014)	0.498

* Significant at the 5% level; ** significant at the 1% level

Panel G: IT and Communications

Year	No. obs.	Total $\overline{R}^2_{BE}$	Book value $\overline{R}^2_{B}$	Earnings $\overline{R}^2_{E}$	Incr. B $\Delta\overline{R}^2_{B}$	Incr. E $\Delta\overline{R}^2_{E}$
1993	7	0.900	0.844	0.768	0.132	0.056
1994	9	0.904	0.759	0.878	0.026	0.145
1995	12	0.817	0.805	0.677	0.140	0.012
1996	20	0.738	0.734	0.590	0.148	0.004
1997	28	0.711	0.577	0.481	0.230	0.134
1998	32	0.713	0.628	0.530	0.183	0.085
1999	34	0.465	0.394	0.381	0.084	0.071
2000	40	0.452	0.352	0.462	-0.010	0.100
2001	40	0.204	0.215	0.192	0.012	-0.011
2002	40	0.652	0.513	0.348	0.304	0.139
Pooled	***262***	***0.370***	***0.363***	***0.336***	***0.034***	***0.007***
Weighted		**0.572**	**0.496**	**0.445**	**0.127**	**0.076**

Panel H: Time trend regression 1993–2002 for IT and communications

Regression: $\overline{R}^2_t = d_0 + d_1 \cdot t + \varepsilon_t \quad t = 1–10$

(p-values in parentheses)

Dependent variable	d_0	d_1	$\overline{R}^2$
$\overline{R}^2_{BE}$	0.981** (0.000)	-0.059** (0.005)	0.611
$\overline{R}^2_{B}$	0.916** (0.000)	-0.061** (0.001)	0.725
$\overline{R}^2_{E}$	0.872** (0.000)	-0.062** (0.000)	0.816
$\Delta\overline{R}^2_{B}$	0.110 (0.167)	0.003 (0.816)	-0.117
$\Delta\overline{R}^2_{E}$	0.065 (0.156)	0.001 (0.829)	-0.118

* Significant at the 5% level; ** significant at the 1% level

PUBLIKASJONER INNEN TELEØKONOMI 1998 –

Øystein Gjerde Kjell Henry Knivsflå Frode Sættem	*The value relevance of financial reporting on the Oslo Stock Exchange* SNF-Working Paper No. 50/2003, Bergen
Leif Jarle Gressgård Inger Stensaker	*Future Mobile Internet Services: Business Model Scenarios* SNF-Report No. 08/2004, Bergen
Øystein Foros Hans Jarle Kind Jan Yngve Sand	*Do Internet Incumbents Choose Low Interconnection Quality?* SNF-Working paper No. 20/2004, Bergen
Tommy S. Gabrielsen Steinar Vagstad	*Why is on-net traffic cheaper than off-nett traffic? Access markup as a collusive device and a barrier to entry* SNF-Working paper No. 69/2003, Bergen
Mette Bjørndal Kurt Jørnsten	*Pricing in Iterative Combinatorial Auctions* SNF-Working paper No. 68/2003, Bergen
Herbjørn Nysveen Helge Thorbjørnsen Per E. Pedersen	*Effects of WebTV on Consumer-Brand Relationships* SNF-Working paper No. 45/2003, Bergen
Leif Jarle Gressgård Leif B. Methlie Inger Stensaker	*Mobile Internet Services:* *Integration Models and Structural Determinants* SNF-Report No. 36/2003, Bergen
Hagen, Kåre P. Ola Nafstad	*Telepolitikk i Europa* SNF-rapport nr. 27/2003, Bergen
Per E. Pedersen Herbjørn Nysveen Helge Thorbjørnsen	*Identity expression in the adoption of mobile services:* *The case of multimedia messaging services* SNF-Working paper No. 26/2003, Bergen
Herbjørn Nysveen Per E. Pedersen Helge Thorbjørnsen	*Using mobile services to strengthen brand relationships:* *The effects of SMS and MMS channel additions on brand knowledge, satisfaction, loyalty and main channel use.* SNF-Report No. 22/2003, Bergen
Stemsrudhagen, Jan Ivar	*The structure of balanced scorecard:* *Empirical evidence from Norway.* SNF-Working paper No. 24/2003, Bergen
Stemsrudhagen, Jan Ivar	*The balanced scorecard and leadership:* *The system's (ir)relevance in an uncertain world.* SNF-Working paper No. 23/2003, Bergen

Spiller, Pablo T. Ulset, Svein	*Why Local Loop Unbundling Fails?* SNF-Working paper No. 87/2002, Bergen
Ulset, Svein	*The Rise and Fall of Global Network Alliances. Success or Failure?* SNF-Working paper No. 86/2002, Bergen
Ulset, Svein	*The Disintegration of Network Externalities Industries. The Computer and the Telecommunications Equipement Industries.* SNF-Working paper No. 85/2002, Bergen
Ulset, Svein	*Restructuring Diversified Telecom Operators.* SNF-Report No. 57/2002, Bergen
Ulset, Svein	*Corporate versus Contractual Knowledge Transfer to Foreign Operations. The Case of Mobile Network Operators.* SNF-Report No. 56/2002, Bergen
Andersson, Kjetil Fjell, Kenneth Foros, Øystein	*Are TV-viewers and surfers different breeds?* *Broadband demand and asymmetric cross-price effects.* SNF-Working paper No. 14/2003, Bergen
Stemsrudhagen, Jan Ivar	*The causality of strategic control: three-level construction of causality.* SNF-Working paper No. 77/2002, Bergen
Barros, Pedro Kind, Hans Jarle Nilssen, Tore Sørgard, Lars	*Media competition when the audience dislikes advertising: A theory of vertical alliance on the Internet.* SNF-Working paper No. 79/2002, Bergen.
Pedersen, Per E. Nysveen, Herbjørn	*The adoption of a mobile parking service: Instrumentality and expressiveness.* SNF-Working paper No. 76/2002, Bergen.
Foros, Øystein Kind, Hans Jarle	*Økonomiske aspekter ved Internetts markedsstruktur.* SNF-arbeidsnotat nr. 74/2002, Bergen.
Nysveen, Herbjørn Pedersen, Per E.	*Individual and cross media communication in converging media environments: A review of research on the antecedents and effects of communication using various media in marketing contexts.* SNF-Working paper No. 65/2002, Bergen
Pedersen, Per E. Nysveen, Herbjørn Thorbjørnsen, Helge	*The adoption of mobile services: A cross service study.* SNF-Report No. 31/2002, Bergen

Jensen, Sissel Sannarnes, Jan Gaute	*Prisregulering av et telenettverk: Prinsipiell analyse med særlig fokus på avkastnings- og pristaksregulering.* SNF-Report No. 37/2002, Bergen
Stemsrudhagen, Jan Ivar	*Creative SMC in a Norwegian ICT company: managerial interaction with sources of realised strategies.* SNF-Report No. 26/2002, Bergen
Stemsrudhagen, Jan Ivar	*Strategic control systems in action: managers' use of information devices in creational and institutionalising work.* SNF-Working paper No. 38/2002, Bergen
Pedersen, Per E.	*The adoption of text messaging services among Norwegian teens: development and test of an extended adoption model.* SNF-Report No. 23/2002, Bergen.
Foros, Øystein Kind, Hans Jarle Sand, Jan Yngve	*Do Incumbents Have Incentives to Degrade Interconnection Quality in the Internet?* SNF-Working paper No. 22/2002, Bergen.
Fjell, Kenneth	*Elasticity based pricing rules in telecommunications – a cautionary note* SNF-Working paper No. 19/2002, Bergen.
Kristoffersen, Siri Hege	*Prising og uforstand – ein analyse av prissetjing med ufullstendig informerte konsumentar i den norske marknaden for mobiltelefoni* SNF-rapport nr. 54/2001, Bergen.
Pedersen, Per E.	*Adoption of mobile commerce: An exploratory analysis* SNF-Report No. 51/2001, Bergen.
Gabrielsen, Tommy Stahl Vagstad, Steinar	*On how size and composition of customer bases affect equilibrium in a duopoly with switching cost* SNF-Working paper No. 26/2001, Bergen.
Berge, Laila Kristin	*Prisdiskriminering i oligopol -en teoretisk gjennomgang og eksempler fra telemarkedet* SNF-rapport nr. 13/2001, Bergen.
Bjørndal, Mette Jørnsten, Kurt	*An Analysis of a Combinatorial Auction.* SNF-Working paper No. 19/2001, Bergen.
Vagstad, Steinar	*Price discrimination with uncertain consumers.* SNF-Working Paper No. 12/2001, Bergen.

Gooderham, Paul N. Ulset, Svein	*Knowledge transfer between parent and developing country subsidiaries. A Conceptual Framework.* SNF-Working Paper No. 08/2001, Bergen.
Staahl Gabrielsen, Tommy Vagstad, Steinar	*Second-period pricing in a duopoly with switching costs: the effect of size and composition of customer bases.* SNF-Working Paper No. 09/2001, Bergen.
Pedersen, Per E.	*Adopsjon av mobil handel (m-handel) -en forstudie* SNF-rapport nr. 07/2001, Bergen.
Hundsnes, Tore	*The Management of Complexity* SNF-Report No. 58/2000, Bergen.
Knivsflå, Kjell Henry Rud, Linda Sættem, Frode	*Kapitalnettverk for små og mellomstore bedrifter* SNF-rapport nr. 72/2000, Bergen.
Foros, Øystein	*Strategic Investments with Spillovers, Vertical Integration and Foreclosure in the Broadband Access Market* SNF-Working Paper No 75/2000, Bergen
Lommerud, Kjell Erik Sørgard, Lars	*Entry in Telecommunication: Customer Loyalty, Price Sensitivity and Access Prices.* SNF-Working Paper No. 62/2000, Bergen.
Munkeby, Trygve Osvoll	*Konkurransen mellom norske internetleverandørar.* SNF-rapport nr. 48/2000, Bergen.
Pedersen, Per E. Methlie, Leif B.	*Tjenesteintegrering i elektronisk handel.* SNF-rapport nr. 21/2000, Bergen.
Methlie, Leif B. Pedersen, Per E.	*MAP-IT: A Model of intermediary Integration Strategies in online Markets.* SNF-Working Paper No. 26/2000, Bergen.
Gabrielsen, Tommy Staahl Vagstad, Steinar	*Consumer heterogeneity and pricing in a duopoly with switching costs.* SNF-Working Paper No. 25/2000, Bergen.
Ulset, Svein Gooderham, Paul	*Internasjonalisering av telesektoren. Generelle lærdommer og spesielle utfordringer for Telenor.* SNF-arbeidsnotat nr. 16/2000, Bergen.
Ulset, Svein	*Virtual Network Operation. Strategy, Structure and Profitability.* SNF-Working Paper No. 15/2000, Bergen.
Foros, Øystein	*Access Pricing, Quality Degradation and Foreclosure in the*

Kind, Hans Jarle Sørgard, Lars	*Internet.* SNF arbeidsnotat nr. 12/2000, Bergen.
Foros, Øystein Sand, Jan Yngve	*Asymmetrisk regulering innen telekommunikasjon.* SNF særtrykk nr. 03/2000, Bergen.
Ulset, Svein	*Ekspansive teleselskap. Finansiering, organisering og styring.* SNF-rapport nr. 64/1999, Bergen.
Sannarnes, Jan Gaute	*Ulike reguleringsregimer i telesektoren sett ut fra et dynamisk perspektiv.* SNF-rapport nr. 58/1999, Bergen.
Seime, Gunn Randi	*Konkurransen i det norske mobiltelefonimarkedet.* SNF-rapport nr. 49/1999, Bergen.
Methlie, Leif B. Pedersen, Per E.	*Multimedia Banking* *Bankenes strategiske situasjon. Ny teknologi – ny konkurransearena – ny struktur.* SNF-rapport nr. 41/1999, Bergen.
Pedersen, Per E.	*Multimedia Banking* *Programvareagenter i elektronisk handel. En kartlegging med vekt på agentbaserte tjenester og finanstjenestesektoren.* SNF-rapport nr. 40/1999, Bergen.
Pedersen, Per E.	*Multimedia Banking* *En agentbasert tjeneste for produkt- og leverandør-sammenlikning av finanstjenester*. SNF-rapport nr. 39/1999, Bergen.
Pedersen, Per E. Nysveen, Herbjørn Jensen, Leif Magnus	*Multimedia Banking* *En eksperimentell studie av atferdskonsekvenser ved bruken av agentbaserte tjenester i finanssektoren.* SNF-rapport nr. 38/1999, Bergen.
Fjell, Kenneth Foros, Øystein Gabrielsen, Tommy S. Hagen, Kåre P. Sørgard, Lars Vagstad, Steinar	*Problemstillinger for videre forskning på prising av tele-tjenester.* SNF-rapport nr. 27/1999, Bergen.
Fjell, Kenneth Hagen, Kåre P.	*Oversikt over forskningsprogrammet i teleøkonomi ved SNF: 1996-1998.* SNF-rapport nr. 26/1999, Bergen.

Fjell, Kenneth Foros, Øystein Hagen, Kåre P. Sørgard, Lars	*Telenor – bare lave priser ?* *Drøfting av Telenors rabattstruktur utfra et bedriftsøkonomisk og samfunnsøkonomisk perspektiv.* SNF-rapport nr. 23/1999, Bergen.
Staahl Gabrielsen, Tommy Vagstad, Steinar	*Konkurranseform i telesektoren: Hvordan rasjonalisere observert atferd?* SNF-rapport nr. 65/1998, Bergen.
Altenborg, Ellen	*Koordinering og insentiver i samarbeid om produktutvikling mellom forretningsområder i Telenor.* SNF-rapport nr. 39/98, Bergen
Methlie, Leif	*Multimedia Banking* *Strukturendring i bank. Distribusjon – grovanalyse*. SNF-arbeidsnotat nr. 31/1998, Bergen.
Methlie, Leif	*Multimedia Banking* *Strukturendring i bank. Strategisk posisjonering – grovanalyse.* SNF-arbeidsnotat nr. 30/1998, Bergen.
Foros, Øystein Ulset, Svein	*Naturlige grenser for teleselskapene.* SNF populærvitenskapelig særtrykk nr. 10/1998, Bergen.
Ulset, Svein Spiller, Pablo	*Organizing Global Seamless Networks: Contracts, Alliances and Hierarchies.* SNF Reprint No. 26/1998, Bergen.
Ulset, Svein	*Infrastruktur og konkurranse i telesektoren.* SNF særtrykk nr. 27/1998, Bergen.
Ulset, Svein	*Value-Creating Interconnect* *International Competition in Global Network Services. Technology, Organization and Performances.* SNF-report No. 28/1998, Bergen.
Ulset, Svein	*Value-Creating Interconnect* *Optimal Organization of the Converging Information and Communication Technology (ICT) Industries.* *Theoretical analysis and some illustrative data from the Norwegian market.* SNF-report No. 27/1998, Bergen.
Methlie, Leif B. Nysveen, Herbjørn	*Multimedia Banking* *Kundeatferd ved bruk av Internett og andre kanaler.* SNF-rapport nr. 29/1998, Bergen.

Ulset, Svein	*Verdiskapende samtrafikkavtaler.* *Hvordan kan organisering av infrastruktur bidra til utvikling av bedre og billigere teletjenester. En analyse av betingelsene for konkurranse og samarbeid i telesektoren.* SNF-rapport nr. 25/1998, Bergen.
Spiller, Pablo T.	*Value-Creating Interconnect.* *Unbundling and the Promotion of Local Telephone Competition: Is Unbundling Necessary in Norway?* SNF-Report No. 03/1998, Bergen.
Bjørnenak, Trond Gabrielsen, Tommy Staahl Vagstad, Steinar	*Verdiskapende samtrafikkavtaler.* *Prising av samtrafikk.* SNF- rapport nr. 02/1998, Bergen.
Andersen, Christian Sannarnes, Jan Gaute	*Analyse af tilgangsafgifter ved irreversible investeringer under usikkerhed.* SNF-rapport nr. 07/1998, Bergen.

Oversikt over publikasjoner innen teleøkonomi i perioden 1992-1997 fås ved henvendelse til eli.loetvedt@snf.no, telefon 55 95 95 00.