

The differential valuation weights of Cash Flow-based Measures versus Accrual-based Measures  
in Valuing Intangible-intensive, High-technology Stocks

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## Abstract

This paper examines the accrual versus cash-flow question by looking at value relevance issues of a sample of intangible-intensive, high-tech firms. Prior studies document the importance of accruals for valuation purposes, other studies raise questions about the effectiveness of this accrual quality in certain settings (e.g., Black, 1998). This paper extends these examinations by analyzing the systematic, cross-industry factor: intangible-intensive, high-technology. Using cross-sectional empirical methods, the evidence presented in this paper supports the hypothesis that investors in intangible-intensive, high-technology firms assign higher values to cash flows compared to accruals.

## The differential valuation weights of Cash Flow-based Measures versus Accrual-based Measures in Valuing Intangible-intensive, High-technology Stocks

### **INTRODUCTION**

In accrual-based accounting, the economic impact of an event is recognized and recorded when the event occurs rather than delaying recognition until the cash settlements. This choice to record and report cash-flow versus accrual-based measures is at the very heart of much capital markets accounting research because the differences between the two measures involve issues that define an accounting system (Kothari 2000; Chan et al., 2001). Choosing an accrual-based system would allow estimates and inter-period allocations, and choosing a cash-based system would allow a readily verifiable measurement base. More broadly, accrual reports reflect economic events on a timely basis, but cash-flow reports reflect economic events on a substantiated basis.

Both alternatives are flawed and these flaws provide justification of the other's existence. By their nature accruals can be manipulated because they are based on estimates; but, on the other hand, cash-flows can also be manipulated by deferring or advancing payments (hence, our whole accruals culture). Recently, this question of systems choice has been exacerbated because of the excessive compensation-based performance pressures that have resulted in an epidemic of accruals manipulations. However, modern economic events have also become more complex so that cash-flow measurements cannot reflect many events' economic impacts.

This paper examines the accrual versus cash-flow question by looking at value relevance issues of a sample of intangible-intensive, high-tech firms. While prior

studies document the important role and the major benefits of accruals for determining stock prices and smoothing out cash flows fluctuations of firms in general (e.g. Dechow, 1994), evidence in other studies raise questions about the effectiveness of this accrual quality in certain settings (e.g., Dechow and Dichev 2001). This paper examines intangible-intensive, high-technology firms because the ability of accruals to better match these firms' expenses with revenues have, at the same time, been met with criticisms by financial analysts who support the use of cash flow-based measures for these types of firms (e.g., The Economist 1995; Lowenstein 1996). These authors believe cash-flow measures are more useful because these numbers are less subject to distortion and discretion associated with intangible investments. The evidence presented in this paper supports the hypothesis that investors in intangible-intensive, high-technology firms assign higher values to cash flows compared to accruals.

## **BACKGROUND**

### **1. Accruals vs. Cash flows**

Since Ball and Brown's (1968) seminal study, accounting academicians have extensively researched the information content of firms' accounting earnings and cash flows. However, existing evidence concerning the relative role of accrual earnings and cash flows in determining security prices is somewhat mixed. For example, Ball and Brown (1968), Beaver and Dukes (1972), and Greenberg et al. (1986), Dechow (1994), to name a few, find that earnings are more value-relevant than are cash flows. On the other hand, Wilson (1986), Rayburn (1986) and Bowen et al. (1987), to name a few, find cash flow measures more relevant to market prices than accrual measures.

Recent research has also extends the examination to the components of cash flows and accruals. Bowen et al. (1987) report that the market responds more favorably to cash flow than to current accruals, and to current accruals more than to long term accruals. Livnat and Zarowin (1990) examine the cash flow components and report that the disaggregation of cash flow into its financing and operating components significantly improves the degree of association of cash flows with security returns. Dechow and Dichev (2001) test for the informativeness of working capital and their results suggest that accruals correct for the timing problems of cash flows but at the cost of including errors in estimation that lead to lower accrual quality for earnings persistence.

In addition to examining components within companies, other research examines industry-level differences. Biddle et al. (1995) report that the incremental and relative information contents of net income, operating cash flows, and net sales vary across industries. Black (1998) investigates the impact of the life-cycle stages on firms' performances over a wide sample of firms. Looking at four life-cycle stages (start-up, growth, maturity, and decline), he documents that accrual earnings are more value-relevant in mature stages, whereas cash flows are more value-relevant in stages characterized by growth. Growth industries include those with intangible-intensive, high-technology characteristics, which suffer from timing and matching problems.

## **2. Intangible-intensive, High-technology Industries**

Based on the previous discussion, neither cash-flow based measures nor accruals-based measures are consistently more informative. Rather than asking which is more informative, I ask under what conditions are cash-based or accruals-based

measures more informative. I base my investigation on Black's (1998) study and apply it to an industry-level analysis rather than a life-cycle analysis.

Liu (2000, p. 2) states that, "Intangible-intensive, high-tech firms are generally characterized by high growth, a continuum of innovations, market uncertainty, and an intensive investment in research and development, which is the largest and most important component of their production and investment functions." Intangible investments are critical for the creation of value for these firms. Liu (2000) notes that there has been a large growth of research and development investments in intangible-intensive high-technology industries over the last decade has witnessed, therefore, it is likely that evidence of the relative importance of cash flow versus accruals in valuation will also exist over this period.

Research and Development is a proxy for many firms' valuable intangible assets, most of which are unrecognized under present U.S. GAAP (e.g., Hirschey and Weygandt 1985; Barron et al., 2002). The standard accounting treatment of intangible expenditures is shaped by the perceived degree of uncertainty about their future economic benefit; however, much evidence exists as to their stock price relevance (see Maines et al., 2002). Chambers et al. (2002) examine this link for research and development "intensity" in high-technology firms. Their evidence suggests that research and development has a significant association with market values and represents innovative work and new product development. Consequently, the accrual-based information is likely to be less informative than the cash-based information for these firms.

### **3. Hypotheses**

Based upon the foregoing discussion, the first hypothesis is:

**H1:** *Cash flow measures have a larger effect on the market value of intangible-intensive, high-technology firms than do accrual measures.*

The first hypothesis examines whether investors attach lower weight to accrual-based measures than to cash flow–based measures when valuing intangible-intensive high-technology stocks. The second hypothesis draws from prior research by Rayburn (1986), Wilson (1986), and Bowen et al. (1987) who find that current accruals have a different impact on market price reactions than do non-current accruals. More recently, Barth et al. (2001) disaggregate accruals into several current and non-current categories and report increased predictive ability for future cash flows. If investors are interested in predicting future cash flows, then components of accruals should also map into firm value. Further, investors in the intangible-intensive high-technology firms should weigh the cash flow measures more than the accruals components in valuing stocks. The second hypothesis is:

**H2:** *Cash flow measures are expected to have incremental value-relevant information beyond that contained in accrual components for explaining the variation of the market values of intangible-intensive, high-technology firms.*

## **SAMPLE SELECTION AND VARIABLES**

### **1. Sample Selection**

This study tests for the value-relevance of cash flows and accruals components in intangible-intensive high-technology industries, where the accrual versus cash flow question is sharpest. Intangible-intensive high-technology (IIHT) firms are identified in two steps. In today’s economy, nearly every industry contains

some element of technology, and even the most technologically intensive industry will include low-tech elements. Given this caveat, the first step examines Research and Development intensity to identify high-technology firms (this method is also used by Hirschey and Weygandt 1985; Chan et al. 1990; Barron et al. 2002). The second step is to employ the market-to-book ratio to verify the presence of intangibles (Hirschey and Weygandt 1985; Collins et al. 1997; Lev 2001).

Sample firms and their three-digit SIC code, market value of equity at year-end, number of year-end outstanding shares, book value of equity, total assets, and research and development expenses are selected from COMPUSTAT for 1992 to 2001. Firms with any missing data are dropped. Research and development intensity (R&D) is calculated as follows. For each industry, the sum of member firm research and development expenses is scaled by the industry sum of total assets by year. Then, the industry mean of this scaled research and development expense forms the research and development intensity (R&D). In order to identify IIHT industries, the pooled annual industry R&D averages are calculated and those industries with pooled averages greater than 6% are IIHT and those industries with pooled averages less than 1% are low intangibles and low technology (LILT) industries.<sup>1</sup> This results in 55 IIHT (Panel A, Table 1) industries and 52 LILT (Panel B, Table 1) industries. In Table 1, some individual year's intensity measures may fall below or above the cut-offs because it is assumed that R&D cannot be restricted to a single year's measure.

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<sup>1</sup> The OECD (1995) identifies intangible-intensive high-technology industries as those whose R&D is greater than 6%, whereas, those whose R&D is less than 1% are considered low-technology industries. This is consistent with Franzen (2000) who uses a 10% cut-off for IIHT and with Blonigen and Taylor (2000) who document that the average R&D across IIHT is 9.7 percent.

Following Francis and Schipper (1999) and Choi et al. (2003), this study also assesses the extent to which the two sets of high- and low-technology industries differ along the selected dimension of unrecognized intangible investments. The mean firm market-to-book ratio is 8.10 for IIHT industries compared to 1.50 for LILT industries ( $p < 0.0001$ ) and suggests that R&D also adequately classifies firms intangible-intensive. Francis and Schipper (1999) reports the average market-to-book ratio is 3.18 for high-technology firms versus 1.57 for low-technology firms, but also notes that the number of high technology firms increase significantly in the later years of their sample period. Also, the average R&D for our IIHT is 21.3% compared to 0.7% for LILT. Francis and Schipper (1999) report that average high-technology firms R&D is 9.2% compared to 0.8% for low-technology firms. It is concluded that selected sample can be appropriately identified by the level of their intangible benefits from technology.

## 2. Variables and Model

The two basic models used to test the hypotheses are in the following OLS regressions:

$$MV_{it} = \beta_0 + \beta_1 BV_{it} + \beta_2 (H * CFO_{it}) + \beta_3 (L * CFO_{it}) + \beta_4 (H * ACC_{it}) + \beta_5 (L * ACC_{it}) + \beta_6 GR_{it} + \varepsilon_{it} \quad (1)$$

and

$$MV_{it} = \beta_0 + \beta_1 BV_{it} + \beta_2 (H * CFO_{it}) + \beta_3 (L * CFO_{it}) + \beta_4 (H * \Delta AR_{it}) + \beta_5 (L * \Delta AR_{it}) + \beta_6 (H * \Delta INV_{it}) + \beta_7 (L * \Delta INV_{it}) + \beta_8 (H * \Delta AP_{it}) + \beta_9 (L * \Delta AP_{it}) + \beta_{10} (H * DA_{it}) + \beta_{11} (L * DA_{it}) + \beta_{12} GR_{it} + \varepsilon_{it}. \quad (2)$$

In the above models, H is a dummy variable equal to 1 (otherwise 0) if the firm is a member of an IIHT industry, and L is a dummy equal to 1 (otherwise 0) if the firm is a member of LILT industries.

Variable definitions are as follows.  $CFO_{it}$  is the per share cash flow from operations with research and development expense added back. This assumes that research and development expenses are paid in cash.  $ACC_{it}$  is total accruals and is the difference between earnings before extraordinary items and discontinued operations and cash flow from operations (Dechow and Dichev 2001; Ahmed et al. 2001).  $MV_{it}$  is market value of equity at the fiscal year-end t for firm i (the closing price of common stock),  $BV_{it}$  is year-end (t) book value of equity per share for firm i,  $GR_{it}$  is sales growth over previous year (e.g., Barth et al. 2001; Core et al. 2001). In model (2), the accruals are broken down (Barth et al. 2001).  $\Delta AR_{it}$  is one-period change in the annual accounts receivable for firm i, and similarly,  $\Delta INV_{it}$  is change in the inventory,  $\Delta AP_{it}$  is the change in accounts payable, and  $DA_{it}$  is the annual depreciation and amortization expense; these accruals components are on a per share basis.

The previous data were retrieved for 3,439 firms and 14,109 firm-years from 58 SIC3 industries. This initial sample included 2067 IIHT firms and 1372 LILT firms from 15 IIHT industries and 43 LILT industries. Firms with missing price, book value, cash flow, or accruals data were deleted. Eliminations were also made when share prices were greater than \$500 or less than \$1, when book value per share was less than \$0.00, and when growth exceeded 250% (the 99<sup>th</sup> percentile) in one year; these filters left 9102 firm-years from 1526 IIHT firms and 543 LILT firms.

## **RESULTS**

### **1. Descriptive Statistics**

The descriptive statistics are provided in Table 2. Panel A presents the mean, median, and standard deviation for the whole sample, the means for each of the IIHT and the LILT subsamples, and t-statistics for the subsample differences. For the sample as a whole, the mean (median) share price (market value per share) is 13.99 (8.32) and the mean (median) book value per share is 5.82 (3.54). The IIHT firms are slightly larger than the LILT firms (the t-statistic on the difference is 2.22), but significantly smaller based on book value (\$5.24/share versus \$8.93/share, t-statistic on the difference is 12.46). In all the other measures, IIHT firms are smaller than LILT firms. The negative sign for the accruals (ACC) is consistent with Barth et al. (2001) who point out that that depreciation and amortization are deducted from income, yet their acquisition is an investing activity (remember that accruals equals earnings less cash flow). The mean OTHER is also negative, and because it represents the remaining accruals derived by calculation rather than measurement, it indicates that the net unspecified accruals are income increasing.

Panel B presents the Pearson correlations for the whole sample. Many of the variables are positively correlated, and suggest that they are value-relevant. As expected in H<sub>1</sub>, CFO measures are significantly positively correlated with market value of equity (MV), whereas ACC measures are negatively correlated (although CFO and ACC are positive).

### **2. Regression Results**

Pooled cross-sectional regressions are conducted for each of the regression models, and the results are presented in Table 3 (hypothesis 1) and in Table 4 (hypothesis 1). Each table contains the coefficients, t-statistics, and p-values for the accounting variables as well as the explanatory power for each of the valuation regressions.

Hypothesis 1 predicts that CFO is more significantly correlated than AC with market value of equity of intangible-intensive high-technology firms. The empirical results support the hypothesis. In column (1), fundamental relationships for the whole sample are reported and indicate that book-values and cash flows have significant associations with firm value. The lack of significance for the accruals suggests that the accrual information is already impounded via the other variables. Book value is based on accrual accounting and CFO carves out the cash flow information not reflected in the other accruals based measures.

Column 2 presents the basic results for tests of hypothesis 1. The coefficient for the IIHT cash-flow,  $H^*CFO$ , is larger than the coefficient for the LILT firm cash flow,  $L^*CFO$ , (1.06 versus  $-0.81$ ) and is of opposite sign. This suggests that higher cash flows increase the value of IIHT firms. The coefficient for accruals (ACC) is negative for IIHT firms and positive for LILT firms, suggesting that investors in IIHT firms do assign higher market values from higher accruals, but investors in LILT firms do. These results are restated in columns 3 and 4. Column 3 does not assume the IIHT effect on market value is only through the cash flow and accrual variables. Higher market values may be assigned outside of the accounting variables, (e.g. because the IIHT firms are in “glamor” industries), so a fixed effect is also included

and the results parallel those in column 2. In Column 4, a more restrictive definition of IIHT is employed by using a 20% R&D cutoff. Again, results parallel those in column 2. In conclusion, the results support the hypothesis that investors value, on average, a dollar of cash flows higher than a dollar of accruals for intangible-intensive, high-technology firms.

Hypothesis 2 predicts that CFO have incremental value-relevant information over the individual components of accruals. In Table 4, results of a basic accruals component model are presented in column 1. In untabulated results, regressions of the model  $MV=B_0 + B_1BV + B_2ACC + B_3GR$ , where accruals are not divided into its components, provides an R-square of 0.26. The accruals components model in column 1 has a R-square of 0.42, indicating that the components are more informative than the total accruals alone. Including cash flow (in column 2) increases the R-square to 0.43 and the CFO variable is significant ( $t=10.62$ ). Thus, the cash flow is informative to investors in IIHT and LILT firms. Similar relationships are examined in columns 3 and 4.

In column 3, the accruals components of each of the IIHT and LILT firms are tested for significance. The R-square increases from 0.42 (column 1; and from 0.40 in untabulated results of the model:  $MV=B_0 + B_1BV + B_2ACC*H + B_3ACC*L + B_4GR$ ) to 0.44 in column 3, when the effects of the accruals components on the values attributed to each of the industry types (IIHT versus LILT) are separately tested. In column 4, the cash flow measures are interacted with the subsample dummies (IIHT and LILT) and provide (a) more information to explain the market valuation (the R-square rises again to 0.45), and (b) confirmation of the higher valuation assigned by

IIHT firms to cash flows (the coefficient on  $H^*CFO$  is 0.48,  $t=9.76$ ). Therefore, the results indicate that, as predicted, cash flow measures provide more value-relevant information beyond that of individual accrual components: short-term and long-term accruals, when explaining the variation of the market values of intangible-intensive, high-technology firms.

### **3. Sensitivity and Additional Tests**

This study conducts a number of additional analyses to examine the sensitivity and robustness of the empirical results. First, to assess the sensitivity of the empirical results and to ensure that results are not influenced by the selection of the scale deflator, this study also deflates the valuation model by book value of equity, rather than shares outstanding. Dividing all variables in the valuation models by these alternative measures of firm value (market value and book value of equity) aims to remove the per-share effect because all variables are expressed as ratios. The result of the sensitivity check suggests that the study's inferences are insensitive to the choice of deflator.

Second, the study addresses the possibility that its estimation results may be sensitive to the time period, because during the first part of the study's sample period intangible-intensive, high-tech firms experienced rapid and dramatic increases in their stock prices. However, at the beginning of 2000, the stock prices of high-growth high-tech firms fell dramatically. To check whether investors' responses to the accounting-based measures are robust to the volatile market condition in 2000, this study repeats the valuation regressions for the pre-2000 period (1992-1999). The

results indicate that this study's inferences are unaffected by the selected time period and are reliable and comparable across firms and through time.

Third, to ensure the empirical results are not sensitive to the cut-off percentage of R&D-intensity used to determine high- and low-tech firms, this study stratifies the sample and runs empirical tests on two alternative ranges of R&D intensities: 10% for high-tech firms, and 20% for high-tech firms. As shown in Table 3, the sensitivity analysis suggests that the study's findings are not attributable to the precise level of R&D intensity, as measured by the ratio of R&D spending to total assets.

Fourth, the natural question that may arise is the extent to which the results might be affected by collinearity among the independent scaled variables. Multicollinearity of both the dependent and independent variables can be detected by conducting two alternative sets of diagnostic techniques. The Belsley, Kuh, Welsch (BKW, 1980) condition indices indicate that mild multicollinearity exists if the maximum condition index is between 5 and 10 and severe multicollinearity exists if the condition index is 30. Also, the variance inflation factor (VIF) indicates that severe collinearity exists if the critical value of VIF is 10. Diagnostic tests indicate that none of this study's inferences are influenced by multicollinearity problem among the independent scaled variables since the BKW condition index is below 5, and the highest value of the correlation coefficients among the explanatory variables for all firm-year observations is only 0.82.

## **CONCLUSIONS**

This paper presents results of an examination of the value relevance of accruals versus cash-flows in intangible-intensive, high-tech firms. Prior studies have indicated that the valuation of these measures differs across industries (e.g. Black, 1998). This study contributes to the literature by examining a systematic, cross-industry factor that is likely to effect the relative valuations of accruals and cash flows, namely the extent to which intangibles are reflects in the balance sheet. Evidence is reported that indicates that because intangible-intensive, high-tech firms are not able to adequately reflect the value of intangibles in their statements, then investors in IIHT firms turn to cash flow measures as an alternative to accruals for valuing their investments.

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**Table 1**

Research and development intensity (R&amp;D) by industry for each year 1992 to 2001

## Panel A: R&amp;D for high-technology industries

<u>SIC3</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>
5140	0.03593	0.05275	0.07325	0.29748	0.12945	0.00000	0.00573	0.00161	0.00000	0.00000
7600	0.14676	0.07188	0.05175	0.07191	0.10010	0.08285	0.02570	0.02780	0.03583	0.00698
8000	0.15150	0.19358	0.21118	0.10077	0.00300	0.03239	0.05114	0.00899	0.01202	0.01160
3850	0.04739	0.06226	0.18953	0.06487	0.06213	0.09265	0.12858	0.04334	0.03025	0.03761
8720	0.05754	0.05425	0.04491	0.02876	0.02812	0.02853	0.33186	0.04344	0.03888	0.03878
100	0.06247	0.07588	0.07975	0.09045	0.09600	0.08535	0.08232	0.0637	0.03918	0.04310
8700	0.01585	0.03600	0.04003	0.06140	0.04155	0.15531	0.15838	0.04659	0.04288	0.06858
3990	0.04677	0.02930	0.03552	0.10739	0.05783	0.05378	0.06367	0.08410	0.06278	0.07015
6160	0.00000	0.00000	0.00000	0.11506	0.04332	0.12968	0.46594	0.01604	0.0705	0.08432
3230	0.10802	0.11362	0.11622	0.08459	0.05705	0.04418	0.09637	0.08661	0.08297	0.10493
3740	0.01998	0.02124	0.02266	0.02109	0.01885	0.02678	0.02565	0.32397	0.05617	0.11415
2720	0.41153	0.30317	0.19665	0.08675	0.09572	0.07750	0.05464	0.02598	0.0009	0.00155
3360	0.01016	0.17351	0.15244	0.10901	0.15183	0.13846	0.17348	0.16226	0.2066	0.00705
3430	0.06893	0.05431	0.04506	0.04673	0.03563	0.04827	0.12751	0.44087	0.1614	0.03278
6200	0.24594	0.10764	0.09821	0.15759	0.28532	0.11383	0.16985	0.04614	0.0528	0.03623
3610	0.35123	0.07937	0.08508	0.07338	0.07068	0.10022	0.07144	0.06984	0.0466	0.04733
8200	0.05452	0.00997	0.04767	0.12274	0.05185	0.03066	0.31239	0.70802	0.1108	0.04908
8740	0.27545	0.20433	0.27672	0.26009	0.04045	0.04485	0.02539	0.03416	0.0510	0.05538
4840	0.05947	0.02754	0.04727	0.30865	0.01091	0.01625	0.23705	0.02521	0.0388	0.05989
3690	0.31266	0.06736	0.06630	0.10382	0.07809	0.08610	0.15170	0.12467	0.0695	0.07803
3550	0.11044	0.11594	0.10539	0.09745	0.10580	0.10793	0.12910	0.09917	0.0790	0.10794
3620	0.05253	0.05164	0.05566	0.06089	0.07176	0.08228	0.11903	0.17670	0.1001	0.11086
6280	0.26670	0.21034	0.18289	0.16521	0.18614	0.13323	0.11911	0.10073	0.0246	0.13348
7310	0.17897	0.06138	0.02159	0.10308	0.05457	0.23208	0.23427	0.08230	0.1405	0.14156
7380	0.05430	0.05645	0.12369	0.05602	0.05847	0.11882	0.44282	0.05705	0.1159	0.14785
3670	0.12955	0.14092	0.13978	0.12607	0.14060	0.16104	0.20825	0.15076	0.1939	0.15348
2870	0.17601	0.22730	0.66378	0.54127	0.30678	0.11082	0.13362	0.11543	0.0999	0.15826
6410	0.03104	0.08667	0.02821	0.03115	0.07610	0.08249	0.12357	0.08134	0.7167	0.15875
3580	0.03335	0.11362	0.04954	0.03753	0.12116	0.05728	0.08690	0.22059	0.5080	0.15965
3840	0.15403	0.18960	0.17105	0.30610	0.14027	0.19695	0.21387	0.20994	0.1578	0.16703
3820	0.13784	0.12257	0.21887	0.20301	0.16331	0.12666	0.17260	0.21674	0.2106	0.17187
3660	0.10954	0.12833	0.16049	0.17259	0.17044	0.13818	0.21880	0.15963	0.1576	0.18428
3720	0.79755	0.05496	0.05353	0.03572	0.03455	0.03185	0.03940	0.16340	0.2019	0.20318
3570	0.22641	0.18538	0.20834	0.18565	0.19046	0.18009	0.24989	0.16496	0.1789	0.20348
3860	0.06298	0.10373	0.07111	0.08075	0.07909	0.11945	0.11587	0.11877	0.1173	0.20609
7330	0.05946	0.06250	0.09097	0.11217	0.04920	0.02334	0.66456	0.14031	0.2002	0.22600
4820	0.09960	0.10797	0.09460	0.10414	0.09360	0.16014	0.25165	0.05999	0.0808	0.22795
8710	1.23062	0.10251	0.06216	1.11076	0.02667	0.04540	0.01891	0.01714	0.1075	0.24379
2750	0.05709	0.21759	0.20932	0.10011	0.12945	0.22952	0.33724	0.09704	0.0789	0.27136
2740	0.35927	0.15494	0.21841	0.79163	0.05495	0.29940	0.22242	0.86441	0.3887	0.30084
2820	0.07584	0.10292	0.11322	0.11992	0.11416	0.11199	0.14359	0.23342	0.1333	0.30807
8730	0.22710	0.23042	0.26765	0.63185	0.74199	0.28657	0.58691	0.41118	0.2438	0.33861
2830	0.32920	0.27768	0.53818	0.50106	0.32639	0.32870	0.47189	0.51529	0.3186	0.34561
7370	0.18892	0.27787	0.22101	0.22108	0.21774	0.26422	0.24946	0.17659	0.2226	0.44002

2650	0.01463	0.01203	0.01170	0.01189	0.61141	0.48303	0.02980	0.07508	0.1115	0.47703
3510	0.03605	0.03318	0.03826	0.03888	0.04322	0.03977	0.27700	0.24941	0.9289	0.50744
7810	0.01910	0.02816	0.20824	0.03231	0.03468	0.04535	0.08551	0.06750	0.7046	0.55462
3390	0.11044	0.09153	0.06914	0.03436	0.02014	0.04063	0.03850	0.09851	0.0629	0.57569
8070	0.09686	0.09296	0.09596	0.11248	0.06518	0.14003	0.05388	0.17196	0.1116	0.61688
9990	0.35290	0.14158	0.15178	0.14488	0.12754	0.11010	0.35678	0.12666	0.1061	0.71118
4890	0.07864	0.06009	0.01710	0.01690	0.14321	0.10711	0.11142	0.08740	0.0624	0.72923
3650	0.06784	0.05809	0.08593	0.10357	0.14561	0.21071	0.49388	0.28082	0.5317	0.73924
2840	0.03831	0.07540	0.09398	0.05617	0.06770	0.06827	0.10326	0.06985	0.0882	0.92808
4950	0.15106	0.15540	0.14285	0.23055	0.08600	0.07285	0.09419	2.58844	22.5557	1.74304
5960	0.02029	0.02813	0.03229	0.02882	0.05035	0.03149	0.06276	0.02636	0.0823	4.66458

**Table 1 (continued)**

Research and development intensity (R&amp;D) by industry for each year 1992 to 2001

**Panel B: R&D for low-technology industries**

<u>SIC3</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>
2320	0.002845	0.003129	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
5010	0.002585	0.003081	0.008142	0.005373	0.003726	0.002910	0.000639	0.000171	0.000000	0.000000
5070	0.000000	0.000000	0.000000	0.000000	0.000000	0.000645	0.000758	0.000110	0.000083	0.000000
5190	0.012393	0.011528	0.020434	0.005148	0.00555	0.005920	0.000859	0.000995	0.000000	0.000000
5730	0.000000	0.000000	0.000000	0.000000	0.000666	0.000000	0.000000	0.010780	0.007262	0.000000
5900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000374	0.000000	0.000000	0.000000	0.000000
6320	0.061905	0.031627	0.009361	0.007662	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
7500	0.000410	0.001681	0.001909	0.001001	0.000769	0.001310	0.001483	0.000302	0.000000	0.000000
8080	0.009892	0.012183	0.003887	0.002032	0.004076	0.000000	0.000000	0.000000	0.000000	0.000000
5410	0.000138	0.000119	0.000121	0.000080	0.00001	0.000010	0.000040	0.000015	0.000018	0.000020
7010	0.000012	0.000000	0.001462	0.006615	0.000027	0.000039	0.000024	0.000018	0.000030	0.000045
5810	0.000044	0.000085	0.000394	0.000084	0.000056	0.000058	0.000087	0.000083	0.000079	0.000104
5910	0.035921	0.009887	0.011854	0.009062	0.008872	0.011336	0.000383	0.000828	0.000000	0.000266
1090	0.001064	0.000820	0.000791	0.000977	0.001874	0.000834	0.000909	0.000786	0.000875	0.000712
2070	0.001940	0.001761	0.002298	0.001691	0.0011	0.001074	0.001236	0.001568	0.003654	0.000830
2330	0.000965	0.001698	0.001333	0.001281	0.000524	0.000658	0.000059	0.000502	0.000753	0.000895
5200	0.001876	0.001236	0.000988	0.000895	0.000779	0.000767	0.000718	0.000959	0.001508	0.002050
2600	0.005535	0.005694	0.005752	0.004621	0.003982	0.003734	0.003623	0.002907	0.002185	0.002476
1700	0.022173	0.011145	0.000630	0.000000	0.000664	0.001389	0.002466	0.003836	0.002572	0.002545
2400	0.004122	0.003295	0.003295	0.002942	0.003019	0.005680	0.005579	0.004156	0.002988	0.002699
2630	0.008907	0.008778	0.005125	0.005476	0.005602	0.005600	0.006978	0.003847	0.002927	0.002724
5080	0.009323	0.009865	0.012086	0.006956	0.008605	0.009656	0.004695	0.002380	0.003109	0.003273
6510	0.006629	0.003933	0.003733	0.004019	0.005342	0.006936	0.005425	0.006028	0.003907	0.003296
3270	0.006017	0.007101	0.006676	0.008315	0.006053	0.008501	0.007113	0.008963	0.008086	0.004213
5940	0.000000	0.000000	0.000000	0.000000	0.000000	0.003255	0.001172	0.000883	0.002314	0.004777
3330	0.007972	0.007821	0.008539	0.024317	0.024376	0.018220	0.017575	0.005708	0.005742	0.005254
2010	0.004847	0.005182	0.004994	0.005137	0.002793	0.005613	0.005784	0.005695	0.005842	0.005307
3410	0.005628	0.005957	0.006632	0.007972	0.009208	0.009065	0.007139	0.006168	0.005040	0.006085
1400	0.005815	0.004173	0.005426	0.006803	0.007248	0.007256	0.006676	0.006240	0.004417	0.006398
2030	0.006399	0.007115	0.006838	0.008929	0.009293	0.009098	0.011780	0.009200	0.009631	0.007493
5060	0.005014	0.003563	0.004708	0.003266	0.003329	0.007175	0.007853	0.010840	0.016772	0.007809
3340	0.007828	0.014229	0.010041	0.009532	0.008563	0.011125	0.011906	0.011132	0.009804	0.008061
2060	0.006678	0.005980	0.005546	0.005449	0.004579	0.005570	0.008402	0.007065	0.005705	0.008160
7990	0.000789	0.000670	0.000400	0.001303	0.001078	0.002459	0.009162	0.007272	0.007785	0.008318
5090	0.018830	0.018877	0.023688	0.019253	0.006308	0.008177	0.004811	0.005745	0.004954	0.008433
2590	0.015271	0.013370	0.012997	0.012676	0.012367	0.012800	0.009813	0.010602	0.009571	0.008517
3320	0.019009	0.015372	0.013610	0.014380	0.012455	0.011952	0.010472	0.010542	0.009278	0.009901
7350	0.003406	0.012847	0.006482	0.005877	0.006032	0.006765	0.009428	0.045225	0.029558	0.009916
3460	0.025799	0.016530	0.001999	0.004429	0.005367	0.014807	0.019275	0.024400	0.005637	0.010004
3470	0.011192	0.010909	0.011364	0.011990	0.013168	0.010467	0.006506	0.007117	0.007123	0.010220
7830	0.000000	0.011581	0.026073	0.003946	0.002455	0.005625	0.007539	0.005565	0.007826	0.012043
2610	0.001471	0.001189	0.002734	0.002955	0.007666	0.011422	0.014280	0.014607	0.014031	0.012099
2000	0.019415	0.016370	0.013833	0.010804	0.011905	0.010680	0.010409	0.011803	0.012218	0.012105
2510	0.012162	0.009263	0.009021	0.009161	0.015152	0.012219	0.009515	0.009813	0.011761	0.012543
1000	0.003126	0.004375	0.004832	0.005502	0.005529	0.004767	0.004481	0.003423	0.005375	0.012933
2760	0.016143	0.015657	0.014096	0.013281	0.012383	0.013906	0.012539	0.011735	0.011363	0.017170
3450	0.013005	0.011204	0.010527	0.011196	0.007066	0.012966	0.010130	0.018650	0.020899	0.018182
5990	0.000000	0.000000	0.000000	0.000775	0.000996	0.009365	0.034087	0.017795	0.062706	0.019003
1540	0.009169	0.007679	0.006650	0.001310	0.002849	0.003801	0.004750	0.008207	0.000000	0.019386
2540	0.017419	0.011689	0.009950	0.011069	0.007916	0.009367	0.008271	0.014276	0.014751	0.019498
8060	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000263	0.008205	0.026274
3310	0.008332	0.006582	0.007384	0.007139	0.008562	0.007779	0.006678	0.004524	0.005623	0.026663

SIC3 Three digit SIC code defined industry.

R&D Research and Development intensity, calculated as Research and Development expense divided by Total Assets.

**Table 2**  
**Variable Distributions**

Panel A: Distributional statistics for all firm-year observations

variable	mean	median	Standard deviation	IIHT	Not-IIHT	t-statistic for difference
MV	13.99	8.332	21.33	14.15	13.11	2.22*
BV	5.82	3.545	11.56	5.24	8.93	12.46*
CFO	1.11	0.680	5.79	1.07	1.28	1.39
ACC	-0.82	-0.224	11.19	-0.72	-1.37	2.21*
$\Delta$ AR	2.09	0.874	5.50	2.02	2.46	3.66*
$\Delta$ INV	2.00	0.504	6.11	1.54	4.46	15.44*
$\Delta$ AP	1.11	0.343	3.06	0.85	2.50	15.91*
AMORT	0.14	0.002	0.57	0.13	0.17	2.44*
OTHER	-0.76	-0.278	7.61	-0.67	-1.24	1.58
GR	4.25	0.570	53.96	3.68	7.33	2.58*

Panel B: Pearson correlations for all firm-year observations:

	BV	CFO	ACC	$\Delta$ AR	$\Delta$ INV	$\Delta$ AP	AMORT	OTHER	GR
MV	0.62*	0.17*	-0.08*	0.49*	0.45*	0.37*	0.22*	-0.06	0.01
BV		0.04*	-0.30*	0.72*	0.75*	0.58*	0.24*	-0.18*	-0.01
CFO			0.64*	0.20*	0.25*	0.15*	0.07*	0.36*	0.01
ACC				-0.01	0.01	-0.02	-0.11*	0.79*	0.01
$\Delta$ AR					0.81*	0.78*	0.21*	-0.07*	-0.00
$\Delta$ INV						0.78*	0.18*	-0.02	0.01
$\Delta$ AP							0.20*	-0.07*	0.01
AMORT								-0.04*	-0.00
OTHER									-0.00

\*p<0.01

All data is gathered from COMPUSTAT, and the variables are defined as follows:

MV = market value of equity at the fiscal year-end, the closing price of common stock;

BV = year-end book value of equity;

CFO = pre-R&D cash flow from operating activities;

ACC = total accruals, calculated as pre-R&D reported net income minus pre-R&D cash flows;

$\Delta$ AR = year-end total trade receivables less prior year total trade receivables;

$\Delta$ INV = year-end total inventory less prior year total inventory;

$\Delta$ AP = year-end total accounts payable less prior year total accounts payable;

AMORT = current year amortization expense plus depreciation expense;

OTHER = unspecified accruals, defined as net income before extraordinary items less (CFO +  $\Delta$ AR +  $\Delta$ INV -  $\Delta$ AP - AMORT).

GR = growth in sales, calculated as current year total sales less prior year total sales.

All variables are measured as of fiscal year-end, in millions of dollars, and expressed on a per-share basis.

**TABLE 3**

Regression results for H1: CFO has a larger effect on market value than does AC for intangible-intensive, high-technology firms

$$MV_{it} = \beta_0 + \beta_1 BV_{it} + \beta_2(H^*CFO_{it}) + \beta_3(L^*CFO_{it}) + \beta_4(H^*ACC_{it}) + \beta_5(L^*ACC_{it}) + \beta_6 GR_{it} + \varepsilon_{it}$$

	(1)	(2)	(3)	(4) <sup>a</sup>
Intercept	6.82 (32.70) *	6.50 (31.65) *	3.87 (8.22) *	2.34 (4.22) *
<b>IIHT</b>			3.02 (6.20) *	5.70 (9.62) *
<b>BV</b>	1.13 (53.73) *	1.15 (55.71) *	1.17 (56.09) *	1.34 (38.97) *
<b>CFO</b>	0.52 (10.81) *			
<b>H*CFO</b>		1.06 (19.09) *	1.65 (15.58) *	1.72 (13.10) *
<b>L*CFO</b>		-0.81 (9.29) *	-0.64 <sup>b</sup> (7.16) *	-0.71 <sup>b</sup> (7.20) *
<b>ACC</b>	0.01 (0.06)			
<b>H*ACC</b>		-0.20 (7.52) *	-0.51 (9.63) *	-0.51 (8.05) *
<b>L*ACC</b>		0.39 (8.65)	0.33 <sup>c</sup> (7.15) *	0.39 <sup>c</sup> (7.67) *
<b>GR</b>	0.01 (1.75)	0.01 (1.88)	0.01 (2.05)	0.02 (3.18) *
Adjusted R-square	0.27	0.29	0.30	0.27
F-statistic	848	646	561	255
Sample	9102	9102	9102	4790

<sup>a</sup> This column represents results based on an alternative cut-off of 20% R&D for IIHT industries.

<sup>b</sup> These coefficients are for the base CFO variable (no interaction with LOW).

<sup>c</sup> These coefficients are for the base ACC variable (no interaction with LOW).

\* Significant at  $p < 0.01$

MV = market value of equity at the fiscal year-end, the closing price of common stock;  
BV = year-end book value of equity;  
H = dummy variable equal to 1 when the firm is a member of a IIHT industry, and 0 otherwise.  
L = dummy variable equal to 1 when the firm is a member of a LILT industry, and 0 otherwise.  
CFO = pre-R&D cash flow from operating activities;  
ACC = total accruals, calculated as pre-R&D reported net income minus pre-R&D cash flows;  
GR = growth in sales, calculated as current year total sales less prior year total sales.

All variables are measured as of fiscal year-end, in millions of dollars, and expressed on a per-share basis.

**TABLE 4**

Regression results for H2: CFO has a larger effect on market value than do accruals components for intangible-intensive, high-technology firms

$$MV_{it} = \beta_0 + \beta_1 BV_{it} + \beta_2(H^*CFO_{it}) + \beta_3(L^*CFO_{it}) + \beta_4(H^*\Delta AR_{it}) + \beta_5(L^*\Delta AR_{it}) + \beta_6(H^*\Delta INV_{it}) + \beta_7(L^*\Delta INV_{it}) + \beta_8(H^*\Delta AP_{it}) + \beta_9(L^*\Delta AP_{it}) + \beta_{10}(H^*DA_{it}) + \beta_{11}(L^*DA_{it}) + \beta_{12}GR_{it} + \varepsilon_{it}.$$

	(1)	(2)	(3)	(4)
Intercept	6.82 (32.99) *	6.67 (32.11) *	6.38 (30.95) *	6.09 (29.55) *
BV	1.12 (51.09) *	1.08 (47.62) *	1.22 (54.16) *	1.22 (51.37) *
CFO		0.36 (6.12) *		
H*CFO				0.60 (9.05) *
L*CFO				-0.86 (6.27) *
$\Delta AR$	-0.45 (6.38) *	-0.65 (8.37) *		
H* $\Delta AR$			-0.07 (0.58)	-0.10 (0.84)
L* $\Delta AR$			0.10 (0.92)	0.39 (3.20) *
$\Delta INV$	0.74 (13.02) *	0.52 (7.75) *		
H* $\Delta INV$			1.29 (13.27) *	0.73 (6.30) *
L* $\Delta INV$			0.62 (1.92)	0.01 (0.01)
$\Delta AP$	2.05 (9.69) *	1.97 (9.33) *		
H* $\Delta AP$			1.17 (3.38) *	1.14 (3.31) *

L* $\Delta$ AP			-1.75 (3.63) *	-0.13 (0.26)
AMORT	2.27 (7.25) *	2.01 (6.38) *		
H*AMORT			0.88 (2.46)	0.15 (0.43)
L*AMORT			0.81 (1.21)	1.81 (2.68) *
OTHER	-0.26 (6.85) *	-0.32 (8.02) *		
H*OTHER			-0.81 (12.67) *	-0.78 (12.20) *
L*OTHER			0.46 (5.90) *	0.40 (5.19) *
GR	0.01 (1.04)	0.01 (1.19)	0.01 (1.39)	0.01 (1.38)
Adjusted R-square	0.28	0.29	0.30	0.32
F-statistic	517	459	334	300
Sample	9102	9102	9102	9102

\* Significant at  $p < 0.01$

MV = market value of equity at the fiscal year-end, the closing price of common stock;

BV = year-end book value of equity;

H = dummy variable equal to 1 when the firm is a member of a IIHT industry, and 0 otherwise.

L = dummy variable equal to 1 when the firm is a member of a LILT industry, and 0 otherwise.

CFO = pre-R&D cash flow from operating activities;

$\Delta$ AR = year-end total trade receivables less prior year total trade receivables;

$\Delta$ INV = year-end total inventory less prior year total inventory;

$\Delta$ AP = year-end total accounts payable less prior year total accounts payable;

AMORT = current year amortization expense plus depreciation expense;

OTHER = unspecified accruals, defined as net income before extraordinary items less (CFO +  $\Delta$ AR +  $\Delta$ INV -  $\Delta$ AP - AMORT).

GR = growth in sales, calculated as current year total sales less prior year total sales.

All variables are measured as of fiscal year-end, in millions of dollars, and expressed on a per-share basis.

**TABLE 5**

Regression results for H2: CFO has a larger effect on market value than do accruals components for intangible-intensive, high-technology firms

$$MV_{it} = \beta_0 + \beta_1 BV_{it} + \beta_2(H*CF_{it}) + \beta_3(L*CF_{it}) + \beta_4(H*\Delta AR_{it}) + \beta_5(L*\Delta AR_{it}) + \beta_6(H*\Delta INV_{it}) + \beta_7(L*\Delta INV_{it}) + \beta_8(H*\Delta AP_{it}) + \beta_9(L*\Delta AP_{it}) + \beta_{10}(H*DA_{it}) + \beta_{11}(L*DA_{it}) + \beta_{12}GR_{it} + \varepsilon_{it}.$$

	IIHT		LILT	
	(1)	(2)	(3)	(4)
Intercept	6.38 (27.67) *	6.18 (26.69) *	4.91 (13.24) *	4.92 (13.27) *
BV	1.39 (51.40) *	1.35 (48.61) *	0.81 (26.99) *	0.77 (21.85) *
CFO		0.47 (6.69) *		0.24 (2.31)
$\Delta AR$	0.12 (0.95)	0.04 (0.37)	-0.43 (5.65) *	-0.56 (5.89) *
$\Delta INV$	1.40 (13.77) *	0.94 (7.61) *	0.26 (1.24)	0.41 (1.84)
$\Delta AP$	0.78 (2.17)	0.86 (2.39)	0.06 (0.20)	-0.23 (0.66)
AMORT	-0.23 (0.62)	-0.51 (1.36)	4.25 (9.05) *	4.29 (9.14) *
OTHER	-0.84 (12.48)	-0.80 (12.00) *	0.05 (1.06)	0.03 (0.51)
GR	0.01 (0.50)	0.01 (0.71)	0.01 (2.81) *	0.01 (2.85) *
Adjusted R-square	0.29	0.30	0.54	0.54
F-statistic	463	413	248	218
Sample	7613	7613	1489	1489

\* Significant at  $p < 0.01$

MV = market value of equity at the fiscal year-end, the closing price of common stock;

BV = year-end book value of equity;

H = dummy variable equal to 1 when the firm is a member of a IIHT industry, and 0 otherwise.

L = dummy variable equal to 1 when the firm is a member of a LILT industry, and 0 otherwise.  
CFO = pre-R&D cash flow from operating activities;  
 $\Delta AR$  = year-end total trade receivables less prior year total trade receivables;  
 $\Delta INV$  = year-end total inventory less prior year total inventory;  
 $\Delta AP$  = year-end total accounts payable less prior year total accounts payable;  
AMORT = current year amortization expense plus depreciation expense;  
OTHER = unspecified accruals, defined as net income before extraordinary items less (CFO +  $\Delta AR$  +  $\Delta INV$  -  $\Delta AP$  - AMORT).  
GR = growth in sales, calculated as current year total sales less prior year total sales.

All variables are measured as of fiscal year-end, in millions of dollars, and expressed on a per-share basis.