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Seraina C. Anagnostopoulou

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Chapter 5 Part B: R&D, Dispersion and Revisions of Forecasted Earnings: Evidence from the UK

5B.1 Introduction and Literature Review

The properties of analyst earnings' forecasts is a highly researched topic, both for the US and for the UK. With respect to forecast accuracy, there is evidence that analyst forecasts outperform earnings forecasts from time-series models (Fried and Givoly, 1982; Brown and Rozeff, 1978; Brown et al, 1987; for the UK Bhaskar and Morris, 1984; Patz, 1989; Capstaff, Paudyal and Rees, 1995). The overperformance of the analysts over time series models could be attributed to a timing advantage they have over naive models, by using information acquired after the initiation date of the model up to the time when they produce their forecasts (Brown et al, 1987; Kross, Byung and Schroeder, 1990). Despite the existence of a certain amount of accuracy in analyst forecast, there exists significant evidence that analysts are overoptimistic (O'Brien, 1988; Butler and Lang, 1991; Ali, Klein and Rosenfeld, 1992, Easterwood and Nutt, 1999 for the US and Capstaff, Paudyal. and Rees, 1995; Hussain, 1996 for the UK), with optimism to be decreasing as the time horizon decreases (Das, Levine and Sivaramakrishnan, 1998 for the US, Hussain, 1996 for the UK). Despite the existence of older research that describes analyst underreaction in the UK (Bhaskar and Morris, 1984; O'Hanlon and Whoddett, 1991), more recent evidence testifies overly optimistic analyst forecasts for the UK as well (Capstaff, Paudyal. and Rees. 1995, Hussain, 1996). Hussain (1996) provides evidence for the UK that analyst optimism increases if analysts also act as brokers, and Hodgkinson (2001) finds that close relationships between analysts and firms also contribute to optimism.

Heyes (1998) testifies the tendency by analysts to follow stocks that do well, consistent with Capstaff, Paudyal and Rees (1995), who find that forecasts are more accurate when earnings are increasing. McNichols and O'Brien (1997) also give the explanation of selection bias from the side of the analysts as a possibility that justifies their optimism. There is also evidence that forecasts improve at the end of the financial year (Crichfield, Dyckman and Lakonishok, 1978), and that the basis for the forecast changes from the beginning to the end of the financial year, with initial forecasts focusing on permanent earnings revised over the year (Helbok and Walker, 2003 for the UK). Industry factors also appear to be influencing forecasts (Richards, Benjamin and Strawser, 1977 for the US; Patz, 1989 for the UK).

Regarding whether analyst forecasts incorporate all information included in previous changes in earnings and dividends, Abarbanell and Bernard (1992) and Ali, Klein and Rosenfeld (1992) testify underestimation of current earnings surprise, producing forecasts that are thus not efficient. On the other hand, Givoly and Lakonishok (1984) find that analysts produce unbiased forecasts, with no relationship between current forecast errors and past change in earnings, a fact that also makes their forecasts efficient, consistent with DeBondt and Thaler (1990) who suggest that forecast errors are accidental, resulting from cognitive bias.

There exist additionally specific firm characteristics that tend to make earnings forecasts more or less difficult to predict. For example, firm size has been empirically linked positively to the accuracy of forecasts, with earnings being more difficult to predict for smaller firms (Das, Levine and Sivaramakrishnan, 1998 for the US and Patz, 1989; Hussain, 1996 for the UK). In specific Das, Levine and Sivaramakrishnan (1998) argue that if one assumes that optimism facilitates the analyst access to non-public information, analysts will tend to be using more optimistic forecasts for firms with less predictable earnings. Moreover, Bryan and Tiras (2007) testify that in the presence of high information asymmetry, analysts tend to focus less on fundamentals and more on non-accounting information.

Regarding analyst forecast dispersion, empirical literature states that analyst forecast dispersion is both the result of higher uncertainty and lack of market consensus (Barry and Jennings, 1992, Barron et al 1998). Barry and Jennings (1992) in specific develop an analytical model that shows that divergence of opinion overstates the estimation of risk. Barron et al (1998) argue that forecast dispersion is a combination of uncertainty *and* divergence of opinions.

Diether, Malloy and Scherbina (2002) testify a negative association between analyst forecast dispersion, which they interpret as evidence of differences of opinion, and subsequent excess stock returns. They argue that analyst forecast dispersion is a proxy for divergence of opinion, an argument in contrast with Barron et al (1998). With respect to the theoretical framework on the association between forecast dispersion and stock returns, there exist a number of theoretical explanations that predict either positive or negative relationship between analyst disagreement and subsequent stock returns, or a non directional relationship, which are very well summarised in Diether, Malloy and Scherbina (2002). They argue in favour of the Miller (1977) framework, where a negative association between forecast dispersion and returns is predicted: this is because upon analyst disagreement, the optimistic investors are the ones who set process, since pessimistic investors do not trade due to high short selling costs and this leads to higher asset prices and therefore lower stock returns. At the same time, there are models that do not predict such pricing of stocks and argue in favour of a non directional relationship between forecast dispersion and stock returns (Diamond and Verecchia, 1987; Hong and Stein, 2000) A final theoretical framework on dispersion and stock returns mentioned in Diether, Malloy and Scherbina (2002) is the one that views dispersion as a risk proxy and predicts a positive relation between forecast dispersion and returns: if forecast dispersion is indication of a less predictable stream of future earnings, stocks with higher dispersion should be earning higher returns, and dispersion in forecasts 'will hold explanatory power beyond the standard risk factors', but their evidence does not support this hypothesis and they interpret their findings to be in accordance with the Miller (1997) divergence of opinion premium hypothesis. They argue that given their evidence, analyst forecast dispersion, as a proxy for differences of opinion, does not represent risk. The findings of Diether, Malloy and Scherbina are supported by Bike and Park (2003) and Park (2005). Johnson (2004) provides an analytical model in accordance with Diether, Malloy and Scherbina, that also predicts that highly distressed firms, and not firms with high intangible value, are more prone to analyst disagreement, despite the fact that these firms with high leverage and poor past performance may possess lower intangible value: when a firm is levered, its equity has the value of a call option, and this value increases with uncertainty. If this uncertainty is idiosyncratic it will not be priced and will thus result in lower expected returns.

Doukas, Kim and Pantzalis (2006) find evidence that does not support the negative relationship between divergence of opinion and stock returns testified by

Diether, Malloy and Scherbina (2002). They testify that uncertainty, that plays a part in forecast dispersion, has a negative association with stock returns, and that Diether, Malloy and Scherbina (2002) observe a negative association between uncertainty and future returns and not differences of opinion and returns. Doukas, Kim and Pantzalis (2006) argue that the view that the more investor views differ, the more overpriced stock are does not hold, because dispersion in analysts' forecasts is driven by uncertainty. They argue in favour of the Barron et al (1998) definition of forecast dispersion, where dispersion is a function of uncertainty and diversity (disagreement-divergence of opinion). In this context, they argue that analyst forecast dispersion is a poor proxy for divergence of opinion and they find that the Diether, Malloy and Scherbina findings are reversed when they control for uncertainty in analyst forecasts, and that high divergence of opinion stocks actually earn higher returns than low disagreement stocks. Doukas, Kim and Pantzalis (2006) finally argue that if dispersion in analyst forecasts (according to the Diether, Malloy and Scherbina, 2002 definition) is a risk proxy associated with uncertain information about future firm performance, the negative relationship between dispersion and returns presented in Diether, Malloy and Scherbina (2002) implies that investors desire more and not less risk.

Chen and Jiambalvo (2004) find evidence and argue that the low returns earned by high dispersion firms, as predicted by Diether, Malloy and Scherbina (2002), are simply explained by the post announcement drift phenomenon. They also put in question the argument in Diether, Malloy and Scherbina (2002) that prices reflect the views of optimistic investors in the presence of high dispersion, leading to low returns, since they find that lower earnings response coefficients relate to negative earnings surprises for high compared to low dispersion firms, which puts the optimism argument into doubt.

On differences of opinion and stock returns, Zhang (2006) testifies that greater information uncertainty provides higher expected returns following good news and relatively lower expected returns following bad news. Clement, Frankel and Miller (2003) find that the confirmation of forecasts by firms reduces dispersion in forecasts and this reduction in 'uncertainty' as they call it is priced by the market positively. Kwon (2002) testifies lower analyst forecast dispersion (and unsigned forecast errors) for high tech versus low tech firms, attributed to the information effect being stronger than a noise effect. Barron and Stuerke (1998) find evidence that analyst forecast dispersion is a useful indicator of uncertainty about future firm performance, since they find a positive association between forecast dispersion after earnings announcements and the demand for more information, and also greater price reactions around subsequent earnings announcements.

From the above presentation of empirical findings, it is deduced that the underlying disagreement on the literature on dispersion and stock returns is whether dispersion is associated negatively with returns, as Diether, Malloy and Scherbina (2002) find, or whether actually forecast uncertainty, and not divergence of opinion, is associated negatively with returns, since differences of opinion and dispersion do not mean the same thing, with divergence of opinion to be forming only a part of forecast dispersion, and actually divergence of opinion to be associated positively with returns, as argued by Doukas, Kim and Pantzalis (2006).

At the same time, there exists evidence on greater analyst forecast bias for firms intensive in R&D investments, or firms that belong to R&D intensive sectors, such as technology firms. The inherently risky and uncertain nature of R&D investments and investments in new technologies in some sectors, as is the case with any kind of innovation, justifies in theory greater bias when financial analysts forecast earnings in the presence of significant R&D investments. R&D investments have been empirically associated already with greater analyst following and effort (Barth, Kasznik and McNichols, 2001), greater analyst incremental contribution for explaining stock returns and greater analyst forecast errors (Amir, Lev and Sougiannis, 2003; Gu and Wang, 2005) for the US market. There also exists evidence on greater forecast errors for technology firms (Gu and Wang, 2005).

R&D intensity has also been associated with higher analyst disagreement. This can take the form of either lower consensus, measured as the correlation in analyst forecast errors (Barron et al, 2002), or higher analyst forecast dispersion for R&D intensive firms, in the form of higher coefficients of variation (Chambers, Jennings and Thomson, 2002). The theoretical background of this relationship that has been testified empirically relates to the inherent uncertainty of R&D future benefits, which makes forecasting earnings particularly difficult in the presence of high R&D. At this point, Chambers, Jennings and Thomson (2002) interpret their findings on forecast dispersion as an indication of the riskiness of R&D.

From the previous discussion on dispersion of analysts' forecasts, it is deduced that R&D is expected to influence the uncertainty of analysts' forecast formation, due to the difficult predictability of future benefits, and thus influence forecast dispersion. This way, if there is assumed that analyst forecast dispersion results from both uncertainty and divergence of opinion (Barron et al, 1998), R&D should definitely influence the uncertainty part. But R&D (among other intangibles) has been shown to influence both forecast dispersion (in the form of coefficients of variation in Chambers, Jennings and Thomson, 2002), and also the divergence of opinions (the second forming part of dispersion according to Barron et al, 1998), even after controlling for forecast uncertainty (Barron et al, 2002).

What I get therefore from existing literature, is that forecast dispersion and each one of its possible components (forecast uncertainty and divergence of opinions) are potentially associated with stock returns for different reasons (and have been found to be so in a statistically significant manner), when R&D intensity should also be theoretically associated with forecast dispersion and its components, and has been indeed empirically found to be so.

At the same time, there exists strong empirical evidence that high R&D intensity is positively associated high higher excess risk-adjusted returns (for example Sougiannis, 1994; Lev and Sougiannis, 1996, 1999; Chan, Lakonishok and Sougiannis, 2001; Eberhart, Maxwell and Sidique, 2004; Chambers, Jennings and Thomson, 2002 for the US and Al-Horani, Pope and stark, 2003; Green, Stark and Thomas, 1996 and Toivanen, Stoneman and Bosworth 2002 for the UK), and this is attributed to either a compensation for risk (Chambers, Jennings and Thomson, 2002) or a mispricing explanation (Eberhart, Maxwell and Sidique, 2004; Lev, Sarath and Sougiannis, 2005). In Part A of Chapter 5 of the study there was also testified a positive and persistent relationship between R&D and returns.

The question asked is whether there exists an association between dispersion and returns after controlling for the role of R&D, given the influence of R&D separately on dispersion, and also on stock returns. Existing literature has assessed the influenced of

R&D on analyst disagreement, which has been defined either as simple forecast dispersion or by using more accurate definitions through decomposing dispersion into forecast uncertainty and pure divergence of opinions. At the same time, forecast dispersion or its components have been found to relate to returns in a statistically significant manner (Diether, Malloy and Scherbina, 2002 testify a negative relation between forecast dispersion and returns, and Doukas, Kim and Pantzalis, 2006 testify a negative relation between forecast uncertainty and returns and a positive relation between forecast divergence of opinions and returns). Leaving aside the dispersion-return discussion, R&D intensity on its own has been theoretically related with subsequent stock returns in a positive manner, and has been indeed empirically found to relate positively with future market performance.

The contribution of this study at this point is exactly the assessment of the association between dispersion in forecasts and subsequent returns, when R&D has been observed to influence separately forecast dispersion, and also to influence stock returns, without controlling for dispersion. Previous studies have not included controls for R&D, when assessing the relation between dispersion and returns, despite the identified influence of R&D on dispersion. In order to be consistent with all aspects of the matter examined in prior literature, dispersion is defined as a function of both forecast uncertainty and pure divergence of opinions among analysts, according to the conceptual framework of Barron et al (1998). I therefore wish to assess the relation between dispersion *and* divergence of opinion on stock returns, after controlling for the role of R&D. Therefore after performing a thorough analysis on the impact of R&D for analyst forecast dispersion for the UK dataset used in this study, which also represents a matter unexplored by prior studies, there will be assessed the importance of R&D for stock returns for different degrees of forecast dispersion and differences of opinion. Previous studies for the UK such as Al-Horani, Pope and Stark (2003) on R&D and market performance were dedicated in assessing the impact of R&D on stock returns, by using different research designs in order to perform the analysis, and have used a framework that did not include any discussion on a possible impact of R&D on forecast dispersion and the impact of dispersion on returns. This was done because the research hypotheses of these studies involved no discussion at all on dispersion in analyst forecasts and its possible association with stock returns.

I additionally focus on another aspect of analyst forecast accuracy as a result of R&D intensity. As already explained, empirical research has already identified greater analyst bias as a result of R&D, in the form of greater analyst forecast errors (Amir, Lev and Sougiannis, 2003; Gu and Wang, 2005, also in Chambers, Jennings and Thomson, 2002), from the direction of which there is implied more optimism. These greater errors for R&D intensive firms are attributed to the uncertain nature of the R&D investment. This uncertain context and probable nature, by construction, of the R&D future benefits, could also influence the magnitude of analyst forecast revisions, when made in the presence of high R&D. This is because analyst forecast bias is expected to be influenced by the degree of uncertainly under which they are made, with greeter uncertainty leading to higher bias. For example, Gu and Wang (2005) find indeed that forecast errors are significantly greater for firms that invest in more innovative technologies and with an increasing rate of innovation. When financial analysts are called therefore to revise their earnings forecasts, prior to the end of the financial year for which they are forecasting, for R&D intensive firms, they are called to improve their accuracy in the presence of a great degree of uncertainty. In such case, the amount by which they adjust their predictions can also be uncertain and therefore earnings revisions are expected to be greater in the presence of high R&D intensity. This expectation lies on the assumption that analysts improve their learning as the end of the financial year approaches, but the outcome of this learning process is influenced by the uncertain nature of R&D, leading to higher revisions in the presence of high R&D investments.

The expectation that R&D intensity should influence the magnitude of earnings revisions does not mean that I ignore the influence earnings revisions receive from news, corporate announcements or changes in company fundamentals. For example, Helbok and Walker (2004) find that analysts tend to focus on sustainable earnings early in the financial year when they make forecasts, and as the end of the financial year approaches, they revise in order to incorporate any piece of information associated with large transitory items. In this study, after examining the impact of R&D on forecast errors, as was done previously in the literature, I assess the influence of R&D on the changes in analyst expectations as the end of the financial year approaches.

In this empirically testified context of forecast bias increasing with uncertainty, I expect that forecast revisions are greater and more pronounced as R&D intensity increases. Regarding the sign of the greater revisions expected, consistent with the existing evidence on optimistic bias from analysts in the presence of high R&D intensity (from the direction of forecast errors), my expectation is in favour of greater revisions as R&D intensity gets higher, of a positive sign. At this point, Das, Levine and Sivaramakrishnan (1998) also argue that if one assumes that optimism facilitates the analyst access to non-public information, analysts will tend to be using more optimistic forecasts for firms with less predictable earnings, if this is the case for R&D firms due to the uncertain nature of the investment by definition. Lin (2001) and Jackson (2005) also argue in favour of optimistic analyst forecasts when earnings are uncertain. I therefore hypothesise in favour of greater and positive revisions as a result of R&D intensity.

I use all UK listed firms during the period 1990-2003 with analyst forecasts on IBES and find that R&D intensity is a contributing factor for analyst forecast dispersion even after controlling for other firm characteristics. The finding is robust to different definitions of R&D intensity, and is consistent with prior findings for the US. In addition, I confirm a negative relationship between dispersion and returns, consistent with Diether, Malloy and Scherbina (2002) for the US, with the bottom forecast dispersion portfolio to be exhibiting a positive but not statistically significant excess return (alpha), and alphas to be getting negative for higher dispersion portfolios, which are generally not statistically significant as well. I also find that upon the inclusion of the R&D factor in the traditional Fama and French three factor model, the previously testified negative relationship between dispersion and returns is still holding: even after controlling for the impact of R&D on stock returns, I find that the bottom dispersion portfolio exhibits a positive alpha which is not significant, and alphas tend to get negative for higher dispersion portfolios. Most importantly, I find that for R&D firms, the inclusion of the RD factor makes the alpha for the top dispersion portfolio become statistically different from zero. After decomposing dispersion in analysts' forecasts into analyst forecast uncertainty and a pure differences in opinion part, I find that as dispersion increases, the ability of R&D to influence returns continuously increases, but when divergence of opinion increases, the relative impact of R&D on returns is constantly getting lower. Given that dispersion is defined as a function of both divergence of opinion and uncertainty in analyst forecasts, the above finding implies an increase in the impact of analyst forecast uncertainty for returns as R&D intensity increases.

In addition, there is not observed a linear positive trend for signed errors and revisions to increase as R&D intensity increases regardless of the way I define R&D intensity, without controlling for other factors. There is though observed such a trend when there are used unsigned errors and revisions. I find that R&D intensity is associated positively with forecast errors and revisions, and that this relationship is generally statistically significant in the case of revisions, when there exists a reasonable amount of time between the initial and the revised analyst forecast, but not for errors, after controlling for other factors. As a final, comment, I get evidence that stock returns relate negatively with revisions and errors, in addition to forecast dispersion, and this relationship is statistically significant in all cases.

The Chapter is organised as follows: In Section 5B.2, I present a draft of the methodology used. Sections 5B.3 and 5B.4 contain the empirical results, and I conclude with Section 5B.5 which also summarises the study limitations.

5B.2. Data and Methodology

The sample of companies used in this study is based on all UK listed (in both the London Stock Exchange and the Alternative Investment Market) non-financial firms for the period 1990-2003. As already explained in Chapter 4, data on analyst earnings forecasts, actual reported earnings, financial year ends and stock prices have been taken from IBES. Accounting figures have been taken from the Worldscope database and information on stock returns and market values has been taken from Datastream. For a firm to be included in the study, there must exist data on the book-to-market ratio, market value of equity, sales and total assets at year end, and have at least one observation of one year ahead forecasted earnings during the 12 months before financial year end, as well as a figure for actual reported earnings from IBES for the particular year. One year ahead forecast data are used.

Given that accounting years end at different times during the calendar year in the UK, there are used accounting year ends for accounting data, and calendar year ends for market based data. Firms that change financial year end more than once during the sample period according to IBES have been eliminated. Following the discussion in Chapter 4, there is used yearly R&D expense taken from the income statement.

As seen in Chapter 4, the above sample selection process results in a total of 10,653 firm-year observations (1,647 firms) for the period 1990-2003, out of which 35.69% report R&D (3,802 firm-year observations and 610 firms).

R&D intensity is defined in two ways: first, as R&D expense from the income statement divided by annual sales, second, as R&D expense divided by firm Total Assets. In the cases though, that the analyses involve the use of stock returns, I also make use of R&D/MVE as a proxy for R&D intensity. This is because Chan, Lakonishok and Sougiannis (2001) have shown that using R&D/MV as a proxy for R&D intensity instead of R&D/Sales increases the association of R&D intensity portfolios with subsequent stock returns.

In order to assess the influence of R&D on stock returns, after controlling for forecast dispersion, I first assess dispersion (with and without decomposing dispersion into an uncertainty and a differences of opinion component) according to R&D intensity and other firm characteristics, such as TA, MV or BM, and then according to matched size-BM portfolios for the R&D, zero R&D, and R&D intensive firms for the sample. I then use regression analysis with the scope to assess whether the impact of R&D on forecast dispersion is statistically significant. After calculating returns for the R&D, zero R&D, R&D intensive and very R&D intensive firms that belong to similar in magnitude analyst dispersion portfolios with simple descriptive statistics, I finally assess the impact of R&D on stock returns through time-series Fama and French type regressions. In that case, I regress the returns of five dispersion portfolios on the market factor, a size factor (SMB), a factor that accounts for the returns of different BM portfolios (HML) and additionally a factor that controls for the impact of R&D on stock returns. This latter RD factor is first constructed according to the methodology by Al Horani, Pope and Stark

(2003), which make use of the BM factor in order to construct the RD factor, and as a second step, it is constructed on its own by taking the returns of different R&D intensity portfolios. I proceed by decomposing forecast dispersion into an uncertainty and a divergence of opinion part, where I repeat the Fama-French time series regressions according this time to portfolios formed according to pure divergence of opinion, instead of dispersion, quintiles.

With respect now to assessing the influence of R&D on forecast revisions, I first examine the magnitude of revisions according to R&D intensity and other firm characteristics, and then according to matched size-BM portfolios for the R&D, zero R&D, and R&D intensive firms. I finally use regression analysis in order to assess the influence of R&D intensity on the magnitude and sign of forecast revisions, after controlling for other possibly influencing factors. The analysis of the impact of R&D on forecast revisions is preceded by relative analyses of the impact of R&D on errors, given the close conceptual link between these two attributes of analyst forecasts, errors and revisions. The study also includes regression analysis in order to assess the impact of R&D and forecast dispersion directly on stock returns, in the process of which both errors and revisions are included among the regressors.

5B.3 R&D, Dispersion in Analyst Earnings Forecasts and Subsequent Stock Returns

5B.3.1R&D and Analyst Forecast Dispersion: Descriptive Statistics

I define forecast dispersion as the standard deviation of one year ahead analyst forecasts for a particular company for a specific month (given by IBES), standardised by the absolute value of the one year ahead mean analyst forecast for this company for the month. The standardisation procedure follows Diether, Malloy and Scherbina (2002). To avoid outliers, observations below the 0.02 and above the 0.98 percentile are eliminated. There are used all of minus twelve, six and one month prior to year end one year ahead forecasts.

As a first step, I assess analyst forecast dispersion, using minus twelve, six and one month prior to year end data for the whole sample, R&D firms, zero R&D firms and according to R&D intensity quartiles, defined using R&D/Sales, R&D/TA and R&D/MVE. Quartiles are rebalanced annually. Table 5B.1 shows the average dispersion in analyst forecasts for the whole sample, the R&D firms, the zero R&D firms and for a particular R&D intensity, TA, MV or BM quartile throughout the sample period. As can be observed from the Table, zero R&D firms tend to exhibit slightly higher dispersion than R&D firms, a fact that could be receive influence by the significantly higher number of observations without R&D compared to R&D reporting firms. Among R&D reporting firms, as R&D intensity though increases, so does forecast dispersion, no matter which proxy we use for R&D intensity. Consistent with prior literature (e.g. Chambers, Jennings and Thomson, 2002), the higher R&D intensity quartiles exhibit higher dispersion compared to the lower ones, and the highest R&D intensity quartile exhibits by far the highest dispersion, no matter which R&D intensity proxy we use or whether we use minus twelve, six and one month prior to year end forecast data. Finally, smaller firms in terms of TA and MV appear to be associated with higher analyst forecast dispersion, and dispersion clearly decreases as firm size gets higher. The opposite is true though as the BM ratio increases: higher BM firms show higher dispersion than lower BM ones.

Insert Table 5B.1 here.

As a last comment, there appears to exist an upward trend for most of the dispersion quartiles as we move from minus twelve month to minus six and then to minus one month prior to year end data. This observation would imply that dispersion increases as we move closer to the end of financial year for which the forecast is made, which implies greater disagreement when there should in theory exist more certainty, which is a fact that appears quite counter intuitive.

Finally, one could argue that a firm's forecast dispersion depends on the number of analysts that produce forecasts for this firm, and therefore a firm that is covered by more analysts will tend to exhibit higher dispersion in its earnings forecasts. In order to control for this limitation, I have repeated the analysis on Table 5.B.1 after including only the firms for which the forecasted EPS is produced by five or more analysts. The relevant results are presented in Appendix 5B.A Part A, and observe no qualitative difference on the direction of the results of Table 5B.1.

Next I assess dispersion for R&D firms, R&D intensive firms and zero R&D firms matched according to firm size, using MVE as the proxy for size, and the book-to market ratio. This way, the sample firms are divided into two market value of equity portfolios, using the median MVE as of the end of December in each year. Then the firms in each of the two MVE portfolios are divided into three book-to-market (BM) portfolios: one containing the lower 30% values for BM, another one with the middle 40%, and finally, a portfolio containing the top 30% of BM ratios. This results in six size-value portfolios (2 by 3 size-BM portfolio analysis). Portfolio breakpoints are rebalanced every year. I define R&D intensive firms as the ones with an R&D/Sales or R&D/TA ratio above the sample median for a particular year. I use minus twelve, six and one month prior to year end data. I then report on Table 5B.2 the average sample period dispersion for the R&D, zero R&D and R&D intensive firms that belong to the six MV-BM portfolios.

Insert Table 5B.2 here.

As can be seen from the table, after controlling for the firm characteristics of size (MV) and BM, there is a tendency for R&D and especially R&D intensive firms to exhibit greater analyst forecast dispersion than zero R&D firms. This tendency is more pronounced for the low MV portfolios. On average, R&D firms tend to exhibit slightly higher dispersion than zero R&D firms in their respective MV-BM portfolios, especially when minus six or one month prior to year end, instead of twelve months prior to year end data are used. In the case of the R&D intensive firms though, no matter whether we use R&D/Sales or R&D/TA as a proxy for R&D intensity, consistent with prior literature, for the majority of the portfolios there are the exactly these firms that show signs of greater analyst disagreement, compared to both R&D reporting firms in general as well as zero R&D firms.

5B.3.2 R&D and Analyst Divergence of Opinion: Descriptive Statistics

As already mentioned on the introduction, there exists criticism in the literature on the validity of forecast dispersion as a measure of differences of opinion (Doukas, Kim and Pantzalis, 2006), who argue that forecast dispersion is actually the result of both forecast uncertainty and differences of opinion. In order to be consistent with all aspects of the matter examined by prior literature, I have also decomposed forecast dispersion into a forecast uncertainty and differences of opinion part following conceptually Barron et al

(1998) and Doukas, Kim and Pantzalis (2006), who exactly differentiate between the uncertainty and differences of opinion parts of forecast dispersion. I therefore decompose the dispersion measure as in Doukas, Kim and Pantzalis (2006) (who follow conceptually an idea by Barron et al, 1998) as $D=V(1-\rho)$, where $1-\rho$ represents differences of opinion (with ρ to be the correlation of forecast errors across analysts, a measure of analyst consensus) and V is uncertainty. D equals nothing more than scaled variance in analyst forecasts, therefore ((standard deviation in forecasts) *(standard deviation in forecasts)/(absolute value of mean EPS forecast)) – also multiplied by 10, with the standard deviation of forecasts to be the one previously used for dispersion calculation (standard deviation in forecasts scaled by absolute mean EPS forecast equals dispersion used in the previous analysis).

With respect to the calculation of other variables, $\rho = h/(h+s)$, and $V=D/(1-\rho)$, where h=precision of common information and s=precision of idiosyncratic information and $h=(SE-(D/N))/((SE-(D/N))+D)^2$, $s=D/((SE-(D/N))+D)^2$,

with SE to be the squared error of the mean forecast (deflated by the absolute value of actual EPS at year end), D is the scaled variance in forecasts described right above (multiplied by 10), deflated by the absolute value of actual EPS at year end and N is the number of forecasts.

One could argue here that this dispersion measure that follows Doukas, Kim and Pantzalis p.603-604 is not consistent with the previous measure of dispersion that follows Diether, Malloy and Scherbina (2002), as the standard deviation in EPS forecasts divided by the absolute value of the mean forecast in question. For this reason, I have recalculated forecast uncertainty (V) in two additional ways: first, as $V= D/(1-\rho)$, where $(1-\rho)$ was calculated as in p.603 of Doukas, Kim and Pantzalis, that is by using deflation by absolute *actual* EPS in the components of rho where deflation is necessary, and D is the scaled variance (squared standard deviation or squared dispersion of Diether, Malloy and Scherbina employed else in the thesis - multiplied by 10), using the Diether, Malloy and Scherbina dispersion definition, which involves scaling by absolute *mean EPS forecast*. I have also recalculated V as $D/(1-\rho)$, with D to be the scaled variance (squared standard deviation or squared dispersion of Diether, Malloy and Scherbina employed else in the thesis - multiplied by 10), using the Diether, Malloy and

Scherbina dispersion definition, which involves scaling by absolute *mean EPS forecast*, and (1-ρ) to be calculated by using here again by scaling by the absolute *mean EPS forecast* when scaling is necessary for ρ calculation. It goes without saying that this final way of calculating (1-ρ) and V is absolutely consistent with the calculation of dispersion employed in the previous analyses in part 5B.3.1 of the Chapter 5B, since scaling by absolute value of mean EPS forecast is used in all cases, and also the scaled variance D used for (1-ρ) and V calculation is the squared scaled standard deviation in forecasts or squared dispersion used in part 5B.3.1.

I report in Appendix 5B.A Part B the average V, (1-ρ), and D (D=V(1-ρ)), calculated using minus 1 month 1 year ahead EPS forecast data prior to year end, for the whole sample, the R&D and zero R&D firms and according to R&D/Sales, R&D/TA, R&D/MV, TA, BM and MV quartiles.

What we observe from other results in Appendix 5B.A is that dispersion is more driven by uncertainty and not by differences of opinion (despite the fact that dispersion D in Table 1 of the Appendix 5B.A is defined by standardising by absolute actual EPS and not by absolute forecast as in Table 5B.1), since as R&D intensity, firm size or BM change the part of D that changes is V and not (1-ρ). As R&D intensity increases, V and not (1-ρ) steadily increases as well, leading to an increase in overall dispersion D. Without controlling for other factors, this finding constitutes some preliminary evidence that R&D intensity has an impact on the uncertainty about future performance part of analyst forecasts. As a final comment, from the findings in Table 3 of the Appendix 5B.A, no matter how I scale D (scaled variance, not standard deviation of forecasts), by absolute actual EPS or mean forecast, V increases as R&D intensity increases, and D also increases, but (1-p) does not increase. So the uncertainty component of dispersion appears to be driving dispersion up as R&D intensity increases and not the lack of consensus part (1-p).

5B.3.3 R&D and Analyst Forecast Dispersion: Regression Analysis

In addition, I use regression analysis in order to assess directly whether R&D intensity influences analyst forecast dispersion in a statistically significant manner. I run the following regression using panel data for the period 1990-2003:

$$Dispersion_{it} = \beta_0 + \beta_1 RD + \beta_2 BM + \beta_3 MV + \beta_4 AF + \beta_5 STDEV + \varepsilon_{it}$$

(5B.1) where:

Dispersion - analyst forecast dispersion defined as the standard deviation in one year ahead analyst forecasts of EPS for a particular month divided by the absolute value of the mean forecast in the specific month. There are used forecasts 12 and 6 months prior to year end

RD - R&D/Sales or R&D/Total Assets or R&D/Market value of equity at year end

BM - the book-to-market ratio at year end

MV - MVE at year end

AF - analyst following that equals the number of analysts that issued one year ahead EPS forecasts for a particular firm for a particular month, using minus 12 or 6 month prior to year end data, depending on what data are used for dispersion each time.

STDEV -the standard deviation of reported EPS for a three year period prior to base year (e.g. 1988-1990 for the base year 1990)

The regression is run using OLS and Whites Heteroskedasticity robust standard errors. Observations above the 98 and below the 2 percentile were eliminated. All variables have been transformed using natural logs since this improved heteroskedasticity in the model and provided a better functional form for the model. As a result, the Durbin Watson Statistics improved to a great extend and got values between 1.9 and 2.05. The relevant results for the errors regression are presented on Table 5B.3.

Insert Table 5B.3 here.

As can be observed from Table 5B.3, consistent with the intuition, firm size, expressed as MV appears to relate negatively to analyst forecast dispersion, no matter whether I use minus 12, 6 or 1 month prior to year end analyst forecast data for dispersion calculation, and is always statistically significant. BM is also statistically significant, but always positive. Consistent with common intuition, past volatility in reported EPS, expressed by the STDEV variable also relates positively to dispersion and is very much statistically significant. Analyst following also relates positively to dispersion, but in this case it is only significant at a meaningful level of significance only when minus 6 or 1 month prior to year end analyst forecast data are used, as opposed to minus 12 month data, when it is not significant. The p- values of the F statistics are always zero, and the adjusted R squares are almost always around 30%.

The R&D intensity variable is always positive and it is statistically significant when at 5% significance level when minus 12 month prior to year end forecast data are used, no matter how we define it. As dispersion data become more recent to the end of the financial year for which analyst forecasts are made, its significance is reduced, but it still remains positive. When using minus 6 or 1 month prior to year end data, the R&D intensity variable is mostly significant when defined as R&D/MVE.

The regression results are robust to replacing MV with a variable that accounts for firm age (defined as the natural log of the difference in years between year t and the year when data is recorded for the first time for a particular firms in LSPD-item G6), which is also statistically significant with a negative sign (results included in Appendix 5B.B Part A). The results are also robust to the inclusion of industry dummy variables, both simple and multiplicative with R&D, to account for four industries which are perceived as intensive in R&D activity: Information Technology Chemicals, General Industries and Health grouped together with Pharmaceuticals and Biotechnology results included in Appendix 5B.B Part B). Even in the case of industry dummy variables multiplicative with R&D, the significance of the R&D intensity variable is reduced below 5% (to 10%) only in a couple of cases upon the inclusion of the multiplicative industry dummies. Finally, the results are robust to possible time period effects during the years of the New Economy, since I have rerun the regressions by excluding the base years 1999 until 2001, and I observed no significant difference in the direction of the results. I have also rerun the regressions for the whole sample period 1990-2003 by including a dummy variable that took the value of 1 if the data referred to the base years 1999, 2000 or 2001 and zero otherwise, and there was overall observed no qualitative difference in the results (results included in Appendix 5B.B Part C). Finally, I have controlled for period fixed and random effects. Running the regression with period fixed and random effects along with adding an AR(1) term was not permitted by econometric software (in order to correct for 1st order serial correlation, see Park, Sickles and Simar, 2003; Baltagi and Chang, 1992), so I report the relevant results in Appendix 5B.B Part D with much caution due to the presence of a serial correlation problem. Nonetheless, the significance of all factors does not change and the R&D intensity variable remains both economically and statistically significant.

Taking the findings from Tables 5B.1, 5B.2 and 5B.3, and also Appendix 5B.A Part B as a whole, I get evidence that R&D intensity is a contributing factor for analyst forecast dispersion in one year ahead forecasts, even after controlling for other firm characteristics, such as firm size, the BM ratio, analyst following and the volatility in past income. The finding is robust to defining R&D intensity either as R&D divided by sales or TA, or MVE and is more robust when referring to older analyst forecast date relative to the end of the financial year for which the forecast is made for dispersion calculation, and is consistent with prior findings for the US on R&D intensity being positively associated with greater analyst dispersion (Chambers, Jennings and Thompson, 2002). If forecast dispersion is decomposed into an uncertainty and a divergence of opinion component, as was done in prior literature (Barron et al, 1998, Doukas, Kim and Pantzalis, 2006), I get indications that the influence of R&D is primarily on the uncertainty component of analyst forecasts, in contrast to the findings of Barron et al (2002) for the US that R&D has a negative impact on forecast consensus even after controlling for uncertainty.

5B.3.4 R&D, Dispersion and Stock Returns: Descriptive Statistics

Having testified a positive association between R&D intensity and forecast dispersion, the next step is to assess stock returns for the R&D, zero R&D and R&D firms that differ in terms of R&D intensity depending on the amount of analyst dispersion present in their earnings forecasts. Diether, Malloy and Scherbina (2002) examine the impact of analyst dispersion on very short term returns, even for the next month in specific. In this study though, I want to examine the impact of R&D intensity on returns, after controlling for analyst dispersion: R&D is an investment that is expected by definition to affect the operating performance of a firm over a period of years, therefore it is a long term investment. In this context, I will be assessing market performance stock returns for the next one year. I calculate both cumulative and buy-and-hold (BAH) total raw returns, which include dividends. Sample firms are divided into four annually rebalanced dispersion portfolios, and I assess average returns for the firms with an R&D intensity ratio below or above the sample R&D intensity median, and in the top R&D intensity quartile, that belong to each dispersion quartile. Cumulative and buy-and-hold returns are calculated on a 12 month basis, from July at year t+1 until June of year t+2. The first month for which a return is used is July 1991, corresponding to the base year 1990 (in order to allow enough time for accounting information to be made public), and the last month is June 2004, for the base year 2002. R&D intensity is defined as R&D/Sales, R&D/TA and R&D/MVE (taking the MVE as of the end of December of year t).

Dispersion quartiles are rebalanced annually, and I make use of minus one month prior to financial year end forecast data for the calculation of dispersion. The results appear on Table 5B.4, which shows the respective equal-weighted returns (cumulative and buy-and-hold) for the next year according to dispersion quartiles for the whole sample (Panel A) and then for firms with R&D intensity below and above the median, or in the top quartile, as well as for zero R&D firms (Panel B).

Insert Table 5B.4 here.

As can be observed from Table 5B.4, Panel A, with plain descriptive statistical data using forecast dispersion data one month prior to year end for the calculation of dispersion, at the sample level there appears to exist no particular trend for the direction of returns as analyst forecast dispersion changes, without controlling for any other factor. This observation is not consistent with Diether, Malloy and Scherbina (2002), who testify a negative relationship between dispersion and returns. In this study though, I do not assess stock returns immediately after analyst forecast dispersion in assessed for all firms, given that accounting years end throughout the calendar year in the UK, and this later fact could be influencing the results. In the case of Panel B, which assesses raw stock returns for the firms with R&D intensity below/above the median, in the top intensity quartile and zero R&D firms, a casual comparison of the different categories of firms indicates that R&D intensive (R&D intensity ratio above median) and especially very R&D intensive (R&D intensity ratio in top quartile) firms tend exhibit higher returns than zero R&D firms in their respective dispersion quartiles. This particular result is more striking when R&D/MVE is used as a proxy for R&D intensity. Again, I observe no generalized trend for returns as dispersion changes, with the exception maybe of the most R&D intensive firms, which tend to exhibit higher returns for the highest dispersion quartiles.

A limitation inherent by construction in the analysis presented in Table 5B.4 relates to the fact that returns are every time taken from July t+1 to June t+2 for the base year t, when accounting years finish throughout the financial year in the UK, so dispersion calculated with minus 1 month prior to year end data is taken at different months for different firms. This would imply that more forecast data (and therefore dispersion data) has been made available for some firms before the firms month of return calculation in the UK for some firms and fewer for other firms, with their relative probable influence on stock returns.

In order to overcome this problem, I repeat the analysis in Table 5B.4 with one modification: I calculate returns from July t+1 until June t+2 for the whole sample, and then for the firms with and R&D intensity ratio below/above the sample median, or in the top intensity quartile, and the zero R&D firms according to dispersion quartiles (as in Table 5B.4) but this time using dispersion data of June t+1 (accounting data for year t), only for these firms whose accounting year ends between July t+1 - December t+1. June t+1 is the closest month for which there exist forecast data for dispersion calculation prior to the firms' month of return calculation. The reason for limiting the sample and including only these firms with an accounting year tending between July t+1 and December t+1 is in order to assure that the 1 year ahead EPS forecasts, out of which dispersion is calculated, refer to the accounting year that finishes within the calendar year t+1, and I therefore use only one year ahead forecast data that refer to the calendar year t+1 (for example, for a firm whose accounting year ends in March of t+2, the one year ahead EPS forecasts issued in June t+1 refer to an accounting year that will end after the first calendar year of return calculation).

Table 5B.5 presents exactly these average returns according to dispersion quartiles for the whole sample (Panel A) and for firms with an R&D intensity ratio below/above the sample median, or in the top intensity quartile, and the zero R&D firms (Panel B). Consistent with Diether, Malloy and Scherbina (2002) this time, in the sample level (Panel A) the lowest dispersion firms exhibit higher returns, other things equal.

This observation appears to be valid for zero R&D firms too. In the case of R&D intensive and very R&D intensive firms, there appears to exist no particular trend using this simple descriptive statistics analysis regarding the direction of returns for different analyst forecast dispersion. Overall, the findings from Table 5B.5 are not so much different from the ones in Table 5B.4, indicating that the fact that I included firms with accounting years that end throughout the calendar year in Table 5B.4 does not produce great changes in the results.

Insert Table 5B.5 here.

5B.3.5 R&D, Dispersion and Stock Returns: Fama-French Time-Series Regressions and other Regression Analysis

I then explicitly assess the impact of R&D on stock returns when analyst earnings forecast dispersion differs across firms. Diether, Malloy and Scherbina (2002) use time series Fama and French type regressions, where the monthly returns of five dispersion portfolios are regressed on the market factor (market excess return), a size factor (SMB), a value factor (HML) and a momentum factor, and find that alphas are positive and not statistically significant for their low dispersion portfolios, but negative (and significant for the top dispersion portfolio) for their higher dispersion ones, and thus they deduce a negative relationship between dispersion and stock returns. They make use of dispersion data that refer to the month immediately before return calculation.

In this study, I replicate their Fama and French time series model by regressing monthly excess returns for a total of 156 months, from July 1991 until June 2004, on the market factor, SMB, HML and additionally a factor that accounts for the effect of RD on stock returns. I consider that in order to assess the influence of forecast dispersion on stock returns after taking into account the role of R&D, such a modification to the Diether, Malloy and Scherbina is necessary: I receive motivation from the Al-Horani, Pope and Stark (2003) modification to the traditional Fama-French time series model, which includes the addition of a factor that accounts for the returns of different R&D intensity firms. This way, I perform the Fama-French time series test for different dispersion portfolios by also controlling for the possible impact of R&D on stock returns. Al-Horani, Pope and Stark (2003) had run Fama and French time series regressions with the addition of an RD Factor according to different R&D intensity portfolios for the R&D firms, and also for the zero R&D firms, given that their scope was to assess the influence of R&D for stock returns. In this study, I run Fama-French time series, with and without the addition of a factor to account for the role of R&D for returns, according to different dispersion portfolios, since the research hypothesis relates to assessing the relation between analyst forecast dispersion and returns after accounting for the role of R&D.

For model construction purposes, up to a certain point I follow quite closely the methodology by Al Horani, Pope and Stark (2003). The market factor is defined as the difference between the monthly value-weighted return of all the sample firms minus the risk free rate (1 month UK Treasury Bill rate). Then I divide sample firms in two size portfolios, using the median MVE as at the end of June of year t, and 3 BM portfolios, with BM calculated with BE for the accounting year that ended within the calendar year t-1 and MVE as at the end of December of year t-1. The lowest BM portfolio consists of the values of the lowest 30% of BM values, the mid BM portfolio includes the values of the mid 40% of values for BM and finally the top BM portfolio consists of the top 30% of firms. This procedure results in the construction of 6 (2 by 3) annually rebalanced size-BM portfolios, using the intersections of the MV and BM portfolios: Small-low (SL: small MVE-low BM), small-mid (SM: small MVE-mid BM), small-high (SH: small MVE-high BM), big-low (BL: big MVE-low BM), big-mid (BM: big MVE-mid BM) and finally big-high (BH: big MVE-high BM). The SML factor is calculated by using the difference between the average monthly returns of three small and three large MVE portfolios: (SL+SM+SH)/3-(BL+BM+BH)/3. In the same direction, the value factor HML is defined as the difference between the average monthly returns between two high BM and two low BM portfolios: (SH+BH)/2-(SL+BL)/2. Following Diether, Malloy and Scherbina (2002), all portfolio returns for the construction of the SMB and HML factors are equal-weighted. In order to allow for accounting data to become public, returns are taken from July in year t until June in year t+1 for annually rebalanced data that refers to the base year t (MVE as of the end of June t, BM with BVE for the accounting year that ended within the calendar year t-1 and MVE as at the end of December at t-1).

With respect to the RD factor, I construct it by performing a modification to what is done by Al Horani, Pope and Stark (2003): They construct the RD factor by dividing sample firms in three BM portfolios, low, mid and high, and each BM portfolio is the divided in further two portfolios, depending on whether each firm is an R&D reporting one (LRD, MRD and HRD) or a zero R&D firm (LZRD, MZRD and HZRD). Their factor is constructed by taking the difference between the average monthly returns of three R&D reporting BM portfolios and three zero R&D portfolios: (LRD+MRD+HRD)/3-(LZRD+MZRD+HZRD)/3. The returns of their six R&D or ZRD, low-mid or high BM portfolios are value weighted. I decided though to construct the RD factor on its own, without making use of any other firm characteristics as previously done with BM. I proceed to this modification to make sure that the RD factor, the way it is constructed by Al-Horani, Pope and Stark (2003) with the use of BM, does not capture any BM effects already captured by HML, and this way provide an alternative RD factor based only on the returns of firms that differ in terms of R&D intensity. I therefore construct the RD factor by subtracting the monthly equal weighted returns of zero R&D firms from the returns of R&D intensive firms as (High RD-Zero RD). High R&D firms are defined as the ones with R&D/Sales above the 70^{th} percentile (High R&D-HRD). The reason for using equal weighted returns in order to calculate the RD factor is because I calculate the excess returns of the different dispersion portfolios as equally weighted following Diether, Malloy and Scherbina (2002), so there should exist consistency between the way of calculating portfolio returns on the right and left side variables of the regression. Al Horani, Pope and Stark (2003) calculate the RD factor by making use of value weighted returns for their above described 6 R&D-no R&D, different BM portfolios, but I argue that there should exist consistency between the way of calculating portfolio returns on the right and left side variables of the regression, because in a different case there could exist biases from the inclusion of both value and equal weighted factors in the same regression. I therefore calculate the excess returns of the different dispersion portfolios as equally weighted, I do the same for the construction of the RD factor.

For reasons of completeness of the analyses, I have repeated the analyses by constructing the RD factor according to the methodology by Al Horani, Pope and Stark

(2003) as described above, with equal weighted returns though. The relevant results are included in Appendix 5B.C Part A Panel A. In addition, I have repeated the analysis by constructing the RD factor again on its own, but this time using also the returns of lower RD intensity portfolios. In this case, I divide sample firms in four portfolios: zero R&D firms (ZRD), firms with and R&D/Sales ratio below the 30th percentile (low R&D-LRD), firms with and R&D/Sales ratio between the 30th and the 70th percentile (mid R&D-MRD) and finally firms with R&D/Sales above the 70th percentile (High R&D-HRD). I then subtract the average monthly returns of the low R&D and zero R&D firms from the relevant returns of the mid and high R&D portfolios: (High RD+Mid RD)/2-(Low RD+Zero RD)/2. In the case of the R&D and R&D intensive firms (firms with an R&D/Sales ratio above the sample median for a particular year), I also construct the RD factor without the use of any zero R&D firm returns by simply using the returns of the highest and lowest R&D portfolio as (High RD-Low RD). The relevant results are included in the Appendix 5B.C Part A Panels A and B.

Following the argumentation described above on the issue of the RD factor construction with equal versus value weighted returns, the returns of the four portfolios (Zero RD, low RD, mid RD and high RD) are equal weighted, and so are the RD/ZRD-BM portfolios for the RD factor construction according to the Al Horani, Pope and Stark methodology. Nonetheless, I have repeated all analyses by constructing the RD factor using the value-weighted returns all portfolios, with the relevant results included in Appendix 5B.C Part B. As intuitively expected, the results in that case tend to become implausible for some regressions.

The use of the R&D/Sales ratio instead of another R&D intensity measure such as R&D/MVE is justified by the fact that I wish to isolate the ratio from the influence of market volatility. Nonetheless, I have repeated some of the analysis in Table 5B.6 Panel B by using R&D/TA for the construction of the R&D factor with no great qualitative change in the direction of the results, as can be observed in Appendix 5B.C Part C.

This way, the following regression is run using time series monthly data for a total of 156 months, from July 1991 until June 2004:

$$(Rp - Rf) = alpha + \beta_1 (Rm - Rf) + \beta_2 SMB + \beta_3 HML + \beta_4 RDFactor + \varepsilon$$

(5B.2) where:

Rp-Rf- the difference between the equal-weighted monthly returns of five annually rebalanced dispersion portfolios and the risk free rate (1 month UK Treasury Bill rate).. One month prior to year end 1 year ahead analyst forecast data are used for dispersion calculation. The analysis is repeated by including only the R&D, zero R&D and firms with an R&D/Sales ratio above median according to 5 dispersion portfolios. The average number of observations included in each of the five dispersion portfolios for the whole sample, the R&D, zero R&D and firms with an R&D/Sales ratio above median is reported in Appendix 5B.C Part F.

Rm-Rf- the difference between the monthly value-weighted return of all the sample firms and the risk free rate (1 month UK Treasury Bill rate).

SMB- the size factor, calculated by using the difference between the average equal-weighted monthly returns of three small and three large MVE portfolios: (SL+SM+SH)/3-(BL+BM+BH)/3.

HML- the value factor, defined as the difference between the average equal-weighted monthly returns between two high BM and two low BM portfolios: (SH+BH)/2-(SL+BL)/2.

RDFactor- the factor that accounts for the difference in the returns of differing R&D intensity firms, calculated by subtracting the average monthly returns of zero R&D firms from the monthly returns of high RD firms with R&D/Sales above 70^{th} percentile. I also repeat the analyses by constructing the RD factor as in Al-Horani, Pope and Stark (2003), by taking the difference between the average (equal-weighted) monthly returns of three R&D reporting BM port folios and three zero R&D portfolios: (LRD+MRD+HRD)/3-(LZRD+MZRD+HZRD)/3, and secondly by subtracting the average monthly returns of low R&D (R&D/Sales) and zero R&D firms from the returns of mid and high R&D portfolios: (High RD+Mid RD)/2-(Low RD+Zero RD)/2. In the case of the R&D and R&D intensive firms, I also repeat the analysis by constructing the RD factor using just the returns of the highest and lowest R&D portfolio (High RD-Low

RD). The relevant results of these alternative RD factor construction methodologies, as well as the RD factors constructed with value instead of equal weighted returns, are included in the Appendix 5B.C Parts A and B.

Regarding dispersion portfolio calculation, sample firms are divided in 5 dispersion portfolios, from low (D1) to high (D5), using 1 month prior to year end forecast data for dispersion calculation. For example, for the year 1990, if a firm's accounting year ends in December 1990, there are used dispersion data as of November 1990. For a firm with an accounting year end in March 1990, there are used dispersion data as of February 1990. For the dispersion portfolios of the base year 1990, in order to allow for accounting data to be made public, returns are taken from July 1991-June 1992. Dispersion portfolios are annually rebalanced. In the case of Diether, Malloy and Scherbina (2002), dispersion portfolios are monthly rebalanced, based on dispersion of the previous month for returns of the current month. This monthly rebalancing would not be quite feasible in this study though, given the multiple accounting year ends in the UK. For example, if we were to take dispersion quintiles as of June 1991, and calculate the relative returns for July 1991, 1 year ahead EPS forecast data used for dispersion calculation would include forecasts for both the fiscal years 1991 and 1992, depending on the accounting year end of each firm. Given that the return calculation period must be obviously homogeneous across firms, I make use of 1 month prior to year end forecast data for dispersion calculation, which implies that dispersion data are taken at different months for different firms. The problem of differing months for accounting year ends is inherent in all type of empirical research for the UK, that makes use of both accounting and market based data. I explicitly make use of 1 month prior to year end forecast data in order to minimise the lag between dispersion and return calculation. As previously stated, dispersion is defined as the standard deviation in 1 year ahead EPS analyst forecast divided by the absolute value of the mean forecast for the month in question.

The time-series regressions are run using OLS and Whites Heteroskedasticity robust errors. The regression results are reported on Table 5B.6, Panels A (no RD factor included), and B (RD factor calculated using the returns of a high R&D portfolio minus the returns of a zero R&D portfolio, RD factor constructed with equal-weighted returns)

In Appendix 5B.C Part A there are reported the results when using an factor according to Al-Horani, Pope and Stark, 2003 with equal weighted returns (Panel A), an RD factor calculated on its own using the returns of a high and a medium R&D intensity portfolio minus the returns of a low R&D and a zero R&D portfolio with equal weighted returns (Panel B), and finally an R&D factor calculated using the returns of a high R&D portfolio minus the returns of a low R&D portfolio for the R&D and R&D intensive firms, again with equal-weighted returns (Panel C). In Appendix 5B.C Part B there are reported the relevant results from Table 5B.6, as well as from Appendix 5B.C Part A, but this time by using an RD factor calculated with value-weighted returns. In Appendix 5B.C Part G there are presented the average number values of the factors included in the Fama-French time-series regressions on Table 5B.6 and also Appendix 5BC Part A and Part B for the 156 months used in the regressions (July 1991-June 2004), and also the average raw and excess returns of the five dispersion portfolios formed according to all sample data.

Insert Table 5B.6 here.

I also report on Table 5B.7 the Pearson correlation coefficients among the regression independent variables Rm-Rf (RM), SMB, HML and the RD factor. As can be observed from the table, the correlation coefficients among RM, SMB and HML get values at reasonable levels for the purpose of inclusion in a regression. In the case of the RD factor, its correlation with other factors depends very much on the way it is constructed. When I use equal-weighted returns for its construction for the reasons previously stated, the only case when it gets no Pearson correlation coefficient with a value above 0.5 is when the Al Horani, Pope and Stark methodology is used. This way, the results with the inclusion of this particular R&D factor could be considered more reliable for this reason, but nonetheless I although I report the Pearson correlation coefficients among the regression independent variables for all constructed RD factors, including the one used in Table 5B.6.

Regarding the regression results on Table 5B.6, in the case of Panel A, when the regressions are run for five dispersion portfolios for all the sample firms, and for the R&D, zero R&D and R&D intensive firms separately without the RD factor, I observe that consistent with prior literature, all of the Rm-Rf, SMB and HML factors are positive and statistically significant at 1% significance level. The coefficient of the market factor increases as we move to higher dispersion portfolios, and so do the coefficients for SMB and HML. Alphas are statistically not significant for all dispersion portfolios at any reasonable level of significance, but consistent with Diether, Malloy and Scherbina (2002), alpha is positive for the bottom dispersion portfolio and starts getting negative for higher dispersion portfolios, indicative of a negative relation between dispersion and returns. Adjusted R squares remain steadily above 70% for all dispersion portfolios and the F statistics always get very high values.

Interestingly, when I repeat the regressions for five dispersion portfolios for the R&D, zero R&D and R&D intensive firms, in the case of the R&D intensive firms, alphas are always positive and also significant at 5% for the bottom dispersion portfolio, but additionally the HML factor gets a negative coefficient of limited overall significance, consistent with prior literature (e.g. Lev and Sougiannis, 1999) on limited significance of the value factor for R&D intensive firms. Alphas are always negative and not statistically significant for the zero R&D firms (HML always with a positive and significant coefficient). Lastly, in the case of the R&D firms, alpha is positive for three out of four dispersion portfolios (including the two lower ones) but overall not statistically significant, and HML gets a positive and significant coefficient in all cases but for the bottom dispersion portfolio, where it is both negative and not statistically significant.

When the RD factor is included in the regression (Table 5B.6 Panel B), calculated from the difference of the average equal-weighted monthly returns between zero R&D firms and high R&D firms, the RD factor is always positive. It is statistically significant for the R&D and R&D intensive firms, and of limited overall significance in the sample level. The factor is also positive contrary to the intuition in the case of the zero R&D firms, although not statistically significant. Alphas are negative and not significant in the sample level and also for the zero R&D firms. In the case of the R&D and R&D intensive firms, alphas are positive (not significant always) for the low dispersion portfolio and tend to get negative for the higher dispersion portfolios. Interestingly, upon the inclusion of the RD factor, alpha is negative and gets significantly different from zero at 5% level for the top dispersion R&D portfolio indicating that the excess returns for very high dispersion R&D firms are statistically significantly negative, even after I control for the RD factor. Finally, consistent with the results of the value factor for R&D intensive firms by Lev and Sougiannis (1999), upon the inclusion of the RD factor, HML loses its significance for the R&D and R&D intensive firms, despite the fact that it remains significant in the sample level and also for zero R&D firms.

When the RD factor of Al-Horani, Pope and Stark (2003) type is included in the regression (Appendix 5B.C Part A Panel A), the results no not change much with respect to the significance of the market factor, SMB and HML compared to the relative results when no RD factor is included. In the sample level, the RD factor is generally not statistically significant and neither are the alphas, with both the RD factor and the alpha for the bottom dispersion portfolio to be positive (as previously in the case of the alpha, for the regression without the RD factor) and to be getting negative for higher dispersion portfolios. When I repeat the analysis for 5 dispersion portfolios for the R&D firms only, the RD factor gets steadily positive and significant, and alpha behaves as in the previous cases, being steadily statistically not significant and positive when dispersion is low and negative as it increases. This is the case when I repeat the results for the firms with an R&D/Sales ratio above the sample median: in that case though, the economical significance if the RD factor is even greater compared to the case when the regressions are run for the R&D firms in general. When I repeat the regressions for dispersion portfolios for the zero R&D firms, the coefficients of the RD factors are always negative, and for three out of five dispersion portfolios statistically significant at 5% significance level. Therefore even after I control for the influence of RD on stock returns, there is testified a negative relation between dispersion and returns.

When I include an R&D factor calculated from the difference of the average equal-weighted monthly returns between low R&D/zero R&D firms and mid R&D/high R&D firms (Appendix 5B.C Part A Panel B) alpha is negative and not statistically significant in every case but for the top dispersion portfolio, where it is statistically significant at 10% significance level. Alpha gets though a value very close to zero for the bottom dispersion portfolio. There are no great qualitative differences with respect to the previous cases regarding the behaviour of the market factor and SMB and HML.

When I repeat the analysis for the R&D and R&D intensive firms, the RD factor remains positive and its economic significance increases in the case of the R&D firms, compared to the relevant results for the whole sample, and even more for R&D intensive firms. For both the R&D and R&D intensive firms, alpha is now positive although not statistically significant for the bottom dispersion portfolio and gets negative for higher dispersion portfolios. Interestingly, for the R&D firms in the case of the top dispersion portfolio alpha is negative and statistically significant at 5% significance level. When I repeat the analysis for the zero R&D firms, alphas are always negative and generally not statistically significant and the coëfficient of the R&D factor, contrary to the intuition, remains positive.

Finally, when I construct the RD factor using the difference in the returns between very high and low R&D intensity firms (Appendix 5B.C Part A Panel C), and I limit the analysis into only R&D and R&D intensive firms, again I observe no dramatic changes in the direction of the results. The RD factor is positive and significant in every case, and of much greater economical significance for the R&D intensive compared to the R&D firms overall. Except in the case of the top dispersion portfolio for R&D firms, where the alpha is negative and significantly different from zero at 5% level, alphas are overall not statistically significant. As in previous analyses, they are positive for the bottom dispersion portfolio but tend to get negative for higher dispersion portfolios.

As already examined with the analysis in Table 5B.5, the fact that dispersion data are taken at different months for different firms, depending on the specific month that the accounting year ends for each firm may introduce the limitation that more forecast data (and therefore dispersion data) has been made available for some firms before the firms month of return calculation in the UK for some firms and fewer for other firms, with their relative probable influence on stock returns. In order to overcome this problem, I repeat the analysis in Table 5B.6 with one modification: I use dispersion data for portfolio formation as of June t but only for these firms whose accounting years end between July t - December t. June t is the closest month for which I have forecast data for dispersion calculation prior to the firms month of return calculation. Again, the reason for limiting the sample and including only these firms with an accounting year ending between July t and December t is in order to assure that the 1 year ahead EPS forecasts, out of which dispersion is calculated, refer to the accounting year that finishes within the calendar year t, and I therefore use only one year ahead forecast data that refer to the calendar year t (for example, for a firm whose accounting year ends in March of t+1, the one year ahead EPS forecasts issued in June t refer to an accounting year that will end after the first calendar year of return calculation). I therefore repeat the analysis from Table 5B.6 in Appendix 5B.C Part D by performing this modification, in order to make sure that the results I get on Table 5B.6 are not biased from the fact that accounting years end at different times during the calendar year in the UK, with the relative impact on the months I take for dispersion calculation. As can be observed from the results in Table 5B.6 in Appendix 5B.C Part D, Panels A (regressions run without an RD factor), B (regressions run with an RD factor, calculated from the equal-weighted returns of High R&D and zero R&D firms), and C (regressions run with an RD factor, calculated as in Al Horani, Pope and Stark with equal-weighted returns) for the whole sample, and separate R&D and zero R&D firm portfolios, the main observation from these results is that the positive alphas for the bottom dispersion portfolios are statistically significant at 5% significance level in the sample level, and also for R&D and zero R&D firms separately, both when the RD factor is included and not included in the regressions. The RD factor is negative in the sample level and for zero R&D firms too, and interestingly it turns negative in a couple of cases for the R&D firms too, and is overall of limited significance, probably an indication of the fact that the effects of R&D should be more tong-term. Finally, the HML factor is also of limited overall significance, and it tends to be negative for low dispersion portfolios, both when the RD Factor is included or excluded from the regressions. The same qualitative changes in the results apply when I use an RD factor calculated according to the Al Horani, Pope and Stark methodology with equal-weighted returns.

In order to control for possible effects from the New Economy years on the results (late 1990's – early 2000), I have repeated the regressions in Panels A and B of the Table 5B.6 by excluding the months from January 1999-December 2001. The regressions have also been repeated by using an RD Factor calculated with equal weighted returns according to the Al-Horani, Pope and Stark (2003) methodology. The relevant results are reported in Part E of the Appendix 5B.C. When the RD Factor is not included in the regression (Panel A of Part E of Appendix 5B.C), the main observation relates to the reduction in the significance of the HML factor, both in the sample level and for R&D firms as well, which turns to not statistically significant for the low dispersion portfolios. The HML factor continues to be negative in the case of the R&D intensive firms. There are no great changes with respect to the direction of the results for the alphas. A very interesting observation though is that for the reduced sample period, alpha is positive and statistically significant at 5% for the bottom dispersion portfolio in the case of the R&D intensive firms, and for the same group of firms alpha is negative but with increased statistical significance at 10% for the top dispersion portfolio.

When the RD factor is included in the reduced sample regressions (Panel B of Part E of Appendix 5B.C), in the sample level there is not one single positive alpha for any dispersion portfolio. In the sample level, the trend for reduced statistical significance for the HML factor in the reduced sample continues with the inclusion of the RD Factor, and the same trend applies for R&D, zero R&D and R&D intensive firms. The RD Factor shows reduced statistical significance for the zero R&D firms (and remains negative) and there are no great changes with respect to its significance for the R&D and R&D intensive firms. The main great change with respect to the direction of the results for the alphas relates to the alphas for the top dispersion portfolios: with the exception of the zero R&D firms, alpha is statistically significant at 5% significance level and negative for the top dispersion portfolio in the sample level and for the R&D and R&D intensive firms. Alpha is negative and statistically significant at 10% level for the top dispersion portfolio for the zero R&D firms. These results generally hold when making use of an RD Factor calculated according to the Al-Horani, Pope and Stark (2003) methodology in Panel C of the Appendix 5B.C Part E, with the alphas for the top dispersion portfolios to be exhibiting high t statistics in absolute terms of a negative sign.

The Diether, Malloy and Scherbina (2002) study on which I extensively based all the previous analyses has received though fierce criticism by Doukas, Kim and Pantzalis (2006), that it makes use of analyst forecast dispersion which is a poor proxy for divergence of opinion, since it does not account for forecast uncertainty. Doukas, Kim and Pantzalis (2006) testify a negative relationship between returns and uncertainty, but a positive relationship between diversity of opinion and stock returns. I have therefore repeated the previous analysis by running the Fama-French three factor time-series model (with and without adding an RD factor) by running the regressions this time according to 5 portfolios formed according to diversity of opinion (1-ρ) and not forecast dispersion. This way I run the regression 5B.2 (with and without adding the RD factor) using as dependent variable the equal-weighted returns of 5 (1-ρ) portfolios for the whole sample and then the R&D, zero R&D and firms with an R&D/Sales ratio above the sample median. Running Fama-French type time-series regressions according to analyst divergence of opinions (1-ρ) portfolios, with and without adding an RD Factor into the model represents an extension into the previous analysis of assessing the relation between dispersion and returns after accounting for the role of R&D for returns, since at this point there is isolated the divergence of opinion component of forecast dispersion (assuming that forecast dispersion consists of both a forecast uncertainty part and a divergence of opinions part). When the RD factor is added, this is calculated with equal-weighted returns either by subtracting the returns the zero R&D firms from the returns of the top 30 percentile R&D/Sales firms as in Table 5B.6, or as in Al Horani-Pope and Stark (2003), as is done in Appendix 5B.C Part A. Panel A. The relevant results are presented in Appendix 5B.P Panels A (no RD factor), B (RD factor as High RD-Zero RD as in Table 5B.6) and C (RD factor as in Al Horani-Pope and Stark, 2003, as is done in Appendix 5B.C Part A. Panel A). The scaling used for (1-ρ) calculation in Appendix 5B.P is by the absolute value of actual EPS and is consistent with the scaling used for D calculation on the Tables on p.85 of this second Volume.

When an RD factor is not included in the regressions, I observe not so great differences compared to Table 5B.6 with respect to the sign and significance of the market factor, SMB and HML, but in the case of alpha, there is no longer observed the previous pattern of a positive alpha for low dispersion portfolios and negative alphas with continuously lower t stats thereafter as dispersion changed, all alphas being statistically not significant. Alphas tend to be positive for the bottom divergence of opinion portfolio (with the exception of the zero R&D firms) and again positive for the medium divergence portfolios (1-ρ)3.

When an RD factor is added (calculated from the returns of High RD-zero RD firms), the first interesting observation is that unlike the relevant results in Table 5B.6, the top divergence of opinion portfolio for the R&D firms no longer gets a negative alpha that is statistically significant. Consistent with the previous results when no RD factor was included, when I construct portfolios according to divergence of opinion and not dispersion, there is again no longer observed the previous pattern in Table 5B.6 of a positive alpha for low dispersion portfolios and negative alphas with continuously lower t stats as dispersion increased, no matter how I define the RD factor in Panels B and C of the Appendix 5B..O. This absence of evidence on a negative association between returns and divergence of opinion is in accordance with Doukas, Kim and Pantzalis (2006), but in this study I do not find a positive relation between (1-ρ) and subsequent returns as they do either.

The most interesting finding though, when I construct portfolios according to divergence of opinion instead of dispersion, has to do with the significance of the RD factor for the RD and RD intensive firms, no matter how I define it in Panels B and C of the Appendix 5B.P. In table 5B.6 and also in Appendix 5B.C Part A Panel A, as dispersion increased, so did the significance of the RD factor, with the t statistics to be getting constantly higher. When I construct though the portfolios according to divergence of opinion (1-ρ) instead of dispersion, as divergence gets higher, the significance of the RD factor is continuously reduced and the t stats get lower and lower, particularly when the RD factor is calculated as from the returns of High RD-Zero RD firms.

In addition, in Appendix 5B.R Part A, I rerun the Fama-French time series regressions presented in Appendix 5B.P according to (1-ρ) portfolios, for the whole sample, the R&D, zero R&D and R&D intensive firms (firms with R&D/Sales above sample median), without including an RD Factor (Panel A) and by including an RD Factor calculated as in Al-Horani, Pope and Stark (2003) with equal-weighted returns (Panel B) or by including an RD Factor calculated from the equal-weighted returns of (High RD-Zero RD) firms (Panel C), when calculating (1-ρ) using scaling by the absolute value of mean EPS forecast one month prior to accounting year end. In other words, (1-ρ) used in Appendix 5B.R Part A is calculated as in Table 3 of the Appendix

5B.A Part B, when (1-ρ) used in Appendix 5B.P is calculated as in Table 1 of the Appendix 5B.A Part B. Therefore the (1-ρ) calculation in Appendix 5B.R Part A is completely consistent with the dispersion calculation when running Fama-French time-series regressions according to five dispersion portfolios in other parts of the Thesis (Table 5B.C and Appendix 5B.C Parts A to G), which is a fact that makes comparisons across the different empirical findings when running the regressions according to five dispersion as opposed to divergence of opinions (1-ρ) portfolios particularly useful.

In the same direction, there is also observed from the results in the Appendix 5B.R Part A that as divergence of opinions increases, in the case of the R&D and especially the R&D intensive firms the significance of the RD Factor is constantly getting lower. When an RD Factor calculated using the Al-Horani, Pope and Stark (2003) methodology is used in Panel B (which is expected to lead to more unbiased results given the fact that it exhibits a very reasonable Pearson correlation coefficient with other regressors, unlike the RD Factor when constructed from the returns of High R&D-Zero R&D firms, which exhibits a Pearson coefficient of above 0.7 in absolute value with HML), the RD Factor exhibits a much lower t statistic for the top (1-ρ) portfolio for the R&D firms, compared to its significance for higher (1-ρ) portfolios, with the significance of the RD Factor to be exhibiting a diminishing trend as divergence of opinions increases for these firms. More importantly, the RD Factor, which shows the same diminishing trend in terms of statistical significance for the R&D intensive firms too as (1-ρ) increases, is not statistically significant at any reasonable level of significance for the top (1-ρ) portfolio for these firms, confirming this way the low power of R&D for to influence returns for R&D intensity firms in the presence of high divergence of opinions.

Appendix 5B.R Part B continues with running Fama-French time series regressions according to analyst forecast uncertainty V portfolios, for the whole sample, the R&D, zero R&D and R&D intensive firms (firms with R&D/Sales above sample median), without including an RD Factor (Panel A) and by including an RD Factor calculated as in Al-Horani, Pope and Stark (2003) with equal-weighted returns (Panel B) or by including an RD Factor calculated from the equal-weighted returns of (High RD-Zero RD) firms (Panel C), when calculating V using scaling by the absolute value of mean EPS forecast one month prior to accounting year end, as was done for (1-ρ) calculation in Appendix 5B.R Part A. So, analyst forecast uncertainty V in Appendix 5B.R Part B is calculated as in Table 3 of the Appendix 5B.A Part B, and the V calculation in Appendix 5B.R Part B is completely consistent with the dispersion calculation when running Fama-French time-series regressions according to five dispersion portfolios in other parts of the Thesis.

What is observed from Appendix 5B.R is that both in terms of alphas as well as in terms of the behaviour of the RD Factor, the results when running Fama French regressions according to V portfolios are close to the relevant results when performing the same analysis according to dispersion portfolios. As far as alphas are concerned, there are no cases where alpha is statistically significant in Panels A and B, and the signs of the alphas seem to follow the respective signs of the alphas when running the regressions according to dispersion portfolios. Regarding the RD Factor, it can be observed that as forecast uncertainty V increases, for the R&D and particularly R&D intensive firms the t statistics of the RD Factor tend to increase and get very high for the top V portfolio. In Panel B, in the case of the top V portfolio for the R&D intensive firms, the t statistic of the positive RD Factor gets its highest value, and the same result is confirmed in Panel C. This result on a very strong significance of the RD factor as R&D intensity gets high for high forecast uncertainty is very similar to the observed very strong significance of the RD Factor for very high dispersion firms in the case of R&D intensive firms previously testified.

The above findings imply that when forecast dispersion is decomposed into a forecast uncertainty and a pure differences of opinion part, as R&D intensity increases, the ability of R&D to influence returns also increases for high dispersion and high forecast uncertainty (V) firms, but the ability of R&D to influence returns is very week for high divergence of opinion (1-ρ) firms. This finding implies at the same time that in the presence of high R&D intensity, dispersion has an impact on returns mainly through the forecast uncertainty component of forecast dispersion, and not through the divergence of opinion component.

Despite the fact that the theoretical relation between dispersion and subsequent returns is an issue of fierce academic debate this moment, with contradicting views in the field (Diether, Malloy and Scherbina, 2002; Doukas, Kim and Pantzalis, 2006), when trying to interpret this finding by using the Doukas, Kim and Pantzalis (2006) conceptual framework, high uncertainty in forecasts should be associated with lower returns according to theorisation by Doukas, Kim and Pantzalis (2006). Therefore this testified strong uncertainty component should be driving returns downwards for these high R&D intensity firms, which is not the case at all though for high R&D firms, given that high R&D firms have been generally associated with very high returns in the literature and also in this study in specific in Chapter 5A. Following this line of reasoning, the returns of these high R&D and high forecast uncertainty firms should be more due to market mispricing.

Appendix 5B.Q also reports the average 156 month (July 1991-June 2004) monthly returns, both raw and risk-adjusted for the whole sample and the R&D, zero R&D, and R&D intensive firms (firms with an R&D/Sales ratio above the sample median for a particular year) according to 5 analysts forecast dispersion (D) and 5 analyst diversity in opinion portfolios (1-ρ) from low (1) to high (5). Dispersion is defined as the standard deviation in 1 year ahead EPS forecasts, standardised by the absolute value of the mean forecast, and (1-ρ) is calculated by using scaling by the absolute value of actual EPS. One month prior to year end data are used for D and (1-ρ) calculation (details on the calculation of risk adjusted returns, calculated with reference to the value weighted-returns of 6 (2 by 3) MV-BM portfolios, are included in the Appendix).

As can be observed from the relative Appendix, there is observed no clear or readily observable trend with respect to the direction of returns as dispersion or divergence in opinion changes, even when I control for firm size and BM through the calculation of returns.

As a final robustness check, I wish to see whether the fact that the standard deviation is scaled by the absolute value of the mean forecast drives this result, in sense that the mean analyst forecast is associated with future stock returns and not the standard deviation in analyst forecasts. Following a previous such control by Diether, Malloy and Scherbina, I regress stock returns on both dispersion, R&D intensity and other control variables by running the following regression for the period 1990-2002 with panel data:

$$\text{Re}\,turns_{it} = \beta_0 + \beta_1 D + \beta_2 RD + \beta_3 PASTS + \beta_4 MEANEPS + \beta_5 MV + \beta_6 BM + \varepsilon_{it}$$

(5B.3) where:

RET - the 12 month raw cumulative return from July of year t until June of year t+1. The first month for which the return is included is July 1991 and the last one is June 2004.

D - analyst forecast dispersion defined as the standard deviation in one year ahead analyst forecasts of EPS for a particular month divided by the absolute value of the mean forecast in the specific month. There are used forecasts 6 months prior to year end (in the thesis, dispersion is calculated with -12, 6, and 1 month before year end and I chose to use the mean value for dispersion calculation in the regression).

RD - R&D/Total Assets or R&D/Market value of equity at year end. The choice of R&D/TA and R&D/MV instead of R&D/Sales is justified by the fact that I use a past sales variable among the regressors.

MEANEPS - Mean analyst earnings forecast 6 months prior to year end

PASTS - the sales growth over the two years prior to year t (geometric mean)

BM - the book-to-market ratio at year end

MV - MVE at year end (natural log)

The regression is run using OLS and Whites Heteroskedasticity robust standard errors. Observations above the 98 and below the 2 percentile were eliminated.

As can be observed from the Appendix 5B.C Part H, the dispersion variable always gets a negative sing, consistent with prior literature for the US (Diether Malloy and Scherbina, 2002), and is statistically significant at 5%. BM is positive and very much statistically significant and MV is generally of limited significance and negative. The past sales growth variable PASTS is also positive but generally not significant in the regression at any reasonable level. Conforming to the hypotheses and prior literature, the R&D intensity variable is always positive and statistically significant at 5% significance level, no matter if we define it as R&D/TA or R&D/MV. The EPS forecast variable

MEANEPS is also positive and statistically significant at 5% level, but gets values of t statistics lower than the ones of the dispersion variable. Finally, the p values of the F statistics are generally zero, and the adjusted R squares are very low, an indication of the difficulty to explain stock returns.

The fact that dispersion is found to play a significant role for stock returns, when the mean EPS forecast is also statistically significant but with lower t statistics is consistent with Diether, Malloy and Scherbina (2002), constitutes evidence that the results are not driven by the behaviour of the dispersion denominator. The negative and significant coefficient of the dispersion variable is consistent with the previous results on the negative and significant role of dispersion on stock returns, even after controlling for R&D. I acknowledge in the specific regression that the results could be biased from the fact that accounting year ends end at different times during the calendar year, and therefore analyst forecast data are taken at different times during the calendar year, but I have made controls for this problem in previous parts of Chapter 5 Part B and thus I expect that this limitation should not be determining the direction of the results.

The results are robust to the addition of an analyst following independent variable (data in Appendix 5B.C Part H main table, Panel B) The results are robust to possible time period effects during the years of the New Economy, with the inclusion of a time dummy variable for the base years 1998, 1999 or 2000 (data in Appendix 5B.C Part H).

This regression setting also permits controlling whether industry effects influence the results regarding dispersion, R&D and stock returns. Al-Horani, Pope and Stark (2003) control for these in their study by including industry dummies in another part of their paper, which involves running cross-sectional regressions. Diether, Malloy and Scherbina (2002) do not control for industry factors at all. In Part A of Chapter 5 of the thesis, I have regressed size and BM adjusted stock returns on R&D intensity and industry dummies to account for very R&D intensive industries, both simple and multiplicative with R&D, and found no significant change in the power of R&D to influence returns. In this panel setting, I control for industry effects by including industry dummy variables, both simple and multiplicative with R&D, to account for four industries which are perceived as intensive in R&D activity: Information Technology

(INDD1), Chemicals (INDD2), General Industries (INDD3) and Health grouped together with Pharmaceuticals and Biotechnology (INDD4) (data presented in Appendix 5B.C Part H). I observe from the relevant results no significant difference in the sign or significance of neither the R&D nor the dispersion variables upon the inclusion of the dummy variables, except for the case cases of the General Industries simple and multiplicative dummy when R&D intensity is defined as R&D/TA, and therefore I conclude that industry factors should not be the cause for return behaviour.

Taking the above findings from Table 5B.6 Panels A and B, and also Appendices 5B.C, 5B.P and 5B.R as a whole, keeping in mind the econometrical problems due to increased correlation of the RD factor with the other independent variables depending on how this is constructed, I confirm a negative relationship between dispersion and returns. The results in the overall sample level are consistent with the ones by Diether, Malloy and Scherbina (2002) for the US, in the sense that the bottom dispersion portfolio exhibits a positive alpha which is not significant, and alphas tend to get negative for higher dispersion portfolios, which are generally not statistically significant as well. This later finding is in contrast to the one by Diether, Malloy and Scherbina (2002), who find that the alpha for their top dispersion portfolio is negative and statistically different from zero.

I also observe that the inclusion of the RD factor in the traditional Fama-French model, according to several methods used for its construction, improves the performance of the model since I generally get higher adjusted R squares. Upon the inclusion of the RD factor the previously testified negative relationship between dispersion and returns is still found to hold: again, even after controlling for the impact of R&D on stock returns, I find that the bottom dispersion portfolio exhibits a positive alpha which is not significant, and alphas tend to get negative for higher dispersion portfolios. A very interesting finding is that in the case of the R&D firms, in Table 5B.6, the inclusion of the RD factor makes the alpha for the top dispersion portfolio become statistically different from zero at 5% significance level, consistent at this particular point with Diether, Malloy and Scherbina (2002). The R&D factor, along with a high t statistic for the top dispersion portfolio also gets a high coefficient, suggesting that RD plays a larger part in explaining negative abnormal returns for high dispersion firms. After decomposing though dispersion in analysts' forecasts into uncertainty and pure differences in opinion, I also find that as R&D intensity increases, the ability of R&D to influence returns also increases for high dispersion *and* high forecast uncertainty firms, but the ability of R&D to influence returns is very week for high divergence of opinion firms. This is a finding which implies that in the presence of high R&D intensity, dispersion has an impact on returns mainly through the forecast uncertainty component of forecast dispersion, and not through the divergence of opinion component. When interpreting this finding by using the Doukas, Kim and Pantzalis (2006) conceptual framework, high uncertainty in forecasts should be associated with lower returns according to theorisation by Doukas, Kim and Pantzalis (2006). Therefore this testified strong uncertainty component should be driving returns downwards for these high R&D intensity firms, which is not the case at all though for high R&D firms, given that high R&D firms have been generally associated with very high returns. Following this line of reasoning, the returns of these high R&D and high forecast uncertainty firms should be more due to market mispricing.

5B.4 Forecast Errors and Revisions

5B.4.1 Forecast Errors and Revisions: Descriptive Statistics

Having considered the issue of R&D intensity and stock returns, when forecast dispersion is taken into account, I proceed with assessing the impact of R&D on forecast errors and revisions.

Consistent with previous literature, I use two definitions about (signed) forecast errors: Forecasted minus actual EPS divided by the absolute value of actual EPS and by the firm stock price twelve months prior to year end (Capstaff, Paudyal and Rees, 1995; Helbok and Walker, 2004 for the rationale for scaling by price). As previously, I make use of the mean one year ahead EPS forecast and I use all of the minus 12, 6 and 1 month previous to year end forecasts. In Table 5B.8 Panel A I present the average signed errors throughout the sample period 1990-2003, for the two definitions of forecast errors for the whole sample, R&D and zero R&D firms. As expected, the closer the forecast to the end of the financial year, the lower the errors, which is more striking when I scale errors by the absolute value of actual EPS. When scaling errors by the absolute value of actual EPS, errors are higher for the R&D compared to the zero R&D firms, but this result does not hold when scaling errors by price, errors for R&D firms are pretty stable and are not reduced as move towards the end of the financial year. As one would intuitively observe, errors are generally lower when scaling by price as opposed to absolute value of actual EPS, given that stock prices tend to be greater than EPS ratios.

Insert Table 5B.8 here.

Table 5B.8 Panel B proceeds with showing the sample period average forecast signed errors in quartiles, formed according to R&D intensity (for the R&D firms only, using all of R&D/Sales, R&D/TA and R&D/MV as proxies for R&D intensity).

As can be observed from Panel B, when assessing singed errors according to R&D intensity for R&D firms, the way we define R&D intensity plays a role for error behaviour. Errors are optimistic forecasts and steadily get larger as R&D/MVE increases, with optimism to be decreasing as the end of the accounting year gets closer. When I define R&D intensity as R&D/Sales or TA though, optimism continues to decrease as year end approaches, but I do not observe any clear trend for error behaviour as R&D intensity increases. Finally, error behaviour is a lot smoother when we scale by absolute actual EPS instead of price, which implies that scaling by price may result in denominator driven biases.

In Appendix 5B.D Part A there are also reported the sample period average signed forecast errors in quartiles, formed according to TA, MV and BM. Conforming to the intuition and prior findings in the literature, errors appear to be higher for smaller size firms, both in terms of TA and MV. On the other direction, errors appear to increase as BM increases, no matter how I define them.

In Appendix 5B.D Part B, I report the average sample period absolute (unsigned) errors for the whole sample, R&D and zero R&D firms, and then according to R&D/Sales, R&D/TA, R&D/MV, TA, MV and BM quartiles. In this case we get much clearer trends about the behaviour of errors as R&D intensity, firm size and BM change. There is a clear trend though not always linear for absolute errors to increase as R&D intensity increases, particularly when R&D/MV is used as a proxy for R&D intensity. Errors as in the previous non-absolute case are larger for smaller firms and increase as BM increases. The fact that we get indications for larger unsigned errors when R&D

intensity increases when we use their absolute form, but no such indication when we use non-absolute raw errors, implies biases in the data that result from the relative magnitude of positive and negative errors for different degrees of R&D intensity.

Having observed that the average signed errors steadily increase as R&D/MVE increases, without controlling for any other factors, I proceed with the descriptive analysis of forecast revisions according to different degrees of R&D intensity. It goes without saying that if signed errors are larger as R&D intensity gets higher, but are expected to decrease as year end approaches, the underlying expectation is that signed revisions should be also getting larger as year end gets closer. According to the research hypothesis, I expect signed forecast revisions to increase with R&D intensity. Errors should decrease as year end gets closer, but at the same time both signed errors and revisions are expected to be higher as R&D intensity gets larger.

I use two definitions for signed forecast revisions (using one year ahead forecast data): In the first one, I subtract the mean analyst forecast twelve months prior to financial year end from the mean analyst forecast six months prior to year end, and I divide the result by the stock price twelve months prior to year end (stock price given by IBES). In the second one, I subtract the mean analyst forecast twelve months prior to financial year end from the mean analyst forecast one month prior to year end, and I divide the result by the stock price twelve months prior to year end (stock price given by IBES). The standardisation by stock price is consistent with prior literature (Capstaff, Paudyal and Rees, 1995, Helbok and Walker, 2004). Also following Helbok and Walker (2004), if revision exceeds +/-100%, it is considered an outlier and is removed. I repeat the analysis by standardising the change in forecasts by the absolute value of the median one year ahead EPS forecast twelve months prior to year end instead of price.

I first assess signed forecast revisions according to R&D intensity and other firm characteristics. Table 5B.9 reports the average signed forecast revisions during the sample period for the whole sample, the R&D and zero R&D firms and according to quartiles formed by R&D intensity (using R&D/Sales, R&D/TA and R&D/MV as proxies of R&D intensity), when scaling revisions both by price and the absolute value of the median one year ahead EPS forecast twelve months prior to year end. As can be observed from the table, as one would intuitively expect, revisions between 12 and 6 months prior to year end are much smaller than revisions between 12 and 1 month. Revisions are also higher when scaled by median forecasted EPS compared to prices, as prices tend to be higher than EPS ratios.

In addition, signed revisions appear to be slightly higher for non R&D reporting firms compared to R&D firms, maybe due to the fact that the non R&D reporting firm population is almost double the R&D one. Moreover, given the way they are defined, positive revisions imply upgrades as the end of the financial year approaches. I generally observe positive average revisions, both for the whole sample and as well for the R&D and non R&D samples separately This observation is contradictory to existing empirical evidence for the US but for the UK as well (Hussain, 1996) that testifies a decrease in optimism in analyst forecasts as the end of the financial year gets closer, and also with the relative results of the thesis for errors.

Among R&D firms, signed revisions appear to be particularly high for the top R&D intensity portfolio, no matter if we use R&D/Sales or R&D/TA as proxies (or use price instead of the absolute value of the median one year ahead EPS forecast twelve months prior to year end to scale revisions), and they also appear to be positive. Despite the fact that very high R&D/Sales or R&D/TA firms consistently show very high revisions, there does not appear to exist any clear trend for revisions as R&D intensity increases and we move from lower to higher R&D intensity quartiles. The positive sign of the revisions given the ways they are defined implies an increase in optimism for these firms as year end approaches. The surprising observation is that when we define R&D intensity as R&D/MVE, these results no longer hold: as we move from higher to lower R&D/MV quartiles, revisions increase, a result that could receive influence by the denominator in R&D/MV. Interestingly, the top quartile R&D/MV firms exhibit negative revisions, implying decrease in optimism.

Insert Table 5B.9 here.

As a final robustness check, I report in Appendix 5B.E Part A the average sample period signed forecast revisions according to TA, MV and BM quartiles. Interestingly, just like in the case of errors, revisions appear to be higher for smaller firms in terms of TA, but just the opposite occurs when we use MV as a proxy for firm size. This latter fact could provide some light into the previous observation that the highest R&D/MV firms are the ones with the lowest revisions. In the case of BM, contrary to the results for errors, the smaller BM firms are the ones with the highest revisions, without controlling for other factors.

In Appendix 5B.E Part B, I also report the average sample period absolute revisions for the whole sample, R&D and zero R&D firms, and then according to R&D/Sales, R&D/TA, R&D/MV, TA, MV and BM quartiles. In this case, we get much clearer trends about the behaviour of errors as R&D intensity, firm size and BM change. There is a clear trend for absolute revisions to increase as R&D intensity increases, particularly when R&D/MV is used as a proxy for R&D intensity. This comes in contrast with the previous case where I used non absolute revisions, where revisions increased as R&D/Sales or R&D/TA increased, but decreased as R&D/MV increased. Revisions as in the previous non-absolute case are larger for smaller firms and, contrary to the result when I was using non absolute revisions, revisions increase as BM increases. The fact that we get indications for larger revisions when R&D intensity increases when we use their absolute form, no matter which proxy we use for R&D intensity, and also larger absolute revisions when BM increases, but no such results when we use non-absolute raw revisions, implies, as in the case with absolute and non absolute errors, biases in the data that result from the relative magnitude of positive and negative revisions for different degrees of R&D intensity and BM ratios.

An issue that appears relatively strange has to do with the fact that (signed) errors are generally positive (given the way they are defined[1]), with analyst optimism to be decreasing as the end of the financial year for which they are forecasting approaches, and at the same time signed forecast revisions appear to be also positive. This latter fact implies that forecast get more optimistic as year end approaches, when we get indications from errors that earnings forecasts become less optimistic.

In order to investigate this issue, I conduct a detailed analysis of both errors and revisions as the end of the financial year for which earnings forecasts are made gets near. The issue just described can be observed from Appendix 5B.L, Table I, which shows exactly the average and median signed errors and revisions for the sample period

[1] Errors are defined as Forecasted minus actual EPS, and revisions as forecasts made six or one month prior to year end minus forecasts made twelve months prior to year end.

1990-2003. Errors are positive and from their direction there is implied a decrease in optimism as year end approaches. At the same time, revisions are positive, and they get larger values between 12 and 1 month before year end, compared to 12 and 6 months, as one would intuitively expect. When I impose stricter criteria for outlier removal for forecast errors (eliminating actual and forecasted EPS observations above the 0.98 and below the 0.02 percentile in Panel A, and well and above that removing error observations above the 0.98 and below the 0.02 percentile for Panel B), average and median errors become smaller, but there is no qualitative change towards the direction of the results.

When it comes to observing the percentages of positive and negative errors as we move towards the end of the financial year (Appendix 5B.L, p. 130, Table II), we see that positive errors tend to become more the case as a percentage of total errors as we move from 12 to 6 and then to 1 month prior to year end, implying a very slight increase in optimism. The increase though in the percentage of positive errors is quite small as we move from minus 12 months with 42.4% (Panel A) to 6 (46.8%) and then to 1 month before year end with 49.2%. In the case of revisions now, as can also be observed from Appendix 5B.L Table II, consistent with the fact that the average and median sample period revisions are positive, a greater percentage of revisions are positive than negative.

The above observations for the percentages of positive and negative errors and revisions could have implications about the relative magnitude of errors and revisions of different sign. This way, in Appendix 5B.L Table III I calculate the average and median errors and revisions for the whole sample and then for positive and negative errors and revisions. In the case of errors, as can be observed from the table, in absolute terms positive errors are much larger than negative ones, and this finding is stronger when I use less strict outlier removal criteria. This fact could lead to very large average errors. Positive errors slightly increase as year end approaches, but the values of the positive and optimistic errors are much higher than the ones of the negative errors. In the case of revisions now, in absolute terms a casual comparison shows not so great differences between positive and negative revisions. Negative revisions in absolute terms are actually slightly larger than positive ones.

This way, in the case of errors, I observe a decrease in optimism in terms of mean and median errors, but the number of positive errors slightly increases as year end approaches. The values of the positive errors are though much larger than the ones of the negative errors. This could provide an explanation on why revisions are positive, both in terms of mean and median values as well as in terms of the percentage of positive and negative revisions.

The findings in Appendix 5B.L are completely in accordance with the findings when we were assessing absolute versus non absolute errors and revisions for different degrees of R&D intensity and BM, and we were getting conflicting results in some cases. They confirm the fact that the relative magnitude and number of positive versus negative errors and revisions causes distortion when average or even median values are computed.

In addition, in order to assess errors and revisions for the R&D as opposed to the zero R&D and R&D intensive firms, while controlling for other firm characteristics, I have calculated the sample period medians of the average signed errors, and the sample period averages of the signed analyst forecast revisions for the whole sample, the R&D, zero R&D and R&D intensive firms that belong to the same MV BM portfolios. R&D intensive firms are considered the ones with an R&D/Sales or R&D/TA ratio above the sample median for a particular year. There are constructed six (2 by 3) MV-BM portfolios, annually rebalanced, as described in the section 5.B.4 on R&D, analyst forecast dispersion and subsequent stock returns of the Chapter, and I assess the errors and revisions (when scaling errors by absolute actual EPS and revisions by absolute median forecasted EPS) for the sample firms in general, and then the R&D, zero R&D and R&D intensive firms that belong to each portfolio. The relevant results are reported in Table 5B.10 for errors and 5B.11 for revisions.

Insert Tables 5B.10 and 5B.11 here.

In the case of signed errors, I observe that for some portfolios, the R&D and particularly the R&D intensive firms tend to exhibit very high errors, and for some other portfolios, the zero R&D firms are the ones with the largest errors. In specific, the R&D and R&D intensive firms exhibit the largest errors for the high MV-high BM portfolios, but for other portfolios, e.g. low MV-low BM, the zero R&D firms exhibit larger errors.

This way, there can be drawn no categorical conclusion as to whether R&D and R&D intensive firm tend to exhibit larger forecast errors than zero R&D firms, after controlling for other firm characteristics.

Regarding signed forecast revisions, the situation is more or less the same, with the R&D and R&D intensive firms to be showing larger revisions than zero R&D firm for some portfolios, especially for the low MV-low BM ones, and the zero R&D firms to be the ones with the largest revisions for other portfolios. Thus, the data does not permit to draw again any clear conclusion as to whether R&D and R&D intensive firm tend to exhibit larger revisions than zero R&D firms, after controlling for the firm characteristics of size and BM.

Taking the findings from Tables 5B.8 and 5B.9, and combining them with the ones from Tables 5B.10 and 5B.11, and also Appendices 5B.D and 5B.E for absolute errors and revisions, there is not observed any linear positive trend for signed errors and revisions to increase as R&D intensity increases, without controlling for other factors, regardless of the way we define R&D intensity. When I control for the firm characteristics of size and BM, I get mixed evidence as to whether R&D intensive firms show larger signed errors and revisions than zero R&D firms. When I make use of unsigned errors and revision compared to signed ones, there exists evidence on a trend for both errors and revisions to increase as R&D intensity increases.

5B.4.2 Errors and Revisions for Different Degrees of Analyst forecast Dispersion

Before proceeding with the application of detailed regression analysis in order to assess whether the impact of R&D on errors first and more importantly on revisions, since the last constitutes part of the research hypothesis, I proceed with the examination of signed and unsigned errors and revisions as analyst forecast dispersion changes. This is because the underlying hypothesis is that uncertainty on future firm performance (in this study due to R&D) should contribute to higher analyst forecast dispersion errors and revisions. In this context, I wish to see whether high forecast dispersion is accompanied by higher errors and revisions. I therefore report on Appendix 5B.M Part A the average errors end revisions according to dispersion quintiles, from D1 (low) to D5 (High). Dispersion is defined as previously in the thesis, following the Diether, Malloy and Scherbina (2002) definition. What we observe is that in the case of errors, as dispersion increases so do signed errors in general, which get more positive, implying increase in optimism. When we assess absolute errors according to 5 dispersion quartiles in Appendix 5B.M Part B, the previous trend appears to hold as with signed errors. In the case of revisions, the result is more interesting. As dispersion increases, revisions increase in absolute values (Appendix 5B.M Part B), but when it comes to their signed values (Appendix 5B.M Part A), they start from slightly positive for the low dispersion portfolios and get much larger negative values for the top dispersion portfolios. The result is more striking when minus 1 month dispersion data are used. Errors and revisions are therefore found to be high when uncertainty for future operating results is high, as testified by high analyst disagreement. Appendix 5B.M Part C reports the Pearson correlation coefficients between the various definitions of revisions, errors (both non absolute) and dispersion, which does not confirm any strong relationship between the three, indicating probably that the relationship between the three variables is not completely linear. Errors and revisions appear to get a slightly negative Pearson coefficient in some cases.

I found that errors tend to be larger and positive for larger dispersion portfolios, and revisions tend to be high and negative (pessimistic analysts) for higher dispersion portfolios. This would provide some intuition and confirm the 1st hypothesis (p.2114 of their paper) of Diether, Malloy and Scherbina (2002), on a negative association between dispersion and returns, since when analyst disagreement is high, the pessimistic investors of the high dispersion portfolios appear to be kept out of the market because of high short sale costs as Diether, Malloy and Scherbina argue, so the remaining optimistic investors will keep the market price high, and returns will be lower for high dispersion portfolios.

5B.4.3 The Impact of R&D Intensity on Forecast Errors and Revisions: Regression Analysis

In order now to assess the impact of R&D intensity on forecast errors and revisions, I use regression analysis. Despite the fact that the research hypothesis of the thesis is on the impact of R&D on forecast revisions, as before I start with forecast errors and in order to assess the impact of the same factors on errors as opposed to forecast revisions, I regress both signed and unsigned forecast errors and forecast revisions on the same set of regressors.

In the case of errors, the following regression is run with OLS using panel data for the period 1990-2003:

$$Error_{it} = \beta_0 + \beta_1 RD + \beta_2 BM + \beta_3 MV + \beta_4 PASTR + \beta_5 STDEV + \varepsilon_{it}$$

(5B.4) where:

Error - both signed and unsigned, defined in two ways, using one year ahead mean EPS analyst forecasts scaled either by stock price or by the actual EPS and using analyst forecast data 12 and 6 months prior to year end:

1) 1 year ahead mean Forecasted EPS using data for 12 and 6 months prior to year end-Actual EPS/Share Price 12 months prior to year end
2) 1 year ahead mean Forecasted EPS using data for 12 and 6 months prior to year end-Actual EPS/Absolute value of actual EPS

RD - R&D/Sales or R&D/Total Assets or R&D/Market value of equity at year end

BM - the book-to-market ratio at year end

MV - the natural log of MVE at year end

PASTR - the 6 month prior to previous year end geometric average of monthly stock returns

STDEV - the standard deviation of reported EPS for a three year period prior to base year (e.g. 1988-1990 for the base year 1990)

and in the case of revisions:

$$Revisions_{it} = \beta_0 + \beta_1 RD + \beta_2 BM + \beta_3 MV + \beta_4 PASTR + \beta_5 STDEV + \varepsilon_{it}$$

(5B.5) where:

Revisions - both singed and unsigned, with the dependent variable defined in four ways, using one year ahead mean EPS analyst forecasts scaled either by stock price or by median EPS forecast:

1) Forecast Revision: 12 6 (Mean Forecast 6m prior to year end-Mean Forecast 12m prior to year end)/Share price 12m prior to year end
2) Forecast Revision: 12 1(Mean Forecast 1m prior to year end-Mean Forecast 12m prior to year end)/Share price 12m prior to year end
3) Forecast Revision: 12 6 (Mean Forecast 6m prior to year end-Mean Forecast 12m prior to year end)/Absolute value of median forecast 12m prior to year end
4) Forecast Revision: 12 1(Mean forecast 1m prior to year end-Mean forecast 12m prior to year end)/Absolute value of median forecast 12m prior to year end

RD - R&D/Sales or R&D/Total Assets or R&D/Market value of equity at year end

BM - the book-to-market ratio at year end

MV - the natural log of MVE at year end

PASTR - the 6 month prior to previous year end geometric average of monthly stock returns

STDEV -the standard deviation of reported EPS for a three year period prior to base year (e.g, 1988-1990 for the base year 1990)

The regressions are run using OLS and Whites Heteroskedasticity robust standard errors. Observations above the 98 and below the 2 percentile were eliminated. All variables have been transformed using natural logs since this improved heteroskedasticity in the models and provided a better functional form for the model. The regressors used in the error equation follow the example of Amir, Lev and Sougiannis (2003). There was used though no firm age variable due to high correlation with the firm size variable of MV. In the case of both regressions, there are used both absolute and non absolute revisions. Non absolute revisions and errors have been adjusted as follows in order to be able to use logs: (100+revision)/100 e.g. if a revision was 3%, it will appear as 103 or 97 for -3%, and similarly for errors.

The relevant results for errors and revisions are presented in Tables 5B.12 for errors and 5B.13 for revisions.

Insert Tables 5B.12 and 5B.13 here.

As can be observed from Table 5B.12 Panel A, which uses absolute errors, errors relate positively to the BM ratio, which is a statistically significant regressor when minus 6 instead of 12 months prior to year end error data are used. MV is also statistically significant and negative, consistent with previous literature that testifies larger errors for smaller firms. The standard deviation in previous earnings also relates positively with errors, consistent with the intuition. The variable is always statistically significant at 1% and also shows strong economic significance. The regression p-values of the F statistics are always significant at 1% significance level, and the adjusted R squares are close or above 20%. The past return variable is negative and significant when errors are scaled by actual EPS instead of stock prices, and exhibits lower significance and a varying sign in the regression where errors are scaled by stock prices.

In the case of the R&D intensity variable, after controlling for other factors, when R&D intensity is defined as R&D divided by Sales or TA or MV, the variable is always not significant at any reasonable significance level, despite the fact that it is in every case positive, When I exclude MV and BM from the regression though, the R&D intensity variable remains positive and is always significant at 1% level. Despite the fact that the Pearson correlation coefficients between R&D intensity and BM or the MV variables never exceed 0.3 in absolute terms, there is concluded that after taking into account firm size and the book-to-market factor, R&D intensity has a positive influence on absolute forecast errors but remains statistically not significant.

When we move from regressing absolute errors to regressing non absolute errors in Table 5B.12 Panel B though, the situation changes with respect to the very sign of the R&D intensity variable. In this case, the MV variable steadily gets a negative sign and is significant conforming to the intuition, and the STDEV variable is always positive and significant as one would expect. BM is always positive and significant and so is PASTR, which is always negative though. In the case of the R&D intensity variable, it is always very much statistically significant with a negative sign though, which goes against the expectations and prior findings in the literature by Amir, Lev and Sougiannis (2003), implying that the lower the R&D, the lower the analyst optimism in EPS forecasts.

Given that this latter finding goes against the research hypothesis, I investigated the matter a little bit further, and I rerun all regressions from Table 5B.12 for both Panels A (Absolute errors) and B (non absolute errors), without including two of the regressors this time: MV and BM. The relevant results are presented in Appendix 5B.F. What we observe when we run the regressions without controlling for firm size and BM is that the R&D intensity variable, for the absolute and in the non absolute error regressions, gets a positive sign and is strongly statistically significant. The only exception is the nom absolute errors regressions when errors are scaled by the absolute value of actual EPS, when R&D is not significant though. This way, I observe clear bias in the initial regression arising from the inclusion of all of the R&D, MV and BM variables together as regressors. I observe therefore a positive and statistically significant relation between R&D intensity and absolute and non absolute forecast errors, but which is not generally robust when I control for other firm characteristics, firm size and BM in specific. The power of R&D to influence analyst forecast errors does not appear to be strong enough on its own, and it appears to be interrelated with the influence of other firm characteristics and their influence on analyst forecast errors.

In the case of the absolute revisions regression now, as we observe from Table 5B.13 Panel A, when the same full set of regressors are used, including MV and BM, MV is always negative and significant and so is BM in the case of revisions scaled by the absolute value of the median forecast 12 months prior to year end. In the case of revisions scaled by stock price, BM is positive but not statistically significant at any reasonable level of significance. Past returns are generally of limited significance in the revisions between 12 and 6 months prior to year end, but positive and significant at 1% in the regressions with revisions between 12 and 1 month prior to year end. This variable is also the one with the highest economical significance. The standard deviation of past EPS is also very strongly statistically significant and always positive, conforming to the intuition. The p-values of the F statistics are always zero and the explanatory power of the model is better when we assess revisions between 12 and 1 month prior to year end, compared to 12 and 6 months, given that in the first case, adjusted R squares are around 20% and in the latter around 15%.

The R&D intensity variable is always positive and statistically significant at 5% significance level in the case of absolute revisions between 12 and 1 month prior to year end, no matter how we define it, when revisions are scaled by the absolute value of the median forecast 12 months before year end. The highest t statistics and coefficients for the R&D variable are observed when it is defined as R&D/MV. The R&D intensity variable though is not significant even at 10% significance level, although positive in the equivalent regressions when revisions are scaled by price. In the case of revisions between 12 and 6 months before year end though, the R&D intensity variable is not significant, and even gets a negative sign when revisions are scaled by price. This provides evidence that R&D is able to influence the magnitude of forecast revisions, when there exists a reasonable amount of time between the initial and the revised analyst forecast, but the definition of revisions plays a role in the robustness of the results.

Given that I have hypothesised in favour of a positive sign in forecast revisions as R&D intensity increases, I have also regressed raw as opposed to absolute revisions on the same regressors, and the relevant results appear on Table 5B.13 Panel B. When taking the sign of revisions into account, BM relates negatively to revisions and is always statistically significant, as was the case with absolute revisions when BM was negative. Contrary to the intuition, MV is generally positive in these regressions and its significance varies with the regression. Strong past returns also relate positively to forecast revisions, and this particular variable is statistically significant at 5% significance level. This variable is also the one with the highest economical significance, as was the case in the absolute revisions regressions. The standard deviation of past EPS is also statistically significant, but it relates negatively to forecast revisions, contrary to the intuition, implying that lower volatility in past earnings would relate to higher revisions. The finding is also in contrast with the positive sign of the same variable in the absolute revisions and errors regression. The p-values of the F statistics are always zero and the explanatory power of the model is better when we assess revisions between 12 and 1 month prior to year end, compared to 12 and 6 months, given that in the first case, adjusted R squares are around 15% and in the latter around 10%, generally lower than the adjusted R squares in the absolute revisions regressions.

The R&D intensity variable is always positive but it is statistically significant at 5% significance level only in the regressions for revisions between 12 and 1 month before year end, as opposed to 12 and 6 months, no matter how we define it. This provides evidence that R&D is able to influence the magnitude as well as the direction of forecast revisions, given the way I define the revisions variable I use in these last regression. The significance of the R&D intensity variable though as in the case of the absolute revisions is stronger when there exists a reasonable amount of time between the initial and the revised analyst forecast, and not for shorter term revisions.

I have also added industry dummy variables in the regressions, both simple and multiplicative with R&D, to account for four industries which are perceived as intensive in R&D activity: Information Technology Chemicals, General Industries and Health grouped together with Pharmaceuticals and Biotechnology, taking the value of 1 if the firm belongs to the specific industry, and 0 otherwise. As can be observed from Appendix 5B.G for errors (using both absolute and non absolute forecast errors, scaled by price, defining R&D intensity as R&D/Sales, and using minus 12 months prior to year end error data, when I include MV and BM in the regression as regressors) and 5B.H for revisions (using both absolute and non absolute forecast revisions, scaled by the absolute value of the median minus twelve month 1 year ahead EPS forecast, defining R&D intensity as R&D/Sales, and using revisions between minus 12 and 1 month prior to year end), apart form a couple of cases, where the significance of the R&D intensity variable was reduced at 10% significance level upon the inclusion of the industry dummy variable, the industry dummies did not cause any change in the regression results overall and in the significance of the R&D intensity variable in specific.

In addition, in order to control for possible time period effects arising from influence from the New Economy years in the late 1990's early 2000, I have rerun the regressions by excluding the base years 1999 until 2001, both inclusive, and I observed no significant difference in the direction of the results, as can be observed in Appendix 5B.I. I have also rerun the regressions for the whole sample period 1990-2003 by including a dummy variable that took the value of 1 if the data referred to the base years 1999, 2000 or 2001 and zero otherwise. The relevant results both for errors and revisions appear in Appendix 5B.I. There was overall observed no qualitative difference in the results, and the time dummy proved to be significant (and negative) in the errors regressions, and significant but positive in the revisions regressions.

I have also rerun the panel data error and revision regressions (indicatively using absolute and non absolute errors, scaled by stock price, with 12 month prior to year end forecast data and absolute and absolute and non absolute revisions, scaled by the absolute value of the median minus 12 months prior to year end 1 year ahead EPS forecast, taking revisions between 12 and 1 month prior to year end, when R&D intensity is defined as R&D/Sales) making use of period fixed and random effects model specifications and I observed no qualitative change in the direction of the results. These results are reported in Appendix 5B.J with much caution though, because econometric software did not permit period fixed and random effects model estimation along with running the model by adding an AR(1) term to correct for first order serial correlation (Park, Sickles and Simar, 2003; Baltagi and Chang, 1992). Therefore the resulting Durbin Watson statistics when period fixed and random effects estimation was applied get values around 1.2. I chose though to report these results anyway, in order for the regression estimation and robustness checks to be as complete as possible.

Finally, I report in Appendix 5B.O Part A the regression results as in Tables 5B.12 and 5B.13 (the impact of R&D intensity on forecast errors and revisions) by including this time the same regressors as in Table 5B.3. In the case of absolute errors, the results are slightly more encouraging regarding the significance of the R&D intensity variable, compared to the ones reported in Table 5B.12, even that t statistics are lower. BM remains positive but its statistical significance is increased, and MV remains negative and statistically significant. STDEV exhibits still very high economic and statistical significance. AF shows very poor statistical significance. Qualitatively the same results hold for BM, MV, STDEV and AF when non absolute errors are included as the dependent variable in the regression, and again as in Table 5B.12 the R&D intensity variable has a negative sign and is statistically significant. In the case of revisions, the t statistics of the R&D intensity variable get slightly higher values in some cases and lower in others, and more or less the same trends apply regarding the significance of MV and BM. STDEV remains positive and very much statistically significant. AF lastly gets a negative coefficient and is in most cases not statistically significant. I also report Appendix 5B.O Part B regression results as in Tables 5B.12 and 5B.13 by including this time the regressors one by one. This means adding an R&D, MV, BM, and STDEV regressor one by one to see how the results evolve, when defining errors and revisions according to all mentioned definition in the chapter. The indications we get from these results is that MV and BM manage to have a distorting effect on the significance of the R&D variable for both errors and revisions, especially for non absolute errors and revisions. Non absolute errors and revisions appear to have a much less statistically significant (although positive) relationship with the RD variable, but R&D intensity as a sole regressor is always statistically significant with a positive coefficient for absolute errors and revisions.

This difference in the significance and even in the sign of the R&D intensity variable for absolute as opposed to non absolute errors and revisions should not come as a surprise: from the calculation of descriptive statistics (absolute and non absolute errors and revisions according to R&D intensity) we had gotten the indication that R&D relates differently to absolute versus non absolute measures, and this should be the result of the differences in the relative magnitudes and numbers of positive versus negative error and revision observations.

Taking the findings from Tables 5B.12 and 5B.13, as well as the results from the different model specifications included in the appendices as a whole, I conclude that after controlling for firm size and BM, R&D intensity does not appear to play a significant role for analyst forecast errors, but it has a stronger influence in the case of revisions. R&D intensity appears to have a positive influence and is shown to be a statistically significant factor for analyst forecast revisions, even when taking the sign of revisions into account, when there exists a reasonable amount of time between the initial and the revised analyst forecast, and not for shorter term revisions. The influence of R&D on both errors and revisions appears to be very sensitive to other possible influencing factors for errors and revisions, such as firm size and BM. This result though, although generally valid, does not hold in every single regression, therefore the way we define forecast revisions and R&D intensity as well plays a role in the validity of the result.

5B.4.4 R&D, Forecast Dispersion, Errors, Revisions and Stock Returns: Regression Analysis

Given the findings in Appendix 5B.M that high analyst forecast dispersion portfolios are accompanied by high forecast errors and revisions, I have repeated the regression in Appendix 5B.C Part H by including on the right hand size error and revisions along with analyst forecast dispersion when the dependent variable is stock returns, and also by replacing dispersion by either errors or revisions, without the inclusion of all three variables (dispersion, revisions and errors). The relevant results are reported in Appendix 5B.N Part B. I observe that when non absolute errors and revisions are included along with dispersion among the regressors in the regression, errors and revisions (only revisions between 12 and 1 months prior to year end and not revisions between 12 and 6 months) are statistically significant at 5% and get a negative coefficient. This result holds even when we add these three variables one by one in the regression, by replacing dispersion by errors and then by revisions. I therefore get evidence that stock returns relate negatively with all of dispersion, revisions and errors, and this relationship is statistically significant in all three cases. The R&D intensity variable is found positive and generally statistically significant at 5% significance level in all cases.

When I use absolute errors and revisions, revisions between 12 and 1 month prior to year end appear to relate now positively with returns, with the relation to be statistically significant. Forecast errors appear to relate negatively with returns, but their influence is not found to be statistically significant. The negative relation between errors and returns is consistent with Aitken, Frino and Winn (1996) and also Ciccone (2003). Revisions between 12 and 6 months prior to year end are found to relate negatively with returns but the values of their t statistics are very low. This result holds even when we add these three variables one by one in the regression, by replacing dispersion by errors and then by revisions. The R&D intensity variable is again found positive and generally statistically significant at 5% significance level in all cases.

As a robustness check, Appendix 5B.N Part A presents the results when rerunning the regression as in Appendix 5B.C Part H by adding factors one by one in order to assess the relative influence of each factor upon its addition in the model. MV and BM are used as single regressors in the model (one by one and both together) and then and R&D intensity variable is added (defining R&D intensity as R&D/Sales, R&D/TA and R&D/BM). Then I add a forecast dispersion variable (D) using -1, -6 and -12 month forecast data for dispersion calculation, when R&D intensity is defined in all these different ways, before Appendix 5B.N Part B proceeds with adding Forecast Error (FE) and Forecast Revision (FR) regressors. We then observe that both BM and MV get positive and negative coefficients respectively and are statistically significant when included as single regressors in the regression. When we include MV with BM though, MV preserves its negative sign, but turns to statistically not significant. When we add an R&D intensity variable to BM and MV, only when defined as R&D/MV is it statistically significant at 5% significance level. When the additional forecast dispersion variable is added, it always comes with a negative sing, no matter whether we use minus 12, 6 or 1 month data previous to year end for dispersion calculation. The R&D intensity variable becomes statistically significant (and is positive) upon the inclusion of the dispersion variable almost in every single one case. Finally the dispersion variable is statistically significant when using minus 1 and particularly minus 6 month EPS analyst forecast data before year end for its calculation, and not minus 12 month data.

From the results in Appendix 5B.N Part B I therefore observe that given the finding on higher absolute errors and revisions for high analyst forecast dispersion firms, when we include non absolute errors and revisions along with forecast dispersion and R&D among the regressors when stock returns is the dependent variable, all three variables are found to relate negatively with returns, with their influence to be statistically significant. When we use absolute errors and revisions though, the influence of revisions on returns turns positive and is still statistically significant. The impact of errors on returns is still negative, buts becomes statistically not significant. Dispersion, revisions and forecast errors are fount to exhibit a similar (negative) impact on stock returns only when revisions and errors are non absolute and taken raw.

5B.5 Conclusion

Existing literature has associated R&D intensity both theoretically and empirically with higher analyst forecast dispersion and stock returns. At the same time, existing research testifies that high analyst disagreement is associated with lower returns. In this context, the first issue that I wish to examine for the first time is whether R&D plays a role in the relationship between dispersion and returns, given that it has be testified empirically that it has an influencing power on both forecast dispersion and stock returns individually. This examination is performed by additionally contributing to existing literature with the assessment of this issue using a very detailed definition of forecast dispersion, by decomposing dispersion in analyst forecasts into pure lack of consensus among analysts and uncertainty in analyst forecasts.

I use all UK listed firms during the period 1990-2003 with analyst forecasts on IBES and first find for the first time for the UK context that R&D intensity is a contributing factor for analyst forecast dispersion even after controlling for other firm characteristics through descriptive statistics and explicitly via regression analysis. The finding is robust to different definitions of R&D intensity, and is consistent with prior findings for the US. If forecast dispersion is decomposed though into an uncertainty and a divergence of opinion component, as was done in prior literature in other contexts of research, there are indications that the influence of R&D is primarily on the uncertainty component of analyst forecasts. I also confirm a negative relationship between dispersion and returns, consistent with Diether, Malloy and Scherbina (2002) for the US, with the bottom forecast dispersion portfolio to be exhibiting a positive but not statistically significant excess return (alpha), and alphas to be getting negative for higher dispersion portfolios, which are generally not statistically significant as well, even after accounting for the role of R&D. When dispersion is decomposed into uncertainty and pure differences in opinion, I also find that as R&D intensity increases, the ability of R&D to influence returns also increases for high dispersion and high forecast uncertainty firms, but the ability of R&D to influence returns is very week for high divergence of opinion firms. This finding implies that in the presence of high R&D intensity, dispersion has an impact on returns mainly through the forecast uncertainty component of forecast dispersion, and not through the divergence of opinion component.

When trying to interpret this finding by using the Doukas, Kim and Pantzalis (2006) conceptual framework, high uncertainty in forecasts should be associated with lower returns, and therefore this testified strong uncertainty component should be driving returns downwards for these high R&D intensity firms. This is not the case at all though for high R&D firms, given that high R&D firms have been generally associated with very high returns. Following this line of reasoning, the returns of these high R&D and high forecast uncertainty firms should be more due to market mispricing.

In addition, existing empirical research has identified R&D intensity as a factor to contribute to analyst forecast errors, implying more optimism. Starting from forecast errors, the study goes one step further and assesses the impact of R&D intensity on the magnitude of forecast revisions. When financial analysts revise their earnings forecasts for R&D intensive firms, they are called to improve their accuracy in the presence of a highly uncertain investment. In such case, the amount by which they adjust their predictions can also be uncertain and therefore earnings revisions are expected to be greater in the presence of high R&D intensity. The assumption underneath this expectation is that analysts improve their learning as the end of the financial year approaches, but the outcome of this learning process is influenced by the uncertain nature of R&D, leading to higher revisions in the presence of high R&D investments. In the process of assessing the impact of R&D investments on analyst forecast revisions, the study also examines for the first time the impact of R&D on analyst forecast errors for the UK context, and also provides some insight into the joint impact of the analyst forecast characteristics of dispersion, errors and revisions on subsequent stock returns.

I do not observe any linear positive trend for signed errors and revisions to increase as R&D intensity increases, without controlling for other factors. I observe though such a trend when I use unsigned errors and revisions. There is also observed a contradiction in the behaviour of errors and revisions: forecast errors indicate a decrease in analyst optimism as year end approaches, but at the same time forecast revisions are found to be positive, which implies that forecasts get *more* optimistic as year end approaches, when we get indications from errors that earnings' forecasts become *less* optimistic. There is observed though that in the case of errors, optimism decreases in terms of mean and median errors, but the values of the positive errors are much larger than the ones of the negative errors, providing this way an explanation on why revisions are positive in terms of mean and median values when the magnitude of the errors indicates a decrease in optimism as year end approaches. I also find that R&D intensity is associated positively with (mostly unsigned) forecast errors and revisions, and that this relationship is generally statistically significant in the case of revisions but not for errors, when there exists a reasonable amount of time between the initial and the revised analyst forecast, after controlling for other factors.

There is also found evidence that both signed and unsigned analyst forecast errors and revisions increase as analyst forecast dispersion increases. Finally, I get evidence that stock returns relate negatively with revisions and errors, well and above analyst forecast dispersion, and this relationship is statistically significant in all cases, which constitutes evidence for the first time of for the UK that forecast dispersion, errors and revisions can both individually as well as in terms of joint influence be negatively associated with subsequent stock returns in a statistically significant manner.

As a final comment, there are certainly two issues that one has to take into consideration as possible study limitations. The first one relates to the probability that a firm may try to manage/smooth its earnings by deciding on how much R&D it should spend. This way, the amount of R&D that we observe on the income statement and that we use in the study will receive influence by factors we cannot control. This issue becomes even more serious if we consider that a firm may try to meet analyst EPS targets by managing the amount of R&D spending. In such cases, the R&D amount is clearly affected by managerial/earnings management decisions and would not reflect the real amount of R&D that a firm may need to spend in order to reach corporate or competition targets. The second issue relates to the fact that the EPS figures, actual or forecasted, refer to earnings *after* the expensing of R&D. Therefore any change in R&D spending, or major managerial decision to increase/decrease R&D will affect the final EPS figures and show increased or decreased earnings that simply reflect changes in R&D spending, and not sales or gross income changes. This problem exists by definition when an earnings measure in the lower steps of the income statement such as EPS is used. These issues though, appear more or less self built in the very design of the study, but nonetheless I acknowledge them.

Chapter 5B Tables:

Table 5B.1. One year ahead analyst forecast dispersion according to R&D intensity The table shows the average Sample period dispersion for the whole sample, R&D, zero R&D firms and according to quartiles formed by R&D/Sales, R&D/TA, R&D/MV, TA, MV and BM (from low to high). Dispersion is defined as the standard deviation in analyst forecasts divided by the absolute value of the mean forecast in the specific month. Observations below the 0.02 and above the 0.98 percentile have been eliminated. There are used forecasts 12, 6 and 1 month prior to year end.

	12	6	1
Sample	0.105	0.117	0.123
R&D firms	0.098	0.114	0.116
Zero R&D firms	0.110	0.118	0.128
R&D/Sales			
Low	0.081	0.089	0.086
	0.090	0.109	0.114
	0.098	0.129	0.112
High	0.150	0.151	0.174
R&D/TA			
Low	0.080	0.082	0.085
	0.084	0.115	0.116
	0.118	0.134	0.124
High	0.129	0.140	0.162
R&D/MV			
Low	0.071	0.074	0.077
	0.082	0.083	0.087
	0.118	0.142	0.148
High	0.140	0.181	0.184

Table 5B.1. Continued

TA			
Low	0.132	0.154	0.152
	0.119	0.131	0.131
	0.104	0.116	0.131
High	0.087	0.097	0.102

MV			
Low	0.151	0.206	0.215
	0.127	0.135	0.140
	0.099	0.108	0.113
High	0.078	0.088	0.094

BM			
Low	0.085	0.097	0.103
	0.082	0.088	0.093
	0.106	0.120	0.124
High	0.151	0.177	0.187

Table 5B.2. One year ahead analyst forecast dispersion for R&D, zero R&D and R&D intensive firms matched according to MV-BM

The table shows the average sample period dispersion for the R&D, zero R&D and R&D intensive firms that belong to six annually rebalanced portfolios formed according to MVE and BM. R&D intensive firms are defined as the ones with an R&D/Sales or R&D/TA ratio above the sample median for a particular year. Dispersion is defined as the standard deviation in analyst forecasts divided by the absolute value of the mean forecast in the specific month. Observations below the 0.02 and above the 0.98 percentile have been eliminated. There are used forecasts 12, 6 and 1 month prior to year end.

12 month prior to year end data used

MV-BM	R&D firms	Zero R&D firms	Firms with R&D/Sales above median	Firms with R&D/TA above median
low-low	0.152	0.114	0.139	0.155
low-mid	0.115	0.119	0.132	0.142
low-high	0.162	0.168	0.167	0.170
high-low	0.086	0.081	0.101	0.103
high-mid	0.079	0.079	0.106	0.100
high-high	0.100	0.112	0.117	0.118

6 month prior to year end data used

MV-BM	R&D firms	Zero R&D firms	Firms with R&D/Sales above median	Firms with R&D/Sales above median
low-low	0.137	0.105	0.149	0.142
low-mid	0.171	0.122	0.191	0.193
low-high	0.233	0.192	0.219	0.231
high-low	0.094	0.088	0.103	0.099
high-mid	0.079	0.087	0.095	0.089
high-high	0.117	0.126	0.135	0.166

1 month prior to year end data used

MV-BM	R&D firms	Zero R&D firms	Firms with R&D/Sales above median	Firms with R&D/Sales above median
low-low	0.152	0.125	0.187	0.177
low-mid	0.144	0.154	0.144	0.144
low-high	0.247	0.218	0.313	0.283
high-low	0.097	0.095	0.122	0.121
high-mid	0.095	0.084	0.102	0.099
high-high	0.116	0.139	0,169	0.170

Table 5B.3. The influence of R&D intensity on analyst forecast dispersion

The table reports the coefficient estimates and values of t-statistics (in parentheses) that have been estimated by running the following panel data regression during 1990-2003: Dispersion = $\alpha_0 + \alpha_1 RD + \alpha_2 BM + \alpha_3 MV + \alpha_4 STDEV + \alpha_5 AF + \varepsilon_{it}$. The dependent variable Dispersion equals analyst forecast dispersion defined as the standard deviation in one year ahead analyst forecasts of EPS for a particular month divided by the absolute value of the mean forecast in the specific month. There are used forecasts 12 and 6 months prior to year end RD equals R&D/Sales or R&D/Total Assets or R&D/Market value of equity at year end, BM and MV the book-to-market ratio and MVE at year end respectively. STDEV equals the standard deviation of reported EPS for a three year period prior to base year (e.g. 1988-1990 for the base year 1990) and finally AF represents analyst following and is equal to the number of analysts that issued one year ahead EPS forecasts for a particular firm for a particular month, using minus 12 or 6 month prior to year end data, depending on what data are used for dispersion each time. The regression is run using OLS and Whites Heteroskedasticity robust standard errors. Observations above the 98 and below the 2 percentile were eliminated. All variables have been transformed using natural logs. In the last column appear the F statistics and their p-values. *

	C	RD	BM	MV	STDEV	AF	Adjusted R-squared	F-statistic
12 month prior to year end EPS forecast data								
RD=RDS	1.8886	0.0179	0.0963	-0.0768	0.1143	0.0598	0.3058	328.0436
	(17.9249)	(2.0404)	(2.8674)	(-3.5485)	(11.3678)	(1.4815)		(0.0000)
RD=RDTA	1.8847	0.0188	0.0976	-0.0756	0.1145	0.0594	0.3059	328.1197
	(17.8721)	(2.2001)	(2.9045)	(-3.4919)	(11.3766)	(1.4706)		(0.0000)
RD=RDMV	1.8799	0.0185	0.0935	-0.0753	0.1144	0.0588	0.3058	328.0586
	(17.8166)	(2.0803)	(2.7850)	(-3.4760)	(11.3708)	(1.4577)		(0.0000)
6 month prior to year end EPS forecast data								
RD=RDS	1.8276	0.0167	0.1500	-0.0514	0.1479	0.0298	0.3199	349.8872
	(17.9462)	(1.8610)	(4.3649)	(-2.3984)	(14.1226)	(0.7149)		(0.0000)
RD=RDTA	1.8253	0.0120	0.1502	-0.0522	0.1480	0.0288	0.3197	349.4979
	(17.8986)	(1.3485)	(4.3684)	(-2.4307)	(14.1189)	(0.6922)		(0.0000)
RD=RDMV	1.8177	0,0204	0.1470	-0.0488	0.1480	0.0290	0.3201	350.2121
	(17.8317)	(2.3231)	(4.2789)	(-2.2672)	(14.1287)	(0.6962)		(0.0000)
1 month prior to year end EPS forecast data								
RD=RDS	2.1921	0.0047	0.1663	-0.1056	0.0631	0.0864	0.2954	306.1121
	(19.8963)	(0.5139)	(4.9846)	(-4.8396)	(6.1466)	(2.1386)		(0.0000)
RD=RDTA	2.1897	0.0097	0.1673	-0.1038	0.0632	0.0874	0.2955	306.2872
	(19.8583)	(1.0735)	(5.0130)	(-4.7384)	(6.1572)	(2.1678)		(0.0000)
RD=RDMV	2.1849	0.0149	0.1645	-0.1019	0.0632	0.0877	0.2957	306.5850
	(19.8239)	(1.6429)	(4.9364)	(-4.6616)	(6.1653)	(2.1741)		(0.0000)

Table 5B.4. Returns for the next year for R&D, R&D intensive and zero R&D firms with different dispersion in analyst forecasts

Sample firms have been divided into quartiles according to analyst forecast dispersion. There are presented the average (equal weighted) stock returns of the sample firms with and R&D intensity ratio below or above the median, or in the top R&D intensity quartile, and the zero R&D firms that belong to each dispersion quartile. There have been used monthly returns, calculated on a 12 month basis from July of year t+1 until June of year t+2, for the errors that correspond to the base year t. There have been calculated both cumulative and buy and hold returns. Dispersion refers to standard deviation in one year ahead EPS analyst forecasts in minus 1 month prior to the financial year for which the forecast is made, scaled by the absolute value of the mean forecast 12 months prior to financial year end. Dispersion observations above 0.98 and below the 0.02 percentile have been eliminated. R&D intensity is defined as R&D/Sales, R&D/TA and R&D/MVE. Dispersion quartiles have been named from D1 (low) to D4 (high). Panel A presents the average returns for the whole sample for the period 1990-2002 according to annually rebalanced quartiles, and Panel B the average returns according to dispersion quartiles for these firms with and R&D intensity ratio below or above the median, or in the top R&D intensity quartile, and the zero R&D firms that belong to each dispersion quartile.

Pane A

	Cumulative returns	Buy and hold returns
D1 (low)	0.124	1.126
D2	0.100	1.095
D3	0.130	1.126
D4 (high)	0.120	1.115

Panel B

	Cumulative returns				Buy and hold returns			
	R&D/S<Median	R&D/S>Median	R&D/S>75%	Zero R&D	R&D/S<Median	R&D/S>Median	R&D/S>75%	Zero R&D
D1	0.096	0.151	0.117	0.124	1.086	1.142	1.085	1.129
D2	0.124	0.047	0.064	0.104	1.110	1.055	1.140	1.099
D3	0.115	0.153	0.138	0.131	1.100	1.127	1.113	1.134
D4	0.100	0.152	0.150	0.114	1.095	1.137	1.148	1.114
	R&D/TA<Median	R&D/TA>Median	R&D/TA>75%	Zero R&D	R&D/TA<Median	R&D/TA>Median	R&D/TA>75%	Zero R&D
D1	0.106	0.142	0.111	0.124	1.096	1.137	1.099	1.129
D2	0.122	0.057	0.072	0.104	1.109	1.064	1.115	1.099
D3	0.107	0.166	0.163	0.131	1.092	1.145	1.140	1.134
D4	0.079	0.163	0.179	0.114	1.073	1.148	1.162	1.114
	R&D/MV<Median	R&D/MV>Median	R&D/MV>75%	Zero R&D	R&D/MV<Median	R&D/MV>Median	R&D/MV>75%	Zero R&D
D1	0.111	0.148	0.172	0.124	1.100	1.125	1.149	1.129
D2	0.105	0.086	0.022	0.104	1.095	1.091	1.011	1.099
D3	0.092	0.185	0.185	0.131	1.074	1.169	1.170	1.134
D4	0.048	0.176	0.214	0.114	1.038	1.160	1.198	1.114

Table 5B.5. Returns for different R&D intensity/dispersion firms when dispersion is taken immediately before return calculation

Sample firms have been divided into quartiles according to analyst forecast dispersion. There are presented the average (equal weighted) stock returns of the sample firms with and R&D intensity ratio below or above the median, or in the top R&D intensity quartile, and the zero R&D firms that belong to each dispersion quartile, using dispersion data of June t+1 (accounting data for year t) only for these firms whose accounting year ends between July t+1 - December t+1. There have been used monthly returns, calculated on a 12 month basis from July of year t+1 until June of year t+2, for the errors that correspond to the base year t. There have been calculated both cumulative and buy and hold returns. Dispersion refers to standard deviation in one year ahead EPS analyst forecasts in minus 1 month prior to the financial year for which the forecast is made, scaled by the absolute value of the mean forecast 12 months prior to financial year end. Dispersion observations above 0.98 and below the 0.02 percentile have been eliminated. R&D intensity is defined as R&D/Sales, R&D/TA and R&D/MVE. Dispersion quartiles have been named from D1 (low) to D4 (high). The reason for including only these firms with an accounting year tending between July t+1 - December t+1 is in order to assure that the 1 year ahead EPS forecasts, out of which dispersion is calculated, refer to the accounting year that finishes within the calendar year t+1. Panel A presents the average returns for the whole sample for the period 1990-2002 according to annually rebalanced quartiles, and Panel B the average returns according to dispersion quartiles for these firms with and R&D intensity ratio below or above the median, or in the top R&D intensity quartile, and the zero R&D firms that belong to each dispersion quartile.

Pane A

	Cumulative returns	Buy and hold returns
D1 (low)	0.139	1.147
D2	0.124	1.120
D3	0.110	1.096
D4 (high)	0.123	1.132

Panel B

	Cumulative returns				Buy and hold returns			
	R&D/S<Median	R&D/S>Median	R&D/S>75%	Zero R&D	R&D/S<Median	R&D/S>Median	R&D/S>75%	Zero R&D
D1	0.106	0.124	0.118	0.152	1.105	1.126	1.126	1.163
D2	0.101	0.086	0.106	0.146	1.086	1.097	1.144	1.142
D3	0.130	0.124	0.150	0.096	1.110	1.095	1.105	1.092
D4	0.106	0.160	0.151	0.118	1.105	1.178	1.190	1.128
	R&D/TA<Median	R&D/TA>Median	R&D/TA>75%	Zero R&D	R&D/TA<Median	R&D/TA>Median	R&D/TA>75%	Zero R&D
D1	0.112	0.124	0.163	0.152	1.109	1.128	1.149	1.163
D2	0.092	0.094	0.099	0.146	1.076	1.105	1.108	1.142
D3	0.120	0.137	0.174	0.096	1.100	1.106	1.151	1.092
D4	0.106	0.159	0.168	0.118	1.103	1.180	1.203	1.128
	R&D/MV<Median	R&D/MV>Median	R&D/MV>75%	Zero R&D	R&D/MV<Median	R&D/MV>Median	R&D/MV>75%	Zero R&D
D1	0.081	0.154	0.253	0.152	1.087	1.146	1.219	1.163
D2	0.101	0.089	0.163	0.146	1.081	1.114	1.260	1.142
D3	0.122	0.134	0.150	0.096	1.093	1.111	1.118	1.092
D4	0.082	0.179	0.227	0.118	1.078	1.199	1.254	1.128

Table 5B.6. Time series regressions according to five dispersion portfolios

The table reports the coefficient estimates and values of t-statistics (in parentheses) that have been estimated by running the following time-series regression using monthly data from July 1991-June 2004:

$(Rp\text{-}Rf) = alpha + \beta_1(RM\text{-}Rf) + +\beta_2 SMB + \beta_3 HML + \beta_4 RDFactor + \varepsilon$

(Rp-Rf) equals the difference between the equal-weighted monthly returns of five annually rebalanced dispersion portfolios and the risk free rate (1 month UK Treasury Bill rate). One month prior to year end 1 year ahead analyst forecast data are used for dispersion calculation. The analysis is repeated by including only the R&D, zero R&D and firms with an R&D/Sales ratio above median according to 5 dispersion portfolios. (RM-Rf) equals the difference between the monthly value-weighted return of all the sample firms and the risk free rate. SMB equals the size factor, calculated by using the difference between the average equal-weighted monthly returns of three small and three large MVE portfolios: (SL+SM+SH)/3-(BL+BM+BH)/3. HML equals the value factor, defined as the difference between the average equal-weighted monthly returns between two high BM and two low BM portfolios: (SH+BH)/2-(SL+BL)/2. The RD Factor is constructed by subtracting the average monthly returns of the zero R&D firms from the returns of high R&D portfolio (R&D/Sales above 70th percentile): (High RD-Zero RD), Panel A reports the results for the regressions run without an RD factor according to 5 dispersion portfolios from D1 (Low) to D5 (High) for the whole sample, the R&D, zero R&D firms and firms with an R&D/Sales ratio above the median. Panel B reports the results with an RD factor calculated on its own by subtracting the returns of the zero RD firms from the returns of the R&D firms with an R&D/Sales ratio above 70th percentile (High RD-ZRD) with equal-weighted returns, for the whole sample, the R&D, zero R&D firms and firms with an R&D/Sales ratio above the sample median The regressions are run using OLS and Whites Heteroskedasticity robust standard errors. In the last column appear the F statistics and their p-values.

Panel A: No RD factor

Sample	alpha	RM	SMB	HML	Adjusted R-squared	F-statistic
D1 (low)	0.001	1.021	0.562	0.144	0.720	133.875
	(0.3744)	(18.5310)	(8.7435)	(2.2214)		(0.0000)
D2	0.000	1.011	0.395	0.240	0.685	113.237
	(-0.0743)	(17.9991)	(5.5471)	(2.9281)		(0.0000)
D3	-0.002	1.186	0.591	0.381	0.716	130.980
	(-1.0831)	(20.2158)	(7.8657)	(5.0280)		(0.0000)
D4	-0.002	1.179	0.676	0.415	0.719	133.286
	(-0.8051)	(17.3661)	(10.0707)	(5.6700)		(0.0000)
D5 (High)	-0.002	1.419	1.079	0.464	0.754	159.529
	(-1.0027)	(19.5761)	(12.5593)	(5.6053)		(0.0000)

Table 5B.6. Panel A Continued

R&D firms						
D1 (low)	0.002	1.075	0.456	-0.032	0.724	136.796
	(0.8866)	(17.3868)	(5.5462)	(-0.4674)		(0.0000)
D2	0.000	1.018	0.213	0.180	0.657	99.988
	(0.0332)	(17.7453)	(2.4024)	(2.2294)		(0.0000)
D3	-0.001	1.194	0.532	0.274	0.644	94.660
	(-0.2773)	(15.8515)	(5.8193)	(3.3267)		(0.0000)
D4	0.001	1.181	0.548	0.260	0.664	102.913
	(0.2027)	(15.1334)	(6.1589)	(3.1688)		(0.0000)
D5 (High)	-0.002	1.408	0.967	0.176	0.693	117.542
	(-0.6012)	(16.3391)	(9.1063)	(1.6908)		(0.0000)
Zero R&D firms						
D1 (low)	0.000	0.993	0.651	0.250	0.656	99.349
	(-0.1123)	(15.9466)	(9.3927)	(3.4396)		(0.0000)
D2	-0.001	1.002	0.539	0.286	0.626	87.490
	(-0.2554)	(15.6306)	(7.3027)	(3.1222)		(0.0000)
D3	-0.004	1.180	0.650	0.452	0.690	115.843
	(-1.5805)	(19.3412)	(7.9244)	(5.3787)		(0.0000)
D4	-0.003	1.179	0.754	0.508	0.694	117.926
	(-1.3974)	(16.5846)	(10.1892)	(6.4830)		(0.0000)
D5 (High)	-0.002	1.397	1.080	0.586	0.718	132.364
	(-0.9707)	(18.0429)	(10.6762)	(6.7050)		(0.0000)
R&D firms with RD/.Sales> median						
D1 (low)	0.006	1.193	0.568	-0.257	0.638	92.058
	(2.1328)	(11.8476)	(3.9522)	(-2.6762)		(0.0000)
D2	0.000	1.108	0.411	-0.112	0.571	69.870
	(0.1053)	(13.3273)	(3.3586)	(-1.0897)		(0.0000)
D3	0.000	1.351	0.725	-0.061	0.571	69.752
	(0.0400)	(10.1896)	(5.5988)	(-0.4589)		(0.0000)
D4	0.008	1.383	0.811	-0.205	0.532	59.663
	(1.8870)	(10.4338)	(5.7004)	(-1.5218)		(0.0000)
D5 (High)	0.001	1.448	1.189	-0.337	0.601	78.919
	(0.2803)	(12.5005)	(8.5276)	(-2.0003)		(0.0000)

Table 5B.6. Continued -Panel B: Time-series regressions run with an RD factor calculated as (High RD-Zero RD)

Sample	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
D1 (low)	0.000	0.998	0.541	0.241	0.100	0.722	101.650
	(-0.0134)	(17.5095)	(8.5105)	(2.3534)	(1.2886)		(0.0000)
D2	-0.001	0.986	0.372	0.345	0.108	0.687	86.107
	(-0.4532)	(16.7172)	(5.0526)	(3.2478)	(1.2418)		(0.0000)
D3	-0.003	1.165	0.572	0.470	0.091	0.716	98.767
	(-1.3706)	(18.7173)	(7.2646)	(4.4690)	(1.0561)		(0.0000)
D4	-0.003	1.146	0.645	0.556	0.145	0.724	102.445
	(-1.2602)	(16.6637)	(9.4347)	(4.9982)	(1.6955)		(0.0000)
D5 (High)	-0.004	1.362	1.026	0.709	0.251	0.766	127.733
	(-1.7405)	(17.6245)	(12.0390)	(6.1596)	(2.6263)		(0.0000)
R&D firms							
D1 (low)	0.000	1.025	0.409	0.183	0.221	0.738	110.394
	(0.1125)	(16.5148)	(5.2380)	(1.7029)	(2.6390)		(0.0000)
D2	-0.001	0.975	0.173	0.363	0.187	0.667	78.604
	(-0.5615)	(16.4777)	(1.9316)	(3.3021)	(2.0955)		(0.0000)
D3	-0.002	1.152	0.493	0.454	0.184	0.651	73.269
	(-0.7910)	(15.3627)	(5.3087)	(3.5819)	(1.7987)		(0.0000)
D4	-0.001	1.121	0.492	0.517	0.263	0.680	83.460
	(-0.5205)	(15.3251)	(5.7029)	(3.8539)	(2.6103)		(0.0000)
D5 (High)	-0.005	1.293	0.861	0.668	0.504	0.739	110.575
	(-2.0544)	(14.9299)	(8.8906)	(5.4557)	(5.0652)		(0.0000)
Zero RD firms							
D1 (low)	0.000	0.987	0.646	0.274	0.025	0.654	74.095
	(-0.1926)	(15.4744)	(9.2675)	(2.3658)	(0.2891)		(0.0000)
D2	-0.001	0.993	0.531	0.323	0.038	0.624	65.327
	(-0.3646)	(14.5551)	(6.8062)	(2.6864)	(0.3957)		(0.0000)
D3	-0.004	1.175	0.646	0.473	0.022	0.688	86.367
	(-1.6094)	(17.7170)	(7.5204)	(4.0392)	(0.2364)		(0.0000)
D4	-0.004	1.165	0.741	0.568	0.061	0.693	88.302
	(-1.5583)	(15.3691)	(9.7177)	(4.9818)	(0.7235)		(0.0000)
D5 (High)	-0.003	1.376	1.061	0.674	0.091	0.718	99.441
	(-1.1659)	(16.7517)	(10.3990)	(5.0673)	(0.8498)		(0.0000)
R&D firms with RD/.Sales> median							
D1 (low)	0.003	1.094	0.477	0.166	0.434	0.674	81.232
	(1.0586)	(11.9140)	(3.7342)	(1.0835)	(3.4201)		(0.0000)
D2	-0.003	1.019	0.329	0.268	0.389	0.604	60.096
	(-0.8111)	(11.7264)	(2.7744)	(1.8767)	(3.0261)		(0.0000)
D3	-0.002	1.271	0.653	0.275	0.345	0.587	56.123
	(-0.6322)	(9.9129)	(5.3718)	(1.4554)	(2.1982)		(0.0000)
D4	0.004	1.247	0.687	0.372	0.591	0.575	53.379
	(0.9027)	(10.3807)	(5.3615)	(1.6007)	(3.1060)		(0.0000)
D5 (High)	-0.005	1.249	1.007	0.510	0.869	0.687	86.056
	(-1.4953)	(10.7765)	(8.3007)	(2.7448)	(6.4122)		(0.0000)

Table 5B.7. Pearson correlation coefficients among regressors for the regression in Table 5B.6
The table reports the Pearson correlation coefficients among regressors for the regression in Table 5B.6 and also Appendix 5B.C Part A.
The factors are (Rm-Rf), SMB, HML and the RD factor calculated as described in Table 5B.6 and Appendix 5B.C Part A in a total of 8 ways: As in Al Horani et al (2003): (LRD+MRD+HRD)/3-(LZRD+MZRD+HZRD)/3, and on its own as (High RD+Mid RD)/2-(Low RD+Zero RD)/2,(High RD-ZRD) or (High RD-Low RD), in every case with both equal and value weighted returns.

With RD Factor by Al Horani et al with VW returns				With RD Factor by Al Horani et al with EW returns			
	Rm-Rf	SMB	HML		Rm-Rf	SMB	HML
Rm-Rf				Rm-Rf			
SMB	-0.282			SMB	-0.282		
HML	-0.184	-0.321		HML	-0.184	-0.321	
RD factor	-0.295	-0.201	0.365	RD factor	0.275	-0.122	-0.339
With RD Factor as (High RD+Mid RD)/2-(Low RD+Zero RD)/2 with VW returns				With RD Factor (High RD+Mid RD)/2-(Low RD+Zero RD)/2 with EW returns			
	Rm-Rf	SMB	HML		Rm-Rf	SMB	HML
Rm-Rf				Rm-Rf			
SMB	-0.282			SMB	-0.282		
HML	-0.184	-0.321		HML	-0.184	-0.321	
RD factor	-0.510	0.274	-0.194	RD factor	0.284	0.339	-0.768
With RD Factor as (High RD-ZRD) with VW returns				With RD Factor as (High RD-ZRD) with EW returns as seen on Table 5B.6			
	Rm-Rf	SMB	HML		Rm-Rf	SMB	HML
Rm-Rf				Rm-Rf			
SMB	-0.282			SMB	-0.282		
HML	-0.184	-0.321		HML	-0.184	-0.321	
RD factor	-0.861	0.133	0.236	RD factor	0.291	0.301	-0.787
With RD Factor (High RD-Low RD) with VW returns				With RD Factor (High RD-Low RD) with EW returns			
	Rm-Rf	SMB	HML		Rm-Rf	SMB	HML
Rm-Rf				Rm-Rf			
SMB	-0.282			SMB	-0.282		
HML	-0.184	-0.321		HML	-0.184	-0.321	
RD factor	-0.710	0.396	-0.188	RD factor	0.235	0.465	-0.800

Table 5B.8. Signed forecast errors for R&D and zero R&D firms and according to R&D intensity for the period 1990-2003
Panel A: The table reports the average signed forecast errors for the whole sample, R&D and zero R&D firms. Forecast errors have been calculated as a) (Forecasted EPS-Actual EPS)/Absolute value of Actual EPS and b) (Forecasted EPS-Actual EPS)/Stock Price 12 months prior to year end. In the case of the mean forecasted one year ahead EPS, there have been used all of the minus 12, 6 and 1 month prior to year end median forecasts. Actual and forecasted EPS observations above the 0.98 and below the 0.02 percentile have been eliminated. There are also reported the sample period averages of the median error values in the middle of each quintile.
Panel B: The table reports the sample period average forecast errors for quartiles formed according to R&D intensity using all of R&D/Sales, R&D/TA and R&D/MV as proxies for R&D intensity.

Panel A:	Error (F-A)/A Abs	Forecast -12m	Forecast -6m	Forecast -1m	Error (F-A)/P	Forecast -12m	Forecast -6m	Forecast -1m
Sample		0.802	0.530	0.129		0.175	0.159	0.155
R&D firms		0.904	0.647	0.519		0.127	0.124	0.126
Zero R&D firms		0.688	0.448	-0.119		0.201	0.178	0.171
Panel B:								
R&D firms according to R&D/Sales								
Low		0.938	0.680	0.623		0.131	0.106	0.114
		0.973	0.879	0.582		0.172	0.170	0.144
		0.819	0.626	0.556		0.086	0.100	0.095
High		0.686	0.309	0.252		0.117	0.119	0.159
R&D firms according to R&D/TA								
Low		0.756	0.558	0.438		0.082	0.081	0.099
		0.944	0.601	0.590		0.204	0.169	0.135
		1.300	1.097	0.653		0.133	0.149	0.144
High		0.529	0.231	0.378		0.087	0.097	0.128
R&D firms according to R&D/MV								
Low		0.441	0.288	0.244		-0.023	0.005	0.031
		0.425	0.367	0.367		0.058	0.059	0.074
		1.140	0.969	0.695		0.159	0.166	0.168
High		1.689	0.920	0.765		0.332	0.282	0.244

Table 5B.9. One year ahead signed analyst forecast revisions according to R&D intensity

The table shows the average sample period signed forecast revisions for the whole sample, R&D, zero R&D firms and according to quartiles formed by R&D/Sales, R&D/TA, R&D/MV (from low to high). There are used four types of forecast revisions defined as follows:
Scaling revisions by stock price:
Forecast Revision: 12 6 (Forecast 6m prior to year end-Forecast 12m prior to year end)/Share price 12m prior to year end*100
Forecast Revision: 12 1(Forecast 1m prior to year end-Forecast 12m prior to year end)/Share price 12m prior to year end *100
Scaling revisions by the absolute value of median forecast 12m prior to year end:
Forecast Revision: 12 6 (Forecast 6m prior to year end-Forecast 12m prior to year end)/Abs value of median forecast 12m prior to year end *100
Forecast Revision: 12 1(Forecast 1m prior to year end-Forecast 12m prior to year end)/Abs value of median forecast 12m prior to year end *100
One year ahead mean forecasts are used. If revision exceeds +/-100% data are considered outliers and are removed.

	Scaled by price	12 6	12 1	Scaled by median	12 6	12 1
Sample		0.940	1.577		2.269	3.545
R&D firms		0.570	1.494		1.332	3.330
Zero R&D firms		1.175	1.716		2.860	3.729
R&D/Sales						
Low		0.198	1.246		1.265	·2.258
		0.870	0.810		1.692	3.098
		0.090	0.230		0.572	2.002
High		1.446	4.299		2.055	7.052
R&D/TA						
Low		0.899	2.354		1.962	2.907
		-0.204	-0.747		0.201	1.876
		0.245	0.141		0.927	1.997
High		1.737	4.889		2.602	7.603
R&D/MV						
Low		3.521	5.349		4.865	6.869
		0.604	1.324		2.676	5.084
		0.201	1.720		-0.059	2.612
High		-2.467	-3.039		-3.239	-2.402

Table 5B.10. Signed analyst forecast errors for R&D, zero R&D and R&D intensive firms matched according to MV-BM

The table shows the sample period medians of the average signed forecast errors for the whole sample and the R&D, zero R&D and R&D intensive firms that belong to six annually rebalanced portfolios formed according to MVE and BM. R&D intensive firms are defined as the ones with an R&D/Sales or R&D/TA ratio above the sample median for a particular year. Forecast errors have been calculated as (Forecasted EPS-Actual EPS)/Absolute value of Actual EPS. In the case of the mean forecasted one year ahead EPS, there have been used all of the minus 12, 6 and 1 month prior to year end median forecasts. Actual and forecasted EPS observations above the 0.98 and below the 0.02 percentile have been eliminated.

Error (F-A)/P A Abs

MV-BM	Sample	R&D firms	Zero R&D firms	Firms with R&D/Sales above median	Firms with R&D/TA above median
12 month prior to year end data used					
low-low	0.114	0.044	0.084	0.157	0.078
low-mid	0.918	2.287	0.575	0.952	1.956
low-high	1.619	0.613	1.513	1.090	0.951
high-low	0.016	-0.130	0.124	-0.168	-0.192
high-mid	0.164	0.126	0.080	0.117	0.139
high-high	0.358	0.511	0.239	1.147	1.063
6 month prior to year end data used					
MV-BM	Sample	R&D firms	Zero R&D firms	Firms with R&D/Sales above median	Firms with R&D/TA above median
low-low	0.076	0.028	0.146	0.024	0.021
low-mid	0.771	0.797	0.783	0.625	1.754
low-high	1.361	0.979	0.970	0.768	0.730
high-low	0.059	-0.045	0.184	-0.085	-0.102
high-mid	0.284	0.105	0.271	0.117	0.126
high-high	0.152	0.316	0.093	0.711	0.535
1 month prior to year end data used					
MV-BM	Sample	R&D firms	Zero R&D firms	Firms with R&D/Sales above median	Firms with R&D/TA above median
low-low	0.094	-0.024	0.101	-0.038	-0.042
low-mid	0.694	0.888	0.696	0.407	1.498
low-high	0.862	0.442	0.680	0.249	0.330
high-low	0.077	0.039	0.054	-0.052	-0.048
high-mid	0.125	0.130	0.083	0.203	0.237
high-high	0.163	0.316	0.089	0.455	0.414

Table 5B.11. Signed forecast revisions for R&D, zero R&D and R&D intensive firms matched according to MV-BM

The table shows the sample period average signed forecast revisions for the whole sample and the R&D, zero R&D and R&D intensive firms that belong to six annually rebalanced portfolios formed according to MVE and BM. R&D intensive firms are defined as the ones with an R&D/Sales or R&D/TA ratio above the sample median for a particular year. There are used two types of forecast revisions defined as follows:
Forecast Revision: 12 6 (Forecast 6m prior to year end-Forecast 12m prior to year end)/Abs value of median forecast 12m prior to year end *100
Forecast Revision: 12 1(Forecast 1m prior to year end-Forecast 12m prior to year end)/Abs value of median forecast 12m prior to year end *100
One year ahead mean EPS forecasts are used. If revision exceeds +/-100% data are considered outliers and are removed.

12 6					
MV-BM	Sample	R&D firms	Zero R&D firms	Firms with R&D/Sales above median	Firms with R&D/TA above median
low-low	5.168	6.575	4.496	5.403	6.665
low-mid	0.964	-3.616	2.922	-4.018	-3.895
low-high	-4.756	-5.901	-4.235	-8.428	-7.587
high-low	7.148	6.274	8.105	5.228	5.865
high-mid	3.916	1.176	5.970	-0.858	-0.799
high-high	0.133	-1.796	1.013	-3.897	-2.806

12 1					
MV-BM	Sample	R&D firms	Zero R&D firms	Firms with R&D/Sales above median	Firms with R&D/TA above median
low-low	8.885	10.333	7.839	10.511	10.870
low-mid	-2.325	-4.568	-1.006	-5.195	-4.968
low-high	-10.007	-9.746	-9.609	-12.994	-12.859
high-low	13.829	11.591	15.778	11.346	11.998
high-mid	6.988	3.364	9.657	3.883	4.014
high-high	1.677	-0.343	2.885	-5.772	-5.354

Table 5B.12. The impact of R&D intensity on analyst forecast errors

The table reports the coefficient estimates and values of t-statistics (in parentheses) that have been estimated by running the following panel data regression for the period 1990-2003: Forecast errors $=\alpha_0+\alpha_1 RD+\alpha_2 BM+\alpha_3 MV+\alpha_4 PASTR+\alpha_5 STDEV+\varepsilon_{it}$. The dependent variable Forecast Error is defined in two ways, using one year ahead mean EPS analyst forecasts scaled either by stock price or by the absolute value of actual EPS, and using analyst forecast data 12 and 6 months prior to year end:

(1 year ahead mean Forecasted EPS using data for 12 and 6 month prior to year end-Actual EPS)/Share Price 12 months prior to year end

(1 year ahead mean Forecasted EPS using data for 12 and 6 month prior to year end-Actual EPS)/Absolute value of Actual EPS

There have been used absolute (Panel A) and non absolute (Panel B) errors. RD equals R&D/Sales or R&D/Total Assets or R&D/Market value of equity at year end, BM the Book to market ratio at year end, MV the MVE at year end, PASTR equals the 6 month prior to previous year end geometric average of monthly stock returns, STDEV equals the standard deviation of reported EPS for a three year period prior to base year. The regression is run using OLS and Whites Heteroskedasticity robust standard errors. Observations above the 98 and below the 2 percentile were eliminated. All variables have been transformed using natural logs. In the last column appear the F statistics and their p-values.*

Panel A: Absolute errors: Errors scaled by price:

	c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
12 month prior to year end EPS forecast data								
RD=RDS	-1.2383	0.0092	0.0266	-0.2682	1.3128	0.7032	0.3424	483.2907
	(-17.6019)	(1.1651)	(1.0313)	(-20.1647)	(3.9342)	(36.4023)		(0.0000)
RD=RDTA	-1.2388	0.0028	0.0259	-0.2703	1.3138	0.7032	0.3423	482.9964
	(-17.6113)	(0.3482)	(1.0002)	(-20.1061)	(3.9374)	(36.3962)		(0.0000)
RD=RDMV	-1.2414	0.0134	0.0245	-0.2666	1.3178	0.7026	0.3426	483.5904
	(-17.6687)	(1.5896)	(0.9515)	(-19.9937)	(3.9478)	(36.3585)		(0.0000)
6 month prior to year end EPS forecast data								
RD=RDS	-1.2816	0.0049	0.0991	-0.2829	-0.2358	0.5381	0.2804	349.9511
	(-17.7157)	(0.5431)	(3.2914)	(-20.0522)	(-0.6593)	(26.9206)		(0.0000)
RD=RDTA	-1.2825	0.0070	0.0997	-0.2820	-0.2348	0.5380	0.2804	350.0212
	(-17.7371)	(0.7578)	(3.3087)	(-19.8985)	(-0.6564)	(26.9132)		(0.0000)
RD=RDMV	-1.2846	0.0131	0.0975	-0.2800	-0.2309	0.5377	0.2806	350.3450
	(-17.7792)	(1.3896)	(3.2379)	(-19.7616)	(-0.6455)	(26.9111)		(0.0000)
Panel A: Absolute Errors: Errors scaled by actual EPS:								
12 month prior to year end EPS forecast data								
RD=RDS	-1.1949	0.0061	0.0400	-0.2002	-2.2966	0.6373	0.2788	373.8812
	(-15.7440)	(0.7130)	(1.3902)	(-13.7906)	(-6.1080)	(29.7396)		(0.0000)
RD=RDTA	-1.1949	-0.0005	0.0394	-0.2025	-2.2944	0.6374	0.2787	373.7716
	(-15.7403)	(-0.0609)	(1.3660)	(-13.8165)	(-6.1058)	(29.7350)		(0.0000)
RD=RDMV	-1.1972	0.0107	0.0384	-0.1986	-2.2927	0.6368	0.2789	374.0791
	(-15.7921)	(1.1835)	(1.3318)	(-13.6661)	(-6.0966)	(29.7138)		(0.0000)
6 month prior to year end EPS forecast data								
RD=RDS	-1.1967	0.0032	0.1224	-0.2203	-4.2338	0.4898	0.2567	338.5104
	(-15.2301)	(0.3261)	(3.8486)	(-14.2510)	(-10.7452)	(23.4279)		(0.0000)
RD=RDTA	-1.1972	0.0048	0.1227	-0.2197	-4.2333	0.4897	0.2567	338.5390
	(-15.2433)	(0.4692)	(3.8581)	(-14.1513)	(-10.7436)	(23.4203)		(0.0000)
RD=RDMV	-1.1992	0.0106	0.1208	-0.2177	-4.2316	0.4895	0.2569	338.7356
	(-15.2728)	(1.0345)	(3.7983)	(-14.0145)	(-10.7384)	(23.4112)		(0.0000)

Table 5B.12. Continued

Panel B: Non Absolute errors: Errors scaled by price:

	c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
12 month prior to year end EPS forecast data								
RD=RDS	0.0037	-0.0001	0.0009	-0.0007	-0.0206	0.0011	0.2705	344.5537
	(10.3110)	(-4.1286)	(6.5400)	(-10.0048)	(-12.2972)	(9.3280)		(0.0000)
RD=RDTA	0.0037	-0.0001	0.0009	-0.0007	-0.0206	0.0011	0.2706	344.6839
	(10.3461)	(-4.3530)	(6.4818)	(-10.0294)	(-12.3161)	(9.3445)		(0.0000)
RD=RDMV	0.0038	-0.0001	0.0009	-0.0007	-0.0206	0.0011	0.2695	342.6944
	(10.3497)	(-3.1381)	(6.6913)	(-9.8341)	(-12.3193)	(9.3402)		(0.0000)
6 month prior to year end EPS forecast data								
RD=RDS	0.0029	-0.0001	0.0007	-0.0005	-0.0120	0.0007	0.1906	211.9738
	(11.1219)	(-3.3055)	(6.6536)	(-10.1581)	(-8.4352)	(8.3448)		(0.0000)
RD=RDTA	0.0029	-0.0001	0.0007	-0.0005	-0.0120	0.0007	0.1909	212.3054
	(11.1592)	(-3.6711)	(6.5993)	(-10.1757)	(-8.4556)	(8.3559)		(0.0000)
RD=RDMV	0.0029	-0.0001	0.0007	-0.0005	-0.0120	0.0007	0.1901	211.1981
	(11.1579)	(-2.9372)	(6.7913)	(-10.0280)	(-8.4614)	(8.3545)		(0.0000)

Panel B: Non Absolute errors: Errors scaled by actual EPS:

	c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
12 month prior to year end EPS forecast data								
RD=RDS	0.0048	-0.0003	0.0026	-0.0006	-0.0452	0.0017	0.1245	138.2182
	(6.3609)	(-3.7046)	(8.6581)	(-4.2766)	(-8.0800)	(7.4028)		(0.0000)
RD=RDTA	0.0048	-0.0003	0.0026	-0.0006	-0.0452	0.0017	0.1244	138.0951
	(6.3827)	(-3.6139)	(8.6283)	(-4.2934)	(-8.0850)	(7.4184)		(0.0000)
RD=RDMV	0.0048	-0.0002	0.0027	-0.0006	-0.0452	0.0018	0.1233	136.7498
	(6.3625)	(-2.4930)	(8.7544)	(-4.0070)	(-8.0823)	(7.4279)		(0.0000)
6 month prior to year end EPS forecast data								
RD=RDS	0.0038	-0.0002	0.0019	-0.0004	-0.0258	0.0010	0.0809	87.1088
	(6.2120)	(-3.3656)	(7.6223)	(-3.8459)	(-5.3244)	(5.7334)		(0.0000)
RD=RDTA	0.0038	-0.0002	0.0019	-0.0004	-0.0258	0.0010	0.0807	86.8671
	(6.2322)	(-3.1404)	(7.5872)	(-3.8386)	(-5.3278)	(5.7454)		(0.0000)
RD=RDMV	0.0038	-0.0001	0.0020	-0.0004	-0.0259	0.0010	0.0798	85.8156
	(6.2061)	(-2.0486)	(7.7290)	(-3.5452)	(-5.3305)	(5.7551)		(0.0000)

Table 5B.13. The impact of R&D intensity on one year ahead mean EPS forecast revisions

The table reports the coefficient estimates and values of t-statistics (in parentheses) that have been estimated by running the following panel data regression for the period 1990-2003: Revisions $=\alpha_0+\alpha_1 RD+\alpha_2 BM+\alpha_3 MV+\alpha_4 PASTR+\alpha_5 STDEV+\varepsilon_{it}$. The dependent variable Revisions is defined in four ways, using one year ahead mean EPS analyst forecasts scaled either by stock price or by median EPS forecast:
Forecast Revision: 12 6 (Mean Forecast 12m prior to year end-Mean Forecast 6m prior to year end)/Share price 12m prior to year end *100 or the Absolute value of median forecast 12m prior to year end *100
Forecast Revision: 12 1 Mean Forecast 12m prior to year end-Mean Forecast 1m prior to year end)/Share price 12m prior to year end *100 or the Absolute value of median forecast 12m prior to year end *100
There have been used both absolute (Panel A) and non absolute revisions (Panel B). RD equals R&D/Sales or R&D/Total Assets or R&D/Market value of equity at year end, BM the Book to market ratio at year end, MV the MVE at year end, PASTR equals the 6 month prior to previous year end geometric average of monthly stock returns, STDEV equals the standard deviation of reported EPS for a three year period prior to base year. The regression is run using OLS and Whites Heteroskedasticity robust standard errors. Observations above the 98 and below the 2 percentile were eliminated. Non absolute revisions have been adjusted as follows in order to be able to use logs: (100+revision)/100 e.g. if a revision was 3%, it will appear as 103 or 97 for -3% In the last column appear the F statistics and their p-values.*

Panel A: Absolute revisions, revisions scaled by price

12 6	c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
RD=RDS	2.7826	-0.0112	0.0584	-0.2270	0.5704	0.3021	0.1753	189.8803
	(34.0227)	(-1.1433)	(1.8033)	(-13.9930)	(1.3984)	(13.2781)		(0.0000)
RD=RDTA	2.7852	-0.0183	0.0572	-0.2300	0.5710	0.3023	0.1757	190.2922
	(34.0844)	(-1.8615)	(1.7653)	(-14.1176)	(1.4002)	(13.2984)		(0.0000)
RD=RDMV	2.7853	-0.0113	0.0606	-0.2272	0.5646	0.3024	0.1753	189.8687
	(34.0166)	(-1.1190)	(1.8695)	(-13.9402)	(1.3846)	(13.2876)		(0.0000)
12 1								
RD=RDS	2.9748	0.0076	0.0132	-0.2046	2.4557	0.4391	0.2061	238.1093
	(46.8908)	(1.0044)	(0.5442)	(-16.7082)	(6.6016)	(23.5869)		(0.0000)
RD=RDTA	2.9745	0.0040	0.0130	-0.2057	2.4563	0.4390	0.2060	237.9536
	(46.8639)	(0.5179)	(0.5377)	(-16.6513)	(6.6055)	(23.5857)		(0.0000)
RD=RDMV	2.9718	0.0126	0.0113	-0.2027	2.4628	0.4387	0.2064	238.4261
	(46.8668)	(1.6026)	(0.4638)	(-16.5150)	(6.6214)	(23.5652)		(0.0000)

Panel A: Absolute Revisions, Revisions scaled by abs. value of -12m median EPS forecast:

12 6	c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
RD=RDS	2.8282	0.0064	-0.0885	-0.1800	-0.6659	0.2780	0.1511	158.5143
	(33.0947)	(0.6298)	(-2.6713)	(-10.6330)	(-1.6352)	(12.0148)		(0.0000)
RD=RDTA	2.8286	-0.0018	-0.0894	-0.1829	-0.6651	0.2779	0.1510	158.4460
	(33.0978)	(-0.1808)	(-2.6954)	(-10.7471)	(-1.6328)	(12.0142)		(0.0000)
RD=RDMV	2.8274	0.0033	-0.0895	-0.1810	-0.6640	0.2779	0.1510	158.4581
	(33.0650)	(0.3106)	(-2.6986)	(-10.6329)	(-1.6299)	(12.0062)		(0.0000)
12 1								
RD=RDS	3.0166	0.0235	-0.1449	-0.1616	1.1397	0.4309	0.1802	200.7703
	(43.2652)	(2.8211)	(-5.4595)	(-11.9673)	(3.1030)	(21.6189)		(0.0000)
RD=RDTA	3.0143	0.0190	-0.1444	-0.1626	1.1431	0.4306	0.1798	200.1747
	(43.1730)	(2.2549)	(-5.4343)	(-11.9251)	(3.1139)	(21.5904)		(0.0000)
RD=RDMV	3.0099	0.0272	-0.1496	-0.1599	1.1527	0.4300	0.1805	201.1418
	(43.2047)	(3.1203)	(-5.6133)	(-11.8240)	(3.1374)	(21.5684)		(0.0000)

Table 5B.13. Continued

Panel B: Non absolute revisions, Revisions scaled by Price

12 6	c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
RD=RDS	-0.0151	0.0033	-0.0288	0.0047	1.1632	-0.0324	0.0914	89.5801
	(-0.8261)	(1.6963)	(-4.1183)	(1.3569)	(10.2923)	(-5.6300)		(0.0000)
RD=RDTA	-0.0155	0.0034	-0.0287	0.0049	1.1629	-0.0325	0.0914	89.6070
	(-0.8503)	(1.7245)	(-4.0945)	(1.3881)	(10.2897)	(-5.6404)		(0.0000)
RD=RDMV	-0.0153	0.0014	-0.0293	0.0041	1.1641	-0.0325	0.0910	89.1515
	(-0.8333)	(0.7644)	(-4.1614)	(1.1634)	(10.2969)	(-5.6396)		(0.0000)
12 1								
RD=RDS	-0.0412	0.0048	-0.0443	0.0111	2.4658	-0.0362	0.1544	164.4701
	(-2.3161)	(2.5186)	(-6.2402)	(3.3524)	(18.8245)	(-5.8019)		(0.0000)
RD=RDTA	-0.0417	0.0047	-0.0441	0.0112	2.4659	-0.0363	0.1543	164.3952
	(-2.3448)	(2.4162)	(-6.2064)	(3.3643)	(18.8254)	(-5.8176)		(0.0000)
RD=RDMV	-0.0420	0.0037	-0.0450	0.0108	2.4672	-0.0363	0.1540	163.9797
	(-2.3550)	(2.0544)	(-6.3380)	(3.2501)	(18.8359)	(-5.8197)		(0.0000)

Panel B, Non Absolute Revisions, Revisions scaled by abs. value of -12m median EPS forecast:

12 6	c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
RD=RDS	0.0214	0.0033	-0.0351	-0.0003	1.6007	-0.0256	0.1030	101.2056
	(0.9433)	(1.6373)	(-4.2859)	(-0.0675)	(11.2361)	(-3.9848)		(0.0000)
RD=RDTA	0.0209	0.0036	-0.0349	-0.0001	1.6011	-0.0257	0.1031	101.2549
	(0.9198)	(1.7493)	(-4.2588)	(-0.0191)	(11.2427)	(-3.9952)		(0.0000)
RD=RDMV	0.0210	0.0020	-0.0356	-0.0007	1.6022	-0.0257	0.1028	100.9520
	(0.9225)	(1.0274)	(-4.3465)	(-0.1673)	(11.2500)	(-3.9984)		(0.0000)
12 1								
RD=RDS	-0.0103	0.0058	-0.0453	0.0109	3.3704	-0.0374	0.1577	167.7805
	(-0.5083)	(2.7464)	(-4.7108)	(2.6979)	(19.1041)	(-4.6722)		(0.0000)
RD=RDTA	-0.0111	0.0060	-0.0450	0.0112	3.3709	-0.0375	0.1578	167.8409
	(-0.5449)	(2.8493)	(-4.6713)	(2.7472)	(19.1123)	(-4.6902)		(0.0000)
RD=RDMV	-0.0113	0.0049	-0.0462	0.0107	3.3736	-0.0376	0.1574	167.3851
	(-0.5570)	(2.4087)	(-4.8208)	(2.6401)	(19.1094)	(-4.6986)		(0.0000)

APPENDIX 5B.A

Appendix 5B.A Part A: The Appendix 5B.A Part A contains information on analyst forecast dispersion for the whole sample, the R&D, zero R&D firms and according to R&D intensity quartiles (using R&D/Sales, R&D/TA and R&D/MV as proxies) when including only the firms with more than 1 year ahead EPS 5 analyst forecasts issued for a particular month. The table below is equivalent to Table 5B.1, and shows the average sample period dispersion with the inclusion of only the firms with more than 1 year ahead EPS 5 analyst forecasts issued for a particular month, using again minus 12, 6 and 1 month prior to year end analyst forecasts.

	12	6	1
Sample	0.085	0.093	0.097
R&D firms	0.085	0.091	0.094
Zero R&D firms	0.100	0.108	0.115
R&D/Sales			
Low	0.079	0.084	0.087
	0.086	0.095	0.087
	0.081	0.085	0.093
High	0.124	0.117	0.144
R&D/TA			
Low	0.078	0.078	0.086
	0.084	0.092	0.081
	0.093	0.109	0.116
High	0.105	0.091	0.106
R&D/MV			
Low	0.063	0.062	0.072
	0.075	0.078	0.077
	0.113	0.102	0.098
High	0.126	0.168	0.173
TA			
Low	0.128	0.070	0.132
	0.110	0.111	0.110
	0.089	0.101	0.117
High	0.087	0.096	0.097
MV			
Low	0.203	0.189	0.201
	0.148	0.159	0.162
	0.085	0.098	0.110
High	0.078	0.085	0.089
BM			
Low	0.071	0.077	0.083
	0.071	0.090	0.082
	0.093	0.106	0.112
High	0.153	0.158	0.171

Appendix 5B.A Part B: After decomposing forecast dispersion into an uncertainty part (V) and a differences of opinion part (1-ρ) (definitions appear in text), following Doukas, Kim and Pantzalis (2006), Table 1 of the Appendix 5B.A Part B reports the average V and 1 (1-ρ) (and also D=scaled variance of analyst forecasts multiplied by 10) for the whole sample, the R&D, zero R&D firms and according to R&D intensity quartiles (using R&D/Sales, R&D/TA and R&D/MV as proxies) using minus 1 month prior to year end analyst forecasts for all measure calculations (observations below/above 0.02/0.98 percentile have been removed). Table 2 reports V calculated as V= D/(1-ρ), where (1-ρ) was calculated as in p.603 of Doukas, Kim and Pantzalis (by using deflation by absolute *actual* EPS in the components of ρ where deflation is necessary), and D is the scaled variance (squared standard deviation or squared dispersion of Diether, Malloy and Scherbina employed else in the thesis), using the Diether, Malloy and Scherbina dispersion definition, which involves scaling by absolute *mean EPS forecast*. Table 3 reports D (=scaled variance of analyst forecasts multiplied by 10), V and (1-ρ) where V =D/(1-ρ), with D to be the scaled variance (squared standard deviation or squared dispersion of Diether, Malloy and Scherbina - multiplied by 10- employed else in the thesis), using the Diether, Malloy and Scherbina dispersion definition, which involves scaling by absolute *mean EPS forecast*, and (1-ρ) to be calculated by using here again by scaling by the absolute *mean EPS forecast* when scaling is necessary for ρ calculation. Minus one month prior to year end forecast data have been used for D, V and (1-ρ) calculation.

So for Table 1: D=V(1-ρ), where 1- ρ represents differences of opinion (ρ =correlation of forecast errors across analysts, a measure of analyst consensus) and V is uncertainty of the forecast
D= ((standard deviation in forecasts) *(standard deviation in forecasts)/(absolute value of actual EPS)) *10, with the standard deviation of forecasts to be the one used on p.61 for dispersion calculation (standard deviation in forecasts scaled by absolute mean EPS forecast equals dispersion used in p.61). ρ =h/(h+s), V=D/(1-ρ), where h=precision of common information and s=precision of idiosyncratic information, $h=(SE-(D/N))/((SE-(D/N))+D)^2$, $s=D/((SE-(D/N))+D)^2$, with SE = squared error of the mean forecast (deflated by the absolute value of actual EPS) at year end as reported else in the thesis, D= defined right above, N = the number of forecasts
For Table 2: V= D as of page 85 divided with (1-ρ) of p.87
For Table 3: D=V(1-ρ), D= ((standard deviation in forecasts) *(standard deviation in forecasts)/(absolute value of mean EPS forecast)) *10, with the standard deviation of forecasts to be the one used on p.61 for dispersion calculation, ρ =h/(h+s), V=D/(1-ρ), where h=precision of common information and s=precision of idiosyncratic information, $h=(SE-(D/N))/((SE-(D/N))+D)^2$, $s=D/((SE-(D/N))+D)^2$. SE = squared error of the mean forecast (deflated by the absolute value of actual EPS at year end as reported else in the thesis, D= defined right above, N = the number of forecasts.

Table 1:

Scaled variance in forecasts D=V(1-ρ)	1	Uncertainty V	1	Lack of Consensus (1-ρ)	1
Sample	0.992	Sample	1.829	Sample	0.800
R&D firms	1.023	R&D firms	1.892	R&D firms	0.795
Zero R&D firms	0.959	Zero R&D firms	1.807	Zero R&D firms	0.804
R&D/Sales		R&D/Sales		R&D/Sales	
Low	0.441	Low	1.236	Low	0.873
	0.594		1.012		0.816
	1.078		1.873		0.814
High	2.632	High	4.165	High	0.621
R&D/TA		R&D/TA		R&D/TA	
Low	0.418	Low	1.135	Low	0.882
	0.716		1.178		0.798
	1.273		2.449		0.796
High	2.474	High	3.512	High	0.653
R&D/MV		R&D/MV		R&D/MV	
Low	0.424	Low	0.671	Low	0.902
	1.002		1.864		0.806
	1.999		2.654		0.751
High	1.264	High	3.209	High	0.660
TA		TA		TA	
Low	1.467	Low	3.221	Low	0.688
	1.227		1.919		0.779
	1.034		1.837		0.808
High	0.827	High	1.622	High	0.827
MV		MV		MV	
Low	1.835	Low	3.864	Low	0.669
	0.818		1.797		0.788
	1.167		2.067		0.803
High	0.757	High	1.285	High	0.824
BM		BM		BM	
Low	1.076	Low	1.466	Low	0.774
	0.519		1.063		0.837
	0.993		1.711		0.827
High	1.509	High	3.565	High	0.748

Table 2:

Uncertainty V	
Sample	0.746
R&D firms	0.818
Zero R&D firms	0.729
R&D/Sales	
Low	0.366
	0.521
	0.759
High	1.980
R&D/TA	
Low	0.383
	0.540
	0.879
High	1.841
R&D/MV	
Low	0.299
	0.476
	0.971
High	1.944
TA	
Low	1.304
	1.040
	0.729
High	0.534
MV	
Low	1.549
	1.134
	0.701
High	0.445
BM	
Low	0.603
	0.454
	0.785
High	1.318

Table 3:

Scaled variance in forecasts D=V((1-ρ)	1	Uncertainty V	1	Lack of Consensus (1-ρ)	1
Sample	0.631	Sample	1.163	Sample	0.775
R&D firms	0.736	R&D firms	1.250	R&D firms	0.774
Zero R&D firms	0.714	Zero R&D firms	1.108	Zero R&D firms	0.788
R&D/Sales		R&D/Sales		R&D/Sales	
Low	0.210	Low	0.897	Low	0.801
	0.428		0.739		0.765
	0.491		1.429		0.780
High	1.167	High	2.499	High	0.638
R&D/TA		R&D/TA		R&D/TA	
Low	0.201	Low	0.805	Low	0.800
	0.451		0.908		0.747
	0.620		1.892		0.779
High	1.104	High	1.889	High	0.660
R&D/MV		R&D/MV		R&D/MV	
Low	0.208	Low	0.363	Low	0.827
	0.332		1.300		0.743
	0.697		1.383		0.741
High	1.117	High	2.733	High	0.676
TA		TA		TA	
Low	0.908	Low	1.602	Low	0.767
	0.564		1.276		0.771
	0.980		1.407		0.793
High	0.344	High	0.865	High	0.755
MV		MV		MV	
Low	1.394	Low	2.209	Low	0.770
	0.666		1.491		0.792
	0.790		1.333		0.769
High	0.303	High	0.670	High	0.758
BM		BM		BM	
Low	0.625	Low	1.033	Low	0.764
	0.286		0.638		0.791
	0.529		1.063		0.778
High	1.253	High	2.257	High	0.761

APPENDIX 5B.B

Appendix 5B.B contains robustness checks for results of Table 5B.3.

Appendix 5B.B Part A: The table below is equivalent to Table 5B.3, but this time with replacing MV with a variable that accounts for firm age (defined as the natural log of the difference in years between year t and the year when data is recorded for the first time for a particular firm in LSPD-item G6).

	C	RD	BM	AGE	STDEV	AF	Adjusted R-squared	F-statistic
12 month prior to year end EPS forecast data								
RDS	1.6942	0.0195	0.1570	-0.0173	0.1166	-0.0157	0.3092	342.9950
	(13.1084)	(2.2615)	(5.2253)	(-0.4712)	(11.7442)	(-0.4699)		(0.0000)
RDTA	1.6971	0.0200	0.1575	-0.0185	0.1167	-0.0150	0.3093	(343.0485)
	(13.1260)	(2.3835)	(5.2459)	(-0.5034)	(11.7476)	(-0.4471)		(0.0000)
RDMV	1.6948	0.0205	0.1526	-0.0189	0.1166	-0.0150	0.3093	343.0879
	(13.1214)	(2.3456)	(5.0657)	(-0.5140)	(11.7402)	(-0.4502)		(0.0000)
6 month prior to year end EPS forecast data								
RDS	1.6703	0.0180	0.1813	-0.0003	0.1480	-0.0256	0.3207	360.7981
	(13.4379)	(2.0659)	(6.0384)	(-0.0080)	(14.2238)	(-0.7586)		(0.0000)
RDTA	1.6743	0.0126	0.1824	-0.0037	0.1480	-0.0273	0.3204	360.3059
	(13.4605)	(1.4625)	(6.0825)	(-0.1058)	(14.2152)	(0.8088)		(0.0000)
RDMV	1.6696	0.0211	0.1764	-0.0009	0.1480	-0.0237	0.3209	361.1365
	(13.4334)	(2.4697)	(5.8610)	(-0.0260)	(14.2175)	(-0.7023)		(0.0000)
1 month prior to year end EPS forecast data								
RDS	1.9363	0.0080	0.2378	-0.0355	0.0649	-0.0064	0.2955	314.5005
	(14.9099)	(0.8952)	(7.7659)	(-0.9548)	(6.4012)	(-0.1884)		(0.0000)
RDTA	1.9361	0.0129	0.2375	-0.0343	0.0649	-0.0036	0.2957	314.7634
	(14.9101)	(1.4718)	(7.7621)	(-0.9237)	(6.4069)	(-0.1067)		(0.0000)
RDMV	1.9327	0.0196	0.2318	-0.0324	0.0649	-0.0008	0.2961	315.3207
	(14.8891)	(2.2329)	(7.5703)	(-0.8725)	(6.4110)	(-0.0231)		(0.0000)

Appendix 5B.B Part B: In Appendix 5B.B Part B, there is assessed the impact of R&D intensity on analyst forecast dispersion when controlling for industry factors. In specific, Part B of the Appendix 5B.B reports the regression results as in table 5B.3, when minus twelve month forecast data are used and R&D intensity is defined as R&D/Sales, with the inclusion of four industry dummy variables to account for four sectors perceived as intensive in R&D activity: Information Technology (INDD1), Chemicals (INDD2), General Industries (INDD3) and Health grouped together with Pharmaceuticals and Biotechnology ('Pharma' -INDD4). INDDUMMY takes the value of 1 if the firm belongs to the specific industry, and 0 otherwise. The industry dummies are used both in a simple form as well as multiplicative with R&D.

Simple dummy variables - Results with MV among the regressors:

C	RD	BM	MV	STDEV	AF	INDD1	Adjusted R-squared	F-statistic
1.8717	0.0181	0.0998	-0.0748	0.1144	0.0613	0.1348	0.3058	281.3514
(17.6546)	(2.0555)	(2.9493)	(-3.4472)	(11.3810)	(1.5162)	(0.8409)		(0.0000)

C	RD	BM	MV	STDEV	AF	INDD2	Adjusted R-squared	F-statistic
1.8886	0.0179	0.0963	-0.0768	0.1143	0.0598	-0.0009	0.3057	281.1171
(17.9132)	(2.0152)	(2.8671)	(-3.5462)	(11.3615)	(1.4788)	(-0.0088)		(0.0000)

C	RD	BM	MV	STDEV	AF	INDD3	Adjusted R-squared	F-statistic
1.8949	0.0170	0.0955	-0.0774	0.1143	0.0592	-0.0253	0.3057	281.1415
(17.6901)	(1.8932)	(2.8299)	(-3.5603)	(11.3613)	(1.4645)	(-0.3348)		(0.0000)

C	RD	BM	MV	STDEV	AF	INDD4	Adjusted R-squared	F-statistic
1.8924	0.0179	0.0943	-0.0769	0.1141	0.0593	-0.0994	0.3057	281.2050
(17.9040)	(2.0364)	(2.7835)	(-3.5497)	(11.3395)	(1.4696)	(-0.6009)		(0.0000)

Simple dummy variables - Results with AGE among the regressors:

C	RD	BM	AGE	STDEV	AF	INDD1	Adjusted R-squared	F-statistic
1.6607	0.0197	0.1592	-0.0101	0.1166	-0.0119	0.1761	0.3094	294.3232
(12.7764)	(2.2835)	(5.2765)	(-0.2753)	(11.7576)	(-0.3544)	(1.0830)		(0.0000)

C	RD	BM	AGE	STDEV	AF	INDD2	Adjusted R-squared	F-statistic
1.6949	0.0196	0.1570	-0.0176	0.1166	-0.0157	0.0059	0.3091	293.9319
(13.0171)	(2.2483)	(5.2247)	(-0.4713)	(11.7420)	(-0.4714)	(0.0585)		(0.0000)

C	RD	BM	AGE	STDEV	AF	INDD3	Adjusted R-squared	F-statistic
1.6943	0.0199	0.1572	-0.0183	0.1166	-0.0149	0.0141	0.3091	293.9392
(13.1064)	(2.2631)	(5.2198)	(-0.4953)	(11.7418)	(-0.4445)	(0.1886)		(0.0000)

C	RD	BM	AGE	STDEV	AF	INDD4	Adjusted R-squared	F-statistic
1.8924	0.0179	0.0943	-0.0769	0.1141	0.0593	-0.0994	0.3057	281.2050
(17.9040)	(2.0364)	(2.7835)	(-3.5497)	(11.3395)	(1.4696)	(-0.6009)		(0.0000)

Multiplicative dummy variables - Results with MVE among the regressors:

C	RD	BM	MV	STDEV	AF	RD*INDD1	Adjusted R-squared	F-statistic
1.8940	0.0170	0.0943	-0.0777	0.1143	0.0595	0.0391	0.3058	281.2578
(17.9434)	(1.9223)	(2.8003)	(-3.5845)	(11.3706)	(1.4726)	(0.7630)		(0.0000)

C	RD	BM	MV	STDEV	AF	RD*INDD2	Adjusted R-squared	F-statistic
1.8888	0.0186	0.0964	-0.0767	0.1144	0.0592	-0.0109	0.3057	281.1448
(17.9317)	(2.0732)	(2.8703)	(-3.5454)	(11.3673)	(1.4642)	(-0.4667)		(0.0000)

C	RD	BM	MV	STDEV	AF	RD*INDD3	Adjusted R-squared	F-statistic
1.9032	0.0129	0.0937	-0.0787	0.1143	0.0582	0.0230	0.3059	281.4296
(17.9584)	(1.3944)	(2.7748)	(-3.6268)	(11.3679)	(1.4409)	(1.2599)		(0.0000)

C	RD	BM	MV	STDEV	AF	RD*INDD4	Adjusted R-squared	F-statistic
1.8872	0.0182	0.0971	-0.0765	0.1145	0.0596	-0.0180	0.3057	281.1385
(17.8857)	(2.0646)	(2.8779)	(-3.5240)	(11.3804)	(1.4733)	(-0.3107)		(0.0000)

Multiplicative dummy variables - Results with AGE among the regressors:

C	RD	BM	AGE	STDEV	AF	RD*INDD1	Adjusted R-squared	F-statistic
1.6999	0.0189	0.1561	-0.0186	0.1166	-0.0166	0.0291	0.3091	294.0097
(13.1538)	(2.1752)	(5.1881)	(-0.5071)	(11.7482)	(-0.4962)	(0.5623)		(0.0000)

C	RD	BM	AGE	STDEV	AF	RD*INDD2	Adjusted R-squared	F-statistic
1.6985	0.0201	0.1571	-0.0188	0.1166	-0.0160	-0.0098	0.3091	293.9537
(13.0425)	(2.2843)	(5.2269)	(-0.5053)	(11.7431)	(-0.4801)	(-0.4126)		(0.0000)

C	RD	BM	AGE	STDEV	AF	RD*INDD3	Adjusted R-squared	F-statistic
1.6913	0.0168	0.1561	-0.0143	0.1167	-0.0180	0.0138	0.3092	294.0461
(13.0943)	(1.8533)	(5.1831)	(-0.3891)	(11.7534)	(-0.5382)	(0.7648)		(0.0000)

C	RD	BM	AGE	STDEV	AF	RD*INDD4	Adjusted R-squared	F-statistic
1.6927	0.0198	0.1576	-0.0169	0.1167	-0.0157	-0.0185	0.3091	293.9545
(13.1148)	(2.2879)	(5.2328)	(-0.4609)	(11.7597)	(-0.4699)	(-0.3203)		(0.0000)

Appendix 5B.B Part C: Appendix 5B.B Part C reports controls for time period effects as a result of the New Economy. Part C of the Appendix 5B.B reports the regression results as in table 5B.3, when minus twelve month forecast data are used and R&D intensity is defined as R&D/Sales, but by a) running the regressions by excluding the years 1999-2001, and b) running the regression for the whole sample period 1990-2003 with the inclusion of a year dummy variable, taking the value of 1 if the data refer to year 1999 or 2000 or 2001, and zero otherwise, when either MV or AGE is included among the regressors.

Regression run by excluding the years 1999-2001:

C	RD	BM	MV	STDEV	AF	Adjusted R-squared	F-statistic
1.8167	0.0201	0.0431	-0.0569	0.1104	0.0046	0.3256	266.3243
(14.2558)	(1.9010)	(1.0687)	(-2.1973)	(9.5477)	(0.1002)		(0.0000)
C	**RD**	**BM**	**AGE**	**STDEV**	**AF**	**Adjusted R-squared**	**F-statistic**
1.6485	0.0214	0.0882	-0.0049	0.1131	-0.0536	0.3335	284.4376
(10.4181)	(2.0756)	(2.4667)	(-0.1065)	(9.9136)	(-1.3809)		(0.0000)

Regression run with the inclusion of a time dummy:

C	RD	BM	MV	STDEV	AF	Time Dummy	Adjusted R-squared	F-statistic
1.8971	0.0181	0.0956	-0.0775	0.1142	0.0627	-0.0315	0.3058	281.2649
(17.9285)	(2.0636)	(2.8424)	(-3.5802)	(11.3448)	(1.5492)	(-0.8278)		(0.0000)
C	**RD**	**BM**	**AGE**	**STDEV**	**AF**	**Time Dummy**	**Adjusted R-squared**	**F-statistic**
1.6983	0.0197	0.1569	-0.0174	0.1165	-0.0142	-0.0207	0.3091	293.9985
(13.1052)	(2.2813)	(5.2141)	(-0.4718)	(11.7271)	(-0.4248)	(-0.5539)		(0.0000)

Appendix 5B.B Part D: Appendix 5B.B Part D reports controls for period fixed-random effects in the regression in Table 5B.3. Part D of the Appendix 5B.B reports the regression results as in table 5B.3, when minus twelve month forecast data are used and R&D intensity is defined as R&D/Sales, by running the regression (using MV among the regressors) using period fixed and random effects. The model is not run by adding an AR(1) term in order to correct for serial correlation (Park, Sickles and Simar, 2003; Baltagi and Chang, 1992) because econometric software did not permit its application along with period fixed and random effects.

Period fixed effects:

C	RD	BM	MV	STDEV	AF	Adjusted R-squared	F-statistic
1.5506	0.0140	0.1499	-0.1330	0.1753	0.3014	0.1371	53.7994
(27.6993)	(2.4837)	(7.1255)	(-8.7600)	(17.1037)	(9.5467)		(0.0000)

Period Random effects:

C	RD	BM	MV	STDEV	AF	Adjusted R-squared	F-statistic
1.5393	0.0152	0.1602	-0.1146	0.1766	0.2664	0.1072	144.6128
(22.9589)	(2.6969)	(7.6380)	(-7.6887)	(17.2575)	(8.5595)		(0.0000)

APPENDIX 5B.C

Appendix 5B.C Part A: Part A of the Appendix 5B.6 presents the results as in Table 5B.6 Panel B but with the RD factor calculated with equal-weighted returns in different ways:

1) Appendix 5B.C Part A Panel A reports the results with an RD factor calculated as in Al-Horani, Pope and Stark (2003) by taking the difference between the average (equal-weighted) monthly returns of three R&D reporting BM port folios and three zero R&D portfolios: (LRD+MRD+HRD)/3-(LZRD+MZRD+HZRD)/3, for the whole sample, the R&D, zero R&D firms and firms with an R&D/Sales ratio above the sample median.
2) Appendix 5B.C Part A Panel B reports the results with an RD factor calculated on its own by subtracting the average monthly returns of low R&D (R&D/Sales below 30^{th} percentile) and zero R&D firms from the returns of mid and high R&D portfolios(R&D/Sales between 30^{th} and 70^{th} percentile and above 70^{th} percentile respectively): (High RD+Mid RD)/2-(Low RD+Zero RD)/2 with equal-weighted returns, for the whole sample, the R&D, zero R&D firms and firms with an R&D/Sales ratio above the sample median.
3) Appendix 5B.C Part A Panel C reports the results with an RD factor calculated on its own by subtracting the returns of the R&D firms with an R&D/Sales ratio below the 30th percentile from the returns of the R&D firms with an R&D/Sales ratio above 70th percentile (High RD-Low RD) with equal-weighted returns, for the R&D firms and for firms with an R&D/Sales ratio above the sample median.

Appendix 5B.C Part A Panel A: Time-series regressions run with an RD factor as in Al Horani et al (2003)

Sample	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
D1 (low)	0.001	1.019	0.566	0.151	0.040	0.718	99.828
	(0.3216)	(18.1964)	(8.5109)	(2.1401)	(0.2979)		(0.0000)
D2	0.000	1.013	0.389	0.232	-0.049	0.683	84.464
	(-0.0154)	(17.9958)	(5.3271)	(2.7160)	(-0.3817)		(0.0000)
D3	-0.002	1.191	0.581	0.366	-0.088	0.714	97.878
	(-0.9768)	(19.6810)	(7.6338)	(4.6128)	(-0.6026)		(0.0000)
D4	-0.002	1.176	0.682	0.425	0.057	0.718	99.436
	(-0.8449)	(17.4664)	(9.5743)	(5.3807)	(0.3527)		(0.0000)
D5 (High)	-0.002	1.425	1.067	0.446	-0.102	0.753	119.231
	(-0.8781)	(19.1512)	(11.8565)	(5.0036)	(-0.5694)		(0.0000)
R&D firms							
D1 (low)	0.001	1.049	0.506	0.047	0.452	0.740	111.471
	(0.3710)	(17.3987)	(6.3512)	(0.6088)	(3.1659)		(0.0000)
D2	-0.001	0.999	0.249	0.238	0.332	0.665	77.908
	(-0.3077)	(16.9853)	(2.7697)	(2.7158)	(2.2340)		(0.0000)
D3	-0.002	1.172	0.573	0.339	0.372	0.652	73.513
	(-0.6331)	(16.2120)	(6.1808)	(3.6933)	(2.0645)		(0.0000)
D4	-0.001	1.152	0.602	0.346	0.492	0.679	82.965
	(-0.2546)	(16.0000)	(6.8278)	(3.8006)	(2.5646)		(0.0000)
D5 (High)	-0.003	1.377	1.025	0.268	0.527	0.705	93.505
	(-1.0540)	(15.7866)	(10.1868)	(2.5826)	(2.6879)		(0.0000)
Zero R&D firms							
D1 (low)	0.000	1.005	0.627	0.212	-0.215	0.658	75.545
	(0.1344)	(16.4407)	(8.6373)	(2.7133)	(-1.4354)		(0.0000)
D2	0.000	1.021	0.502	0.227	-0.339	0.635	68.320
	(0.1144)	(16.3183)	(6.4418)	(2.4095)	(-2.3376)		(0.0000)
D3	-0.003	1.205	0.603	0.377	-0.425	0.702	92.094
	(-1.1500)	(19.3729)	(7.3119)	(4.4655)	(-2.6092)		(0.0000)
D4	-0.003	1.192	0.729	0.468	-0.229	0.696	89.526
	(-1.1235)	(16.4358)	(9.4450)	(5.5756)	(-1.4305)		(0.0000)
D5 (High)	-0.001	1.422	1.034	0.513	-0.418	0.726	103.420
	(-0.5777)	(18.4484)	(9.4530)	(5.3849)	(-2.0838)		(0.0000)
R&D firms with RD/Sales> median							
D1 (low)	0.005	1.154	0.642	-0.142	0.661	0.660	76.067
	(1.6064)	(12.5926)	(4.2647)	(-1.2823)	(2.7840)		(0.0000)
D2	-0.001	1.085	0.455	-0.043	0.391	0.578	54.086
	(-0.1892)	(12.6675)	(3.5072)	(-0.3691)	(1.5323)		(0.0000)
D3	-0.001	1.319	0.784	0.031	0.532	0.580	54.555
	(-0.2954)	(10.5271)	(5.7312)	(0.2171)	(1.8750)		(0.0000)
D4	0.007	1.342	0.890	-0.081	0.709	0.546	47.654
	(1.4826)	(10.6556)	(6.3285)	(-0.5273)	(1.9638)		(0.0000)
D5 (High)	-0.001	1.395	1.289	-0.180	0.902	0.624	65.323
	(-0.2683)	(11.7790)	(9.6806)	(-1.1241)	(3.3355)		(0.0000)

Appendix 5B.C Part A Panel B: Time-series regressions run with an RD factor calculated as (High RD+Mid RD)/2-(Low RD+Zero RD)/2

Sample	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
D1 (low)	0.000	0.966	0.496	0.346	0.319	0.738	109.981
	(-0.2391)	(17.8903)	(7.8452)	(3.7992)	(3.1190)		(0.0000)
D2	-0.002	0.938	0.307	0.509	0.424	0.717	99.230
	(-0.8137)	(16.4773)	(4.2607)	(5.0632)	(3.3838)		(0.0000)
D3	-0.004	1.121	0.512	0.623	0.380	0.735	108.491
	(-1.6928)	(20.0972)	(6.4461)	(6.3510)	(3.2220)		(0.0000)
D4	-0.003	1.111	0.593	0.669	0.399	0.741	111.984
	(-1.5085)	(17.5338)	(8.1859)	(6.4061)	(3.3042)		(0.0000)
D5 (High)	-0.004	1.328	0.969	0.802	0.532	0.782	140.206
	(-1.8344)	(17.8501)	(11.1273)	(7.6361)	(4.0817)		(0.0000)
R&D firms							
D1 (low)	0.000	0.997	0.361	0.259	0.459	0.757	121.577
	(0.0878)	(16.4515)	(4.8730)	(2.6533)	(4.0000)		(0.0000)
D2	-0.002	0.934	0.110	0.494	0.494	0.697	90.147
	(-0.7515)	(16.8805)	(1.2317)	(4.7004)	(3.7638)		(0.0000)
D3	-0.003	1.095	0.412	0.643	0.580	0.686	85.598
	(-1.1130)	(16.9635)	(4.5199)	(5.2111)	(3.9379)		(0.0000)
D4	-0.001	1.091	0.439	0.594	0.526	0.699	90.993
	(-0.5526)	(16.7277)	(4.8709)	(4.8718)	(3.9850)		(0.0000)
D5 (High)	-0.005	1.259	0.786	0.730	0.872	0.762	125.341
	(-1.9773)	(15.3085)	(7.9893)	(6.3757)	(6.2640)		(0.0000)
Zero R&D firms							
D1 (low)	-0.001	0.954	0.605	0.392	0.225	0.663	77.194
	(-0.4836)	(15.8716)	(8.5032)	(3.7702)	(2.0121)		(0.0000)
D2	-0.002	0.943	0.468	0.506	0.345	0.645	71.443
	(-0.7779)	(13.8124)	(6.0585)	(4.4191)	(2.4855)		(0.0000)
D3	-0.005	1.141	0.602	0.598	0.231	0.695	89.445
	(-1.8933)	(18.1759)	(6.7537)	(5.6039)	(1.8488)		(0.0000)
D4	-0.004	1.126	0.690	0.704	0.308	0.705	93.672
	(-1.8957)	(15.4112)	(8.6766)	(6.4120)	(2.4003)		(0.0000)
D5 (High)	-0.004	1.342	1.013	0.791	0.323	0.727	103.995
	(-1.3676)	(16.7026)	(9.8201)	(6.2307)	(2.1394)		(0.0000)
R&D firms with RD/Sales> median							
D1 (low)	0.003	1.056	0.402	0.253	0.804	0.702	92.251
	(1.2143)	(11.9534)	(3.3425)	(1.8102)	(4.7049)		(0.0000)
D2	-0.003	0.964	0.237	0.423	0.842	0.651	73.388
	(-0.9139)	(11.4045)	(2.0268)	(3.1151)	(4.5622)		(0.0000)
D3	-0.003	1.190	0.531	0.535	0.939	0.639	52.095
	(-0.9106)	(10.2505)	(4.7067)	(2.8297)	(4.3802)		(0.0000)
D4	0.004	1.171	0.555	0.582	1.239	0.630	66.887
	(0.9582)	(11.4632)	(4.5166)	(3.0290)	(5.6901)		(0.0000)
D5 (High)	-0.004	1.208	0.899	0.554	1.403	0.714	97.555
	(-1.1952)	(10.7364)	(7.1784)	(3.1566)	(7.6111)		(0.0000)

Appendix 5B.C Part A Panel C: Time-series regressions run with an RD factor calculated as (High RD-Low RD)

	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
R&D firms							
D1 (low)	0.000	1.019	0.332	0.191	0.189	0.738	110.248
	(0.2157)	(16.0677)	(3.8404)	(1.8275)	(2.6518)		(0.0000)
D2	-0.001	0.957	0.080	0.420	0.203	0.674	81.104
	(-0.6272)	(16.7504)	(0.7600)	(3.8450)	(2.5318)		(0.0000)
D3	-0.002	1.130	0.392	0.527	0.214	0.658	75.599
	(-0.8650)	(15.4865)	(3.6466)	(4.1292)	(2.4694)		(0.0000)
D4	-0.001	1.111	0.397	0.533	0.232	0.681	83.752
	(-0.4531)	(15.1660)	(3.7622)	(4.1924)	(2.9654)		(0.0000)
D5 (High)	-0.005	1.255	0.635	0.776	0.509	0.756	121.299
	(-2.1984)	(15.8169)	(5.5527)	(6.1170)	(6.0561)		(0.0000)
R&D firms with RD/Sales> median							
D1 (low)	0.003	1.071	0.302	0.224	0.409	0.682	83.921
	(1.1664)	(11.3238)	(2.1980)	(1.5553)	(4.0090)		(0.0000)
D2	-0.003	0.974	0.121	0.414	0.446	0.631	67.231
	(-1.0211)	(11.4792)	(0.8564)	(3.1681)	(4.1316)		(0.0000)
D3	-0.003	1.228	0.460	0.419	0.408	0.604	60.076
	(-0.7612)	(9.5988)	(3.2739)	(2.2188)	(3.2693)		(0.0000)
D4	0.003	1.183	0.377	0.580	0.667	0.607	60.883
	(0.8278)	(10.7491)	(2.3805)	(2.8184)	(4.8263)		(0.0000)
D5 (High)	-0.005	1.192	0.634	0.667	0.853	0.713	97.081
	(-1.5751)	(11.4935)	(4.8175)	(3.4041)	(7.6609)		(0.0000)

Appendix 5B.C Part B: Part B of the Appendix 5B.C presents the results as in Table 5B.6 Panel B and Appendix 5B.C Part A Panels A, B and C but this time by using an RD factor calculated from value instead of equal weighted returns.

Appendix 5B.C Part B – Table equivalent to table 5B.C Panel B: Time-series regressions run with an RD factor calculated as (High RD-Zero RD)

Sample	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
D1 (low)	-0.001	0.545	0.485	0.170	-0.513	0.777	135.665
	(-0.3446)	(6.2389)	(7.6273)	(2.9217)	(-5.9729)		(0.0000)
D2	-0.002	0.391	0.294	0.275	-0.668	0.781	139.575
	(-1.1101)	(3.8248)	(4.3581)	(4.2121)	(-6.1444)		(0.0000)
D3	-0.004	0.497	0.479	0.419	-0.742	0.808	163.596
	(-2.3391)	(4.9333)	(6.8362)	(6.9956)	(-6.7014)		(0.0000)
D4	-0.004	0.509	0.567	0.452	-0.722	0.808	163.559
	(-1.8975)	(5.2236)	(8.8550)	(7.1137)	(-7.5450)		(0.0000)
D5 (High)	-0.004	0.695	0.961	0.504	-0.780	0.826	185.202
	(-2.2018)	(6.6324)	(12.3354)	(7.2445)	(-7.2729)		(0.0000)
R&D firms							
D1 (low)	0.001	0.744	0.402	-0.014	-0.357	0.746	115.064
	(0.4871)	(6.8476)	(4.9587)	(-0.2134)	(-3.6607)		(0.0000)
D2	-0.001	0.559	0.138	0.206	-0.495	0.704	93.051
	(-0.5541)	(4.1318)	(1.5363)	(2.9645)	(-3.1447)		(0.0000)
D3	-0.002	0.585	0.433	0.308	-0.657	0.707	94.382
	(-0.9737)	(4.2105)	(4.7298)	(4.1932)	(-4.3909)		(0.0000)
D4	-0.001	0.595	0.453	0.292	-0.632	0.724	102.773
	(-0.4438)	(4.5848)	(4.9243)	(3.8106)	(-5.1108)		(0.0000)
D5 (High)	-0.004	0.733	0.857	0.213	-0.727	0.748	116.186
	(-1.3608)	(5.1559)	(8.0413)	(2.1476)	(-4.9880)		(0.0000)
Zero RD firms							
D1 (low)	-0.002	0.435	0.561	0.280	-0.601	0.732	106.919
	(-0.9181)	(4.3307)	(8.1170)	(4.3512)	(-6.1004)		(0.0000)
D2	-0.003	0.277	0.422	0.326	-0.781	0.751	117.816
	(-1.4107)	(2.5856)	(6.2490)	(4.5025)	(-7.8446)		(0.0000)
D3	-0.006	0.422	0.527	0.493	-0.817	0.798	154.556
	(-3.1447)	(4.0965)	(7.0790)	(7.5126)	(-7.5777)		(0.0000)
D4	-0.005	0.450	0.636	0.549	-0.786	0.794	150.423
	(-2.7228)	(4.3550)	(9.7172)	(8.4339)	(-7.4490)		(0.0000)
D5 (High)	-0.004	0.652	0.959	0.627	-0.803	0.793	149.252
	(-2.1097)	(5.4707)	(10.3436)	(8.8297)	(-6.9801)		(0.0000)
R&D firms with RD/Sales> median							
D1 (low)	0.005	0.786	0.502	-0.235	-0.439	0.658	75.680
	(1.8501)	(4.7384)	(3.4638)	(-2.5334)	(-3.3947)		(0.0000)
D2	-0.001	0.577	0.325	-0.082	-0.573	0.613	62.319
	(-0.3823)	(2.7688)	(2.5209)	(-0.9056)	(-2.8876)		(0.0000)
D3	-0.002	0.683	0.617	-0.025	-0.720	0.616	63.155
	(-0.4426)	(2.9196)	(4.7452)	(-0.1891)	(-3.2376)		(0.0000)
D4	0.006	0.380	0.649	-0.150	-1.082	0.617	63.553
	(1.3620)	(1.7329)	(4.6030)	(-0.2382)	(-6.7007)		(0.0000)
D5 (High)	-0.001	0.636	1.058	-0.292	-0.875	0.650	73.050
	(-0.2821)	(2.8673)	(7.6515)	(-1.7416)	(-3.6382)		(0.0000)

Appendix 5B.C Part B – Table equivalent to table in Appendix 5B.B Part A Panel A: Time-series regressions run with an RD factor as in Al Horani et al (2003)

Sample	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
D1 (low)	0.001	0.923	0.469	0.233	-0.715	0.781	139.478
	(0.6104)	(20.1183)	(7.2540)	(4.3090)	(-6.1585)		(0.0000)
D2	0.000	0.886	0.276	0.353	-0.907	0.784	141.718
	(0.1255)	(21.4891)	(3.9740)	(5.7186)	(-6.2478)		(0.0000)
D3	-0.002	1.046	0.457	0.509	-1.025	0.813	169.820
	(-1.1110)	(22.7436)	(6.5851)	(9.1880)	(-7.2627)		(0.0000)
D4	-0.001	1.051	0.554	0.531	-0.936	0.802	157.591
	(-0.7303)	(16.6431)	(8.0916)	(9.0562)	(-6.7598)		(0.0000)
D5 (High)	-0.002	1.267	0.933	0.603	-1.114	0.836	198.825
	(-1.0127)	(21.5103)	(11.9293)	(9.4296)	(-8.1005)		(0.0000)
R&D firms							
D1 (low)	0.002	1.006	0.389	0.031	-0.510	0.750	117.109
	(1.0307)	(15.6815)	(4.6808)	(0.5071)	(-3.8324)		(0.0000)
D2	0.000	0.930	0.128	0.261	-0.648	0.701	92.053
	(0.1576)	(20.6168)	(1.4186)	(4.0768)	(-3.2052)		(0.0000)
D3	0.000	1.078	0.421	0.380	-0.849	0.702	92.384
	(-0.1648)	(15.1274)	(4.5168)	(5.3943)	(-4.2646)		(0.0000)
D4	0.001	1.081	0.452	0.351	-0.733	0.708	95.170
	(0.3278)	(13.0658)	(4.5577)	(5.0434)	(-3.9950)		(0.0000)
D5 (High)	-0.001	1.275	0.839	0.297	-0.976	0.748	116.286
	(-0.5045)	(15.7178)	(7.4398)	(2.9663)	(-4.9817)		(0.0000)
Zero RD firms							
D1 (low)	0.000	0.878	0.541	0.354	-0.840	0.739	110.649
	(0.0515)	(17.6641)	(7.7893)	(5.9754)	(-6.3223)		(0.0000)
D2	0.000	0.852	0.397	0.422	-1.091	0.762	125.055
	(-0.0813)	(17.1729)	(5.6504)	(5.9239)	(-8.2552)		(0.0000)
D3	-0.003	1.021	0.498	0.597	-1.167	0.813	170.022
	(-1.7932)	(22.6740)	(6.9214)	(9.7011)	(-8.6595)		(0.0000)
D4	-0.003	1.032	0.614	0.642	-1.077	0.799	154.738
	(-1.4678)	(17.6761)	(9.4710)	(10.2988)	(-7.6344)		(0.0000)
D5 (High)	-0.002	1.236	0.927	0.732	-1.176	0.808	163.897
	(-0.9794)	(19.2902)	(10.4270)	(11.5057)	(-8.2728)		(0.0000)
R&D firms with RD/Sales> median							
D1 (low)	0.007	1.107	0.486	-0.179	-0.629	0.662	76.782
	(2.2935)	(9.9199)	(3.2106)	(-2.0399)	(-3.5408)		(0.0000)
D2	0.001	0.996	0.304	-0.010	-0.818	0.619	63.879
	(0.2244)	(12.1669)	(2.3619)	(-0.1148)	(-3.6439)		(0.0000)
D3	0.000	1.232	0.612	0.046	-0.867	0.607	60.785
	(0.1310)	(8.9207)	(4.4648)	(0.3435)	(-2.8892)		(0.0000)
D4	0.009	1.216	0.652	-0.053	-1.220	0.592	57.118
	(2.0763)	(8.4371)	(4.1704)	(-0.4753)	(-5.1049)		(0.0000)
D5 (High)	0.002	1.277	1.026	-0.182	-1.251	0.657	75.325
	(0.4315)	(11.8290)	(7.1228)	(-1.0870)	(-4.1155)		(0.0000)

Appendix 5B.C Part B – Table equivalent to table in Appendix 5B.B Part A Panel B: Time-series regressions run with an RD factor calculated as (High RD+Mid RD)/2-(Low RD+Zero RD)/2

Sample	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
D1 (low)	0.000	0.952	0.566	0.102	-0.208	0.726	103.820
	(0.1902)	(12.1183)	(9.0296)	(1.6690)	(-1.7331)		(0.0000)
D2	-0.001	0.938	0.399	0.196	-0.220	0.692	87.961
	(-0.2740)	(11.7007)	(5.7770)	(2.5591)	(-1.5551)		(0.0000)
D3	-0.003	1.085	0.597	0.319	-0.309	0.727	104.375
	(-1.3810)	(13.3535)	(8.3098)	(4.3230)	(-2.2929)		(0.0000)
D4	-0.002	1.089	0.681	0.360	-0.275	0.728	104.868
	(-1.0564)	(12.1405)	(10.3608)	(5.3395)	(-1.8598)		(0.0000)
D5 (High)	-0.003	1.329	1.084	0.409	-0.274	0.760	123.859
	(-1.2440)	(14.5809)	(13.0755)	(5.2315)	(-1.9627)		(0.0000)
R&D firms							
D1 (low)	0.002	1.020	0.459	-0.066	-0.169	0.727	104.243
	(0.7651)	(13.4705)	(5.6758)	(-0.9611)	(-1.4131)		(0.0000)
D2	0.000	1.003	0.213	0.171	-0.045	0.655	74.611
	(-0.0013)	(12.1757)	(2.4243)	(2.0665)	(-0.3295)		(0.0000)
D3	-0.001	1.134	0.535	0.238	-0.182	0.646	71.810
	(-0.4057)	(11.2099)	(5.9651)	(2.7608)	(-1.1688)		(0.0000)
D4	0.000	1.123	0.551	0.224	-0.178	0.666	78.121
	(0.0842)	(11.0214)	(6.2034)	(2.6064)	(-1.1040)		(0.0000)
D5 (High)	-0.002	1.322	0.972	0.124	-0.262	0.697	90.178
	(-0.7751)	(12.3769)	(9.2643)	(1.2232)	(-1.5955)		(0.0000)
Zero RD firms							
D1 (low)	-0.001	0.911	0.656	0.200	-0.248	0.665	77.799
	(-0.3236)	(10.0845)	(9.6752)	(3.0412)	(-1.8751)		(0.0000)
D2	-0.001	0.893	0.546	0.220	-0.329	0.643	70.678
	(-0.5346)	(10.2199)	(7.6833)	(2.6775)	(-2.0909)		(0.0000)
D3	-0.004	1.045	0.659	0.369	-0.412	0.711	96.549
	(-1.9734)	(12.9094)	(8.4242)	(4.6054)	(-3.0064)		(0.0000)
D4	-0.004	1.070	0.761	0.442	-0.332	0.707	94.495
	(-1.7282)	(11.9327)	(10.5646)	(6.5196)	(-2.2109)		(0.0000)
D5 (High)	-0.003	1.301	1.086	0.527	-0.293	0.725	102.911
	(-1.2056)	(13.6374)	(11.0719)	(6.2498)	(-2.0280)		(0.0000)
R&D firms with RD/Sales> median							
D1 (low)	0.006	1.151	0.571	-0.283	-0.129	0.637	69.078
	(2.0669)	(10.2310)	(3.9702)	(-2.7156)	(-0.8329)		(0.0000)
D2	0.000	1.121	0.410	-0.104	0.039	0.569	69.517
	(0.1284)	(10.2851)	(3.3644)	(-0.9290)	(0.2309)		(0.0000)
D3	0.000	1.261	0.731	-0.116	-0.274	0.574	53.201
	(-0.0846)	(7.4162)	(5.7428)	(-0.8022)	(-1.1862)		(0.0000)
D4	0.008	1.363	0.813	-0.217	-0.062	0.529	44.496
	(1.8334)	(7.5698)	(5.6902)	(-1.5092)	(-0.2317)		(0.0000)
D5 (High)	0.000	1.312	1.198	-0.420	-0.415	0.608	61.209
	(0.1066)	(8.9628)	(8.7633)	(-2.5175)	(-1.7545)		(0.0000)

Appendix 5B.C Part B – Table equivalent to table in Appendix 5B.B Part A Panel C: Time-series regressions run with an RD factor calculated as (High RD-Low RD)

	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
R&D firms							
D1 (low)	0.002	1.113	0.449	-0.014	0.058	0.723	102.273
	(0.9838)	(12.5752)	(5.3937)	(-0.1992)	(0.5293)		(0.0000)
D2	0.000	1.076	0.202	0.207	0.088	0.657	75.062
	(0.1701)	(9.2808)	(2.2875)	(2.4298)	(0.6771)		(0.0000)
D3	-0.001	1.225	0.526	0.289	0.047	0.642	70.637
	(-0.2196)	(9.4845)	(5.6436)	(3.1667)	(0.3065)		(0.0000)
D4	0.000	1.170	0.550	0.255	-0.017	0.661	76.693
	(0.1742)	(9.4337)	(5.8870)	(2.8040)	(-0.1102)		(0.0000)
D5 (High)	-0.002	1.423	0.964	0.183	0.023	0.691	87.602
	(-0.5697)	(11.7517)	(9.1026)	(1.6927)	(0.1821)		(0.0000)
R&D firms with RD/Sales> median							
D1 (low)	0.007	1.279	0.553	-0.217	0.132	0.638	69.259
	(2.2599)	(11.2857)	(3.6245)	(-2.0991)	(0.8034)		(0.0000)
D2	0.001	1.248	0.386	-0.046	0.213	0.575	53.500
	(0.3458)	(9.6817)	(3.1936)	(-0.4332)	(1.4535)		(0.0000)
D3	0.000	1.372	0.722	-0.052	0.032	0.568	51.992
	(0.0701)	(6.4783)	(5.2851)	(-0.3540)	(0.1381)		(0.0000)
D4	0.009	1.491	0.792	-0.154	0.165	0.531	44.856
	(1.9122)	(7.2467)	(5.2748)	(-1.0476)	(0.7097)		(0.0000)
D5 (High)	0.001	1.472	1.185	-0.326	0.037	0.599	58.824
	(0.3135)	(8.9933)	(8.6209)	(-1.8302)	(0.2194)		(0.0000)

Appendix 5B.C Part C: Part C of the Appendix 5B.C presents the time-series regression results as in Table 5B.6 Panel B run with an RD factor calculated as (High RD- Zero RD) with equal weighted returns, and using R&D/TA as a proxy for R&D intensity (Pearson correlation coefficient between RD factor and Rm-Rf: 0.245, SMB: 0.324 and HML: -0.791).

Sample	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
D1 (low)	-0.0001	1.0053	0.5423	0.2316	0.0936	0.7212	101.2590
	(-0.0289)	(17.0380)	(8.5145)	(2.1278)	(1.0921)		(0.0000)
D2	-0.0009	0.9952	0.3755	0.3269	0.0924	0.6857	85.5266
	(-0.4349)	(16.5251)	(5.1303)	(2.9917)	(1.0436)		(0.0000)
D3	-0.0033	1.1685	0.5689	0.4795	0.1051	0.7166	99.0045
	(-1.4496)	(18.7509)	(7.2708)	(4.4376)	(1.2238)		(0.0000)
D4	-0.0028	1.1573	0.6483	0.5374	0.1309	0.7219	101.6110
	(-1.2657)	(16.5314)	(9.5192)	(4.6379)	(1.4544)		(0.0000)
D5 (High)	-0.0042	1.3815	1.0309	0.6767	0.2273	0.7624	125.3550
	(-1.7295)	(17.8112)	(12.0620)	(5.5634)	(2.3061)		(0.0000)
R&D firms							
D1 (low)	0.0001	1.0397	0.4108	0.1683	0.2141	0.7361	109.0957
	(0.0533)	(16.0340)	(5.2045)	(1.4985)	(2.3718)		(0.0000)
D2	-0.0012	0.9926	0.1804	0.3240	0.1534	0.6622	76.9635
	(-0.5071)	(16.0977)	(1.9756)	(2.7554)	(1.6151)		(0.0000)
D3	-0.0026	1.1559	0.4835	0.4889	0.2291	0.6545	74.4160
	(-0.9962)	(15.3998)	(5.2615)	(3.6696)	(2.1960)		(0.0000)
D4	-0.0013	1.1433	0.5002	0.4724	0.2270	0.6741	81.1661
	(-0.4815)	(15.0335)	(5.6749)	(3.3542)	(2.0934)		(0.0000)
D5 (High)	-0.0055	1.3290	0.8671	0.6209	0.4752	0.7295	105.4936
	(-2.0950)	(15.0647)	(8.6192)	(4.7145)	(4.4644)		(0.0000)
Zero R&D firms							
D1 (low)	-0.0004	0.9903	0.6479	0.2636	0.0150	0.6534	74.0462
	(-0.1662)	(15.2799)	(9.2336)	(2.1751)	(0.1608)		(0.0000)
D2	-0.0008	0.9957	0.5320	0.3188	0.0346	0.6239	65.2942
	(-0.3644)	(14.6192)	(6.9389)	(2.6554)	(0.3607)		(0.0000)
D3	-0.0039	1.1779	0.6473	0.4646	0.0140	0.6877	86.3312
	(-1.5915)	(18.1103)	(7.5513)	(3.9472)	(0.1500)		(0.0000)
D4	-0.0036	1.1681	0.7405	0.5691	0.0648	0.6926	88.3125
	(-1.6000)	(15.3898)	(9.7345)	(4.9452)	(0.7482)		(0.0000)
D5 (High)	-0.0031	1.3849	1.0647	0.6544	0.0735	0.7169	99.1093
	(-1.1273)	(16.9506)	(10.5101)	(4.7285)	(0.6674)		(0.0000)
R&D firms with RD/Sales> median							
D1 (low)	0.0029	1.1226	0.4795	0.1397	0.4244	0.6692	79.3904
	(0.9651)	(11.4297)	(3.5785)	(0.9504)	(3.3602)		(0.0000)
D2	-0.0026	1.0471	0.3342	0.2322	0.3674	0.5972	58.4526
	(-0.8209)	(11.8010)	(2.7761)	(1.4587)	(2.5771)		(0.0000)
D3	-0.0033	1.2797	0.6362	0.3367	0.4254	0.5945	57.8030
	(-0.9132)	(9.8399)	(5.3138)	(1.6378)	(2.4938)		(0.0000)
D4	0.0040	1.2965	0.7022	0.2823	0.5206	0.5611	50.5308
	(0.8812)	(10.0681)	(5.2715)	(1.1115)	(2.4116)		(0.0000)
D5 (High)	-0.0057	1.3069	1.0119	0.4556	0.8469	0.6748	81.4227
	(-1.6287)	(11.1782)	(8.0195)	(2.3257)	(5.8025)		(0.0000)

Appendix 5B.C Part D: Part D of the Appendix 5B.C presents the regression results as in Table 5B.6 and Appendix 5B.C Part A Panel A for the whole sample, and R&D and zero R&D firm portfolios separately, when using dispersion data for portfolio formation as of June t but only for these firms whose accounting years end between July t - December t, with June t to be the closest month for which I have forecast data for dispersion calculation prior to the firms month of return calculation.

Panel A: No RD factor

Sample	alpha	RM	SMB	HML	Adjusted R-squared	F-statistic
D1 (low)	0.0065	0.8769	0.3766	-0.0734	0.6684	105.1527
	(3.1848)	(15.4389)	(4.8456)	(-1.3145)		(0.0000)
D2	0.0034	0.9659	0.3473	-0.0670	0.6678	104.8691
	(1.5215)	(14.4405)	(4.6254)	(-1.1321)		(0.0000)
D3	-0.0004	1.0645	0.3184	0.0555	0.7097	127.3112
	(-0.1550)	(16.5944)	(4.1951)	(0.9053)		(0.0000)
D4	-0.0014	1.1337	0.6177	0.1409	0.6416	93.4906
	(-0.4758)	(13.1955)	(5.9249)	(1.4140)		(0.0000)
D5 (High)	-0.0023	1.4303	0.9511	0.0551	0.6605	101.4980
	(-0.6085)	(14.0457)	(6.9207)	(0.5053)		(0.0000)
R&D firms						
D1 (low)	0.0049	0.9494	0.3220	-0.1524	0.6418	93.5729
	(2.1493)	(14.0735)	(3.4993)	(-2.1713)		(0.0000)
D2	-0.0005	1.0586	0.1783	-0.0519	0.6612	101.8402
	(-0.1984)	(15.7734)	(1.9573)	(-0.7610)		(0.0000)
D3	0.0025	1.0185	0.2238	0.0170	0.6565	99.7578
	(1.0406)	(16.1472)	(2.6112)	(0.3041)		(0.0000)
D4	-0.0003	1.1784	0.6469	0.1691	0.5991	78.2205
	(-0.0957)	(10.8745)	(5.2325)	(1.7482)		(0.0000)
D5 (High)	0.0032	1.3771	0.9073	-0.0941	0.5416	62.0544
	(0.6869)	(11.2635)	(6.2028)	(-0.7150)		(0.0000)
Zero R&D firms						
D1 (low)	0.0073	0.8327	0.4148	-0.0385	0.5904	75.4824
	(3.0461)	(13.4085)	(4.9144)	(-0.6079)		(0.0000)
D2	0.0058	0.9045	0.4547	-0.0691	0.5722	70.1115
	(2.2607)	(11.5056)	(5.0658)	(-0.9639)		(0.0000)
D3	-0.0023	1.0964	0.3916	0.0915	0.6392	92.5277
	(-0.8120)	(14.2654)	(4.6607)	(1.1906)		(0.0000)
D4	-0.0020	1.1053	0.5724	0.1152	0.5590	66.4866
	(-0.5619)	(11.7324)	(4.2859)	(0.9603)		(0.0000)
D5 (High)	-0.0052	1.4398	0.9693	0.1221	0.6536	98.5007
	(-1.4169)	(13.8266)	(6.0851)	(1.1813)		(0.0000)

Panel B: Time-series regressions run with an RD factor as (High R&D-Zero R&D) calculated with equal-weighted returns

	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
Sample							
D1 (low)	0.0071	0.8968	0.4273	-0.1530	-0.1443	0.6759	81.8134
	(3.4343)	(15.3656)	(5.6601)	(-2.2832)	(-1.9659)		(0.0000)
D2	0.0038	0.9778	0.3777	-0.1148	-0.0866	0.6685	79.1553
	(1.7129)	(13.5351)	(4.9441)	(-1.6683)	(-1.1080)		(0.0000)
D3	0.0008	1.0981	0.4042	-0.0789	-0.2439	0.7284	104.9278
	(0.3673)	(16.5823)	(5.6917)	(-1.1669)	(-3.6081)		(0.0000)
D4	-0.0011	1.1432	0.6419	0.1029	-0.0689	0.6405	70.0363
	(-0.3708)	(12.3775)	(6.0962)	(0.8218)	(-0.6451)		(0.0000)
D5 (High)	-0.0022	1.4311	0.9532	0.0518	-0.0060	0.6582	75.6247
	(-0.6299)	(12.9101)	(7.5885)	(0.3739)	(-0.0364)		(0.0000)
R&D firms							
D1 (low)	0.0048	0.9473	0.3167	-0.1441	0.0151	0.6395	69.7434
	(2.0997)	(13.6674)	(3.4429)	(-1.6449)	(0.1581)		(0.0000)
D2	-0.0005	1.0605	0.1832	-0.0596	-0.0139	0.6590	75.8985
	(-0.1733)	(14.9463)	(1.9423)	(-0.7066)	(-0.1740)		(0.0000)
D3	0.0027	1.0265	0.2441	-0.0149	-0.0579	0.6554	74.7080
	(1.1399)	(15.6237)	(2.8191)	(-0.2091)	(-0.7108)		(0.0000)
D4	-0.0015	1.1439	0.5590	0.3069	0.2500	0.6109	61.8442
	(-0.4760)	(9.9375)	(4.4240)	(2.3690)	(1.8439)		(0.0000)
D5 (High)	0.0018	1.3347	0.7990	0.0756	0.3078	0.5521	48.7742
	(0.4092)	(10.1179)	(5.5753)	(0.4864)	(1.5616)		(0.0000)
Zero R&D firms							
D1 (low)	0.0084	0.8653	0.4980	-0.1689	-0.2364	0.6131	62.4142
	(3.4473)	(13.8233)	(6.1424)	(-2.2616)	(-3.1909)		(0.0000)
D2	0.0064	0.9223	0.5001	-0.1403	-0.1291	0.5755	53.5434
	(2.4819)	(10.8739)	(5.5346)	(-1.6244)	(-1.1963)		(0.0000)
D3	-0.0005	1.1473	0.5215	-0.1122	-0.3694	0.6770	82.2150
	(-0.1919)	(14.3974)	(6.5721)	(-1.3216)	(-4.5756)		(0.0000)
D4	-0.0007	1.1434	0.6695	-0.0371	-0.2762	0.5750	53.4300
	(-0.1901)	(11.6306)	(5.7869)	(-0.2400)	(-1.9630)		(0.0000)
D5 (High)	-0.0043	1.4652	1.0341	0.0205	-0.1844	0.6568	75.1723
	(-1.2080)	(13.4229)	(7.3724)	(0.1457)	(-1.1819)		(0.0000)

Panel C: Time-series regressions run with an RD factor in Al Horani et al (2003) calculated with equal-weighted returns

Sample	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
D1 (low)	0.0066	0.8858	0.3803	-0.0797	-0.1155	0.6685	79.1552
	(3.2189)	(15.7472)	(5.1195)	(-1.4015)	(-0.9591)		(0.0000)
D2	0.0036	0.9820	0.3541	-0.0782	-0.2083	0.6719	80.3571
	(1.6344)	(14.4786)	(4.8988)	(-1.3290)	(-1.8775)		(0.0000)
D3	-0.0001	1.0801	0.3250	0.0447	-0.2019	0.7130	97.2907
	(-0.0447)	(16.7526)	(4.5452)	(0.7446)	(-1.9396)		(0.0000)
D4	-0.0014	1.1393	0.6200	0.1370	-0.0723	0.6397	69.8122
	(-0.4450)	(12.9717)	(6.0107)	(1.3451)	(-0.5025)		(0.0000)
D5 (High)	-0.0019	1.4516	0.9601	0.0403	-0.2753	0.6629	77.1921
	(-0.5221)	(14.1408)	(7.3809)	(0.3652)	(-1.2237)		(0.0000)
R&D firms							
D1 (low)	0.0048	0.9463	0.3207	-0.1503	0.0398	0.6396	69.7838
	(2.0961)	(13.8182)	(3.4614)	(-2.0996)	(0.3034)		(0.0000)
D2	-0.0007	1.0462	0.1731	-0.0433	0.1599	0.6621	76.9122
	(-0.2688)	(15.5850)	(1.9151)	(-0.6225)	(1.3370)		(0.0000)
D3	0.0023	1.0078	0.2192	0.0245	0.1388	0.6568	75.1469
	(0.9596)	(15.4750)	(2.4642)	(0.4223)	(0.8832)		(0.0000)
D4	-0.0011	1.1321	0.6273	0.2012	0.5991	0.6274	66.2474
	(-0.3288)	(10.7886)	(5.3923)	(2.1619)	(3.7951)		(0.0000)
D5 (High)	0.0027	1.3418	0.8923	-0.0695	0.4574	0.5498	48.3134
	(0.5843)	(11.0592)	(5.8595)	(-0.5259)	(1.5126)		(0.0000)
Zero R&D firms							
D1 (low)	0.0076	0.8502	0.4222	-0.0507	-0.2263	0.5964	58.2599
	(3.1498)	(13.7870)	(5.3675)	(-0.7950)	(-1.6947)		(0.0000)
D2	0.0064	0.9392	0.4694	-0.0933	-0.4500	0.5973	58.4679
	(2.5209)	(12.0450)	(5.8382)	(-1.3464)	(-3.1774)		(0.0000)
D3	-0.0017	1.1305	0.4061	0.0677	-0.4420	0.6582	75.6314
	(-0.6360)	(14.8425)	(5.2574)	(0.9112)	(-3.6666)		(0.0000)
D4	-0.0014	1.1434	0.5885	0.0888	-0.4928	0.5785	54.1922
	(-0.3898)	(12.4413)	(4.8792)	(0.7295)	(-2.4174)		(0.0000)
D5 (High)	-0.0043	1.4897	0.9904	0.0875	-0.6456	0.6765	82.0273
	(-1.2367)	(14.5709)	(6.9225)	(0.8405)	(-2.9440)		(0.0000)

Appendix 5B.C Part E: Part E of the Appendix 5B.C presents the regression results as in Table 5B.6 Panels A and B with and without including an RD (RD factor as High R&D-Zero R&D in Panel B and as in Al-Horani et al (2003) in Panel C) with equal weighted returns with the regressions run by excluding the months from January 1999 until December 2001 (total sample period July 1991-June 2004).

Panel A: No RD factor

Sample	alpha	RM	SMB	HML	Adjusted R-squared	F-statistic
D1 (low)	-0.0010	1.0313	0.5869	0.0993	0.7623	128.1861
	(-0.5209)	(18.3095)	(8.4398)	(1.1238)		(0.0000)
D2	-0.0019	1.0248	0.4346	0.1534	0.7916	151.6294
	(-1.0963)	(21.9107)	(6.5238)	(1.6095)		(0.0000)
D3	-0.0037	1.1746	0.6351	0.3251	0.7819	143.2372
	(-1.7059)	(22.8419)	(9.2942)	(3.2695)		(0.0000)
D4	-0.0046	1.1766	0.6698	0.5273	0.8046	164.3229
	(-2.2696)	(17.8529)	(9.7323)	(5.2947)		(0.0000)
D5 (High)	-0.0054	1.4141	1.0760	0.5409	0.8130	173.4291
	(-2.2939)	(19.4420)	(12.6547)	(4.9208)		(0.0000)
R&D firms						
D1 (low)	0.0010	1.1329	0.5091	-0.1616	0.7619	127.9097
	(0.4729)	(17.1991)	(5.7547)	-(1.5628)		(0.0000)
D2	-0.0010	1.0326	0.2496	0.1821	0.7568	124.4098
	(-0.5141)	(22.2246)	(2.9196)	(1.8760)		(0.0000)
D3	-0.0021	1.2070	0.5243	0.2680	0.6976	92.5100
	(-0.7711)	(15.9420)	(5.6896)	(2.0864)		(0.0000)
D4	-0.0017	1.1691	0.6085	0.3765	0.7251	105.6461
	(-0.6728)	(13.9217)	(6.2926)	(3.2473)		(0.0000)
D5 (High)	-0.0059	1.4004	0.9677	0.1672	0.7386	113.0800
	(-2.0789)	(16.0692)	(8.2814)	(1.2444)		(0.0000)
Zero R&D firms						
D1 (low)	-0.0025	0.9774	0.6694	0.2317	0.7010	94.0020
	(-1.1459)	(15.3647)	(8.8136)	(2.2529)		(0.0000)
D2	-0.0027	1.0129	0.5840	0.1406	0.7336	110.2328
	(-1.3301)	(17.5991)	(8.0922)	(1.1971)		(0.0000)
D3	-0.0050	1.1517	0.7341	0.3574	0.7652	130.2913
	(-2.1667)	(21.1067)	(9.6427)	(3.2537)		(0.0000)
D4	-0.0062	1.1794	0.6963	0.6253	0.7971	156.7937
	(-3.0211)	(18.5045)	(10.0200)	(5.6574)		(0.0000)
D5 (High)	-0.0047	1.3935	1.0749	0.6801	0.7872	147.7026
	(-0.8471)	(17.5246)	(10.9052)	(5.5735)		(0.0000)
R&D firms with RD/.Sales> median						
D1 (low)	0.0076	1.2708	0.6711	-0.5097	0.6427	72.3408
	(2.2720)	(11.0630)	(3.9696)	(-3.3611)		(0.0000)
D2	-0.0013	1.1096	0.4669	-0.0354	0.6048	61.7135
	(-0.4430)	(12.7336)	(3.5776)	(-0.2465)		(0.0000)
D3	-0.0002	1.3123	0.7325	-0.0712	0.5826	56.3547
	(-0.0524)	(8.7346)	(5.1115)	(-0.4066)		(0.0000)
D4	0.0016	1.3672	0.9157	-0.0285	0.5230	44.4849
	(0.3348)	(8.6048)	(5.5848)	(-0.1184)		(0.0000)
D5 (High)	-0.0071	1.4799	1.1048	-0.2684	0.6356	70.2017
	(-1.9354)	(13.1484)	(7.7852)	(-1.3661)		(0.0000)

Panel B: Time-series regressions run with an RD factor as (High R&D-Zero R&D) calculated with equal-weighted returns

Sample	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
D1 (low)	-0.0013	1.0154	0.5754	0.1483	0.0616	0.7617	96.0961
	(-0.6559)	(17.3288)	(8.2936)	(1.3328)	(0.6942)		(0.0000)
D2	-0.0020	1.0167	0.4288	0.1785	0.0315	0.7902	113.0218
	(-1.1441)	(22.2492)	(6.4473)	(1.7664)	(0.3728)		(0.0000)
D3	-0.0039	1.1639	0.6274	0.3582	0.0416	0.7806	106.8327
	(-1.7904)	(20.3718)	(9.0205)	(3.0385)	(0.4948)		(0.0000)
D4	-0.0050	1.1496	0.6503	0.6108	0.1049	0.8063	124.8152
	(-2.5169)	(17.1310)	(9.2193)	(5.0348)	(1.1186)		(0.0000)
D5 (High)	-0.0063	1.3592	1.0363	0.7105	0.2131	0.8209	137.3608
	(-2.6883)	(17.2336)	(12.7030)	(5.2840)	(2.1562)		(0.0000)
R&D firms							
D1 (low)	0.0003	1.0849	0.4744	-0.0134	0.1862	0.7712	101.2686
	(0.1267)	(16.1932)	(5.5934)	(-0.1099)	(1.9205)		(0.0000)
D2	-0.0015	1.0059	0.2303	0.2647	0.1038	0.7588	94.5779
	(-0.7092)	(21.7038)	(2.7685)	(2.2953)	(1.3297)		(0.0000)
D3	-0.0026	1.1715	0.4987	0.3776	0.1378	0.7000	70.4204
	(-1.0023)	(15.1733)	(5.3560)	(2.4689)	(1.2178)		(0.0000)
D4	-0.0028	1.1030	0.5607	0.5809	0.2568	0.7418	86.4838
	(-1.1115)	(14.7714)	(6.1028)	(4.2468)	(2.3667)		(0.0000)
D5 (High)	-0.0077	1.2891	0.8873	0.5111	0.4320	0.7746	103.2399
	(-2.8883)	(14.7439)	(8.5616)	(3.3047)	(4.2751)		(0.0000)
Zero R&D firms							
D1 (low)	-0.0025	0.9816	0.6724	0.2189	-0.0161	0.6985	69.9273
	(-1.1340)	(15.0412)	(8.7960)	(1.6767)	(-0.1648)		(0.0000)
D2	-0.0026	1.0224	0.5909	0.1111	-0.0370	0.7318	82.1863
	(-1.2437)	(18.0035)	(7.8814)	(0.9342)	(-0.3651)		(0.0000)
D3	-0.0049	1.1592	0.7396	0.3342	-0.0292	0.7635	97.0166
	(-2.1095)	(18.9140)	(9.6716)	(2.5736)	(-0.3391)		(0.0000)
D4	-0.0063	1.1777	0.6951	0.6304	0.0065	0.7953	116.5905
	(-3.0873)	(16.6627)	(9.5295)	(4.8211)	(0.0711)		(0.0000)
D5 (High)	-0.0050	1.3746	1.0612	0.7387	0.0736	0.7864	110.5415
	(-1.9531)	(16.4003)	(10.9216)	(5.0984)	(0.6452)		(0.0000)
R&D firms with RD/Sales> median							
D1 (low)	0.0056	1.1485	0.5827	-0.1316	0.4749	0.6875	66.4618
	(1.7591)	(10.9350)	(3.9211)	(-0.7495)	(3.1029)		(0.0000)
D2	-0.0025	1.0351	0.4131	0.1947	0.2890	0.6244	50.4640
	(-0.8073)	(11.7416)	(3.3874)	(1.1494)	(2.3105)		(0.0000)
D3	-0.0015	1.2293	0.6725	0.1853	0.3223	0.5986	45.3700
	(-0.4179)	(8.7917)	(5.2960)	(0.8695)	(1.8286)		(0.0000)
D4	-0.0007	1.2252	0.8130	0.4106	0.5516	0.5661	39.8159
	(-0.1608)	(8.6759)	(5.7041)	(1.4202)	(2.5671)		(0.0000)
D5 (High)	-0.0101	1.2908	0.9681	0.3161	0.7342	0.7164	76.1397
	(-3.0602)	(11.6232)	(8.3549)	(1.5518)	(5.6592)		(0.0000)

Panel C: Time-series regressions run with an RD factor as in Al-Horani et al (2003) calculated with equal-weighted returns

	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
Sample							
D1 (low)	-0.0011	1.0262	0.5940	0.1074	0.0591	0.7606	95.5065
	(-0.5702)	(17.5657)	(8.2564)	(1.1329)	(0.3711)		(0.0000)
D2	-0.0019	1.0259	0.4330	0.1516	-0.0132	0.7898	112.7549
	(-1.0657)	(22.4928)	(6.1046)	(1.5697)	(-0.0894)		(0.0000)
D3	-0.0037	1.1748	0.6348	0.3248	-0.0023	0.7800	106.5021
	(-1.7114)	(21.6593)	(8.9553)	(3.2014)	(-0.0149)		(0.0000)
D4	-0.0048	1.1657	0.6850	0.5447	0.1267	0.8042	123.2144
	(-2.3499)	(18.1273)	(9.4266)	(5.1843)	(0.7326)		(0.0000)
D5 (High)	-0.0054	1.4125	1.0782	0.5434	0.0186	0.8114	128.9670
	(-2.3031)	(18.3775)	(11.9703)	(4.7056)	(0.0992)		(0.0000)
R&D firms							
D1 (low)	0.0003	1.0953	0.5619	-0.1013	0.4390	0.7770	104.6692
	(0.1408)	(16.5469)	(6.6828)	(-0.9164)	(2.7589)		(0.0000)
D2	-0.0016	1.0043	0.2894	0.2276	0.3312	0.7661	98.4273
	(-0.7582)	(20.9611)	(3.1992)	(2.2992)	(1.9841)		(0.0000)
D3	-0.0028	1.1707	0.5753	0.3262	0.4236	0.7079	73.1039
	(-1.0801)	(16.1935)	(6.1636)	(2.3108)	(1.9792)		(0.0000)
D4	-0.0027	1.1203	0.6770	0.4549	0.5703	0.7483	89.4662
	(-1.0718)	(14.9206)	(7.1906)	(3.7393)	(2.6976)		(0.0000)
D5 (High)	-0.0070	1.3488	1.0401	0.2499	0.6023	0.7566	93.4528
	(-2.5149)	(14.8676)	(9.7034)	(1.7656)	(3.0845)		(0.0000)
Zero R&D firms							
D1 (low)	-0.0022	0.9927	0.6481	0.2073	-0.1777	0.7018	71.0211
	(-1.0440)	(15.7755)	(8.0196)	(1.9222)	(-0.9991)		(0.0000)
D2	-0.0022	1.0374	0.5495	0.1012	-0.2864	0.7401	85.7270
	(-1.1575)	(19.7706)	(6.9424)	(0.8951)	(-1.7692)		(0.0000)
D3	-0.0045	1.1787	0.6962	0.3141	-0.3156	0.7716	101.5064
	(-1.9989)	(21.2135)	(9.0446)	(3.0689)	(-2.0480)		(0.0000)
D4	-0.0060	1.1928	0.6775	0.6038	-0.1561	0.7973	117.9914
	(-2.9214)	(18.3359)	(9.2601)	(5.4934)	(-0.9946)		(0.0000)
D5 (High)	-0.0043	1.4145	1.0454	0.6464	-0.2453	0.7887	112.0188
	(-1.7144)	(17.8692)	(9.3751)	(5.4323)	(-1.1404)		(0.0000)
R&D firms with RD/Sales> median							
D1 (low)	0.0063	1.2042	0.7645	-0.4029	0.7769	0.6745	62.6427
	(1.9508)	(11.4597)	(4.3775)	(-2.7065)	(3.0186)		(0.0000)
D2	-0.0020	1.0732	0.5179	0.0229	0.4240	0.6149	48.4981
	(-0.6341)	(11.8572)	(3.6337)	(0.1470)	(1.4327)		(0.0000)
D3	-0.0013	1.2533	0.8152	0.0233	0.6880	0.6033	46.2510
	(-0.3692)	(9.1152)	(5.3411)	(0.1231)	(2.1015)		(0.0000)
D4	0.0003	1.3005	1.0093	0.0785	0.7789	0.5445	36.5565
	(0.0539)	(8.3841)	(6.5502)	(0.2989)	(1.8900)		(0.0000)
D5 (High)	-0.0086	1.4057	1.2087	-0.1495	0.8650	0.6641	59.8285
	(-2.4585)	(12.0165)	(9.1198)	(-0.7535)	(3.1851)		(0.0000)

Appendix 5B.C Part F: Part F of the Appendix 5B.C presents the average number of observations for dispersion portfolios used in the regression in Table 5B.6.

The table reports the average number of observations according to dispersion quintiles for the whole sample, the R&D, zero R&D and R&D intensive firms (firms with R&D/Sales>median) from D1 (low) to D5 (High).

	Sample	R&D firms	Zero R&D firms	RD/Sales above median
D1 (low)	95	38	57	22
D2	93	40	53	17
D3	93	40	53	18
D4	91	35	56	14
D5 (High)	92	29	62	15

Appendix 5B.C Part G: Part G of the Appendix 5B.C presents the average number values of the factors included in the Fama-French time-series regressions on Table 5B.6 and Appendix 5B.C Parts A and B for the 156 months used in the regressions (July 1991-June 2004), and also the average raw and excess returns of the five dispersion portfolios formed according to all sample data.

SML	0.0035
HML	0.0060
Market monthly value-weighted return	0.0072
1 month UK Treasury Bill Rate	0.0586
1 month UK Treasury Bill rate converted to geometric monthly rate	0.0047
Sample VW return-1 month UK Treasury Bill monthly rate (Rm-Rf=RM)	0.0024
RD factor as in Al-Horani et Al (2003) with equal-weighted returns	0.0011
RD factor as in Al-Horani et Al (2003) with value-weighted returns	0.0003
RD factor calculated as (High RD+Mid RD)/2-(Low RD+Zero RD)/2 with EW returns	0.0009
RD factor calculated as (High RD+Mid RD)/2-(Low RD+Zero RD)/2 with VW returns	-0.0036
RD factor calculated as (High RD-Zero RD) with EW returns	0.0027
RD factor calculated as (High RD-Zero RD) with VW returns	-0.0050
RD factor calculated as (High RD-Low RD) with EW returns	0.0033
RD factor calculated as (High RD-Low RD) with VW returns	-0.0065
(R&D intensity above is expressed as R&D/Sales)	

Monthly equal weighted returns of the 5 dispersion portfolios, based on annually rebalanced dispersion data, using forecast data 1m before year end	
D1 (Low)	0.0108
D2	0.0099
D3	0.0096
D4	0.0108
D5 (High)	0.0124

Monthly equal weighted excess returns (Rp-Rf) of the 5 dispersion portfolios, based on annually rebalanced dispersion data, using forecast data 1m before year end	
D1 (Low)	0.0060
D2	0.0051
D3	0.0048
D4	0.0060
D5 (High)	0.0076

Appendix 5B.C Part H: Part H of the Appendix 5B.C presents regression results (panel data) when I regress 12 month returns on analyst forecast dispersion and R&D, controlling for other variables.

Appendix 5B.C Part H. The influence of R&D intensity and analyst forecast dispersion on stock returns

The table reports the coefficient estimates and values of t-statistics (in parentheses) that have been estimated by running the following panel data regression during 1990-2003: Returns = $\alpha_0+\alpha_1 D+\alpha_2 RD+\alpha_3 PASTS+\alpha_4 MV+\alpha_5 BM+\alpha_6 MEANEPS+\varepsilon_{it}$. The dependent variable Returns equals the 12 month raw cumulative return from July of year t until June of year t+1. The first month for which the return is included is July 1991 and the last one is June 2004. D equals analyst forecast dispersion defined as the standard deviation in one year ahead analyst forecasts of EPS for a particular month divided by the absolute value of the mean forecast in the specific month. There are used forecasts 6 months prior to year end (in the thesis, dispersion is calculated with -12, 6, and 1 month before year end and I chose to use the mean value for dispersion calculation in the regression). RD equals R&D/TA or R&D/Market value of equity at year end. The choice of R&D/TA and R&D/MV instead of R&D/Sales is justified by the fact that I use a past sales variable among the regressors. BM and MV the book-to-market ratio and MVE (natural log) at year end respectively. PASTS equals the sales growth over the two years prior to year t (geometric mean) and MEANEPS equals the mean analyst earnings forecast 6 months prior to year end. The regression is run using OLS and Whites Heteroskedasticity robust standard errors. Observations above the 98 and below the 2 percentile were eliminated. In the last column appear the F statistics and their p-values. In Panel A the regression is run without an analyst following regressor, and in Panel B it is run by adding an analyst following variable (AF), equal to the number of analysts that issues one year ahead EPS forecasts for a particular firm for a particular month, using minus 6 month prior to year end forecast data. *

Cumulative returns

Panel A: Regression run without an analyst following regressor

	c	D	RD	PASTS	MV	BM	MEANEPS	Adjusted R-squared	F-statistic
6 month prior to year end EPS forecast data									
RD=RDTA	0.0230	-0.0012	0.8421	0.0400	-0.0022	0.0933	0.0246	0.0168	10.4578
	(0.4683)	(-2.2251)	(2.2126)	(1.0647)	(-0.6151)	(6.4904)	(1.9921)		(0.0000)
RD=RDMV	0.0219	-0.0014	1.0626	0.0437	-0.0020	0.0852	0.0247	0.0192	11.8333
	(0.4512)	(-2.4636)	(3.8013)	(1.1670)	(-0.5598)	(6.0309)	(2.0043)		(0.0000)

Panel B: Regression run with an analyst following variable (AF)

	c	D	RD	PASTS	MV	BM	MEANEPS	AF	Adjusted R-squared	F-statistic
RD=RDTA	0.0280	-0.0012	0.8404	0.0415	-0.0045	0.0919	0.0250	0.0008	0.0166	9.1844
	(0.5699)	(-2.2257)	(2.2094)	(1.0898)	(-0.7615)	(6.3074)	(2.0173)	(0.5223)		(0.0000)
RD=RDMV	0.0260	-0.0014	1.0594	0.0448	-0.0039	0.0841	0.0250	0.0006	0.0190	10.3751
	(0.5353)	(-2.4639)	(3.7823)	(1.1829)	(-0.6566)	(5.8843)	(2.0236)	(0.4237)		(0.0000)

In addition, there are used four industry dummy variables in the above regression to account for four sectors perceived as intensive in R&D activity: Information Technology (INDD1), Chemicals (INDD2), General Industries (INDD3) and Health grouped together with Pharmaceuticals and Biotechnology ('Pharma' -INDD4). INDDUMMY takes the value of 1 if the firm belongs to the specific industry, and 0 otherwise. The industry dummies are used both in a simple form as well as multiplicative with R&D. The regression results with the included dummy variables are presented below:

Simple industry dummy variables:

Appendix 5B.C Part H regression run with industry dummy variables

6 month prior to year end EPS forecast data

Dependent variable: CAR

	c	D	RD	PASTS	MV	BM	MEANEPS	INDDUMMY	Adjusted R-squared	F-statistic
INDD1										
RD=RDTA	0.0272	-0.0012	0.9225	0.0395	-0.0027	0.0921	0.0244	-0.0292	0.0168	9.2850
	(0.5591)	(-2.2053)	(2.4598)	(1.0571)	(-0.7531)	(6.4449)	(1.9755)	(-0.6673)		(0.0000)
RD=RDMV	0.0252	-0.0013	1.0870	0.0433	-0.0023	0.0840	0.0245	-0.0188	0.0191	10.4125
	(0.5248)	(-2.4550)	(3.8906)	(1.1608)	(-0.6496)	(6.0150)	(1.9880)	(-0.4332)		(0.0000)
INDD2										
RD=RDTA	0.0243	-0.0013	0.8559	0.0391	-0.0021	0.0930	0.0246	-0.0194	0.0168	9.2466
	(0.4952)	(-2.2416)	(2.2456)	(1.0385)	(-0.5772)	(6.4757)	(1.9918)	(-0.9965)		(0.0000)
RD=RDMV	0.0234	-0.0014	1.0817	0.0426	-0.0019	0.0847	0.0247	-0.0228	0.0192	10.4879
	(0.4832)	(-2.4868)	(3.8721)	(1.1382)	(-0.5143)	(5.9969)	(2.0041)	(-1.1781)		(0.0000)
INDD3										
RD=RDTA	0.0221	-0.0012	0.8301	0.0403	-0.0022	0.0933	0.0247	0.0023	0.0166	9.1514
	(0.4441)	(-2.2213)	(1.9974)	(1.0699)	(-0.5929)	(6.4802)	(1.9953)	(0.1453)		(0.0000)
RD=RDMV	0.0230	-0.0014	1.0766	0.0433	-0.0021	0.0850	0.0247	-0.0029	0.0190	10.3566
	(0.4671)	(-2.4743)	(3.6223)	(1.1557)	(-0.5703)	(5.9360)	(1.9956)	(-0.1954)		(0.0000)
INDD4										
RD=RDTA	0.0230	-0.0012	0.7562	0.0371	-0.0021	0.0950	0.0246	0.0682	0.0178	9.7577
	(0.4689)	(-2.1873)	(1.9300)	(0.9822)	(-0.5817)	(6.6026)	(2.0053)	(2.1847)		(0.0000)
RD=RDMV	0.0207	-0.0013	1.0228	0.0407	-0.0019	0.0878	0.0248	0.0728	0.0204	11.0640
	(0.4276)	(-2.4223)	(3.6448)	(1.0836)	(-0.5226)	(6.1949)	(2.0296)	(2.4187)		(0.0000)

Industry dummy variables multiplicative with R&D:

Appendix 5B.C Part H regression run with industry dummy variables multiplicative with RD

6 month prior to year end EPS forecast data

Dependent variable: CAR

	c	D	RD	PASTS	MV	BM	MEANEPS	INDDUMMY*RD	Adjusted R-squared	F-statistic
INDD1										
RD=RDTA	0.0222	-0.0012	0.9933	0.0410	-0.0024	0.0933	0.0248	-0.3894	0.0167	9.2308
	(0.4529)	(-2.2045)	(3.4746)	(1.0955)	(-0.6743)	(6.4937)	(2.0039)	(-0.4361)		(0.0000)
RD=RDMV	0.0237	-0.0014	0.8305	0.0411	-0.0017	0.0865	0.0245	0.8825	0.0197	10.7364
	(0.4887)	(-2.5523)	(2.8987)	(1.0956)	(-0.4782)	(6.1760)	(1.9800)	(1.3137)		(0.0000)
INDD2										
RD=RDTA	0.0233	-0.0012	0.8545	0.0398	-0.0022	0.0931	0.0247	-0.4266	0.0166	9.1653
	(0.4749)	(-2.2318)	(2.2130)	(1.0580)	(-0.6021)	(6.4751)	(1.9942)	(-0.4060)		(0.0000)
RD=RDMV	0.0220	-0.0014	1.1092	0.0434	-0.0019	0.0852	0.0248	-1.1374	0.0193	10.5168
	(0.4559)	(-2.4805)	(3.9435)	(1.1628)	(-0.5259)	(6.0502)	(2.0124)	(-0.9503)		(0.0000)
INDD3										
RD=RDTA	0.0226	-0.0012	0.7890	0.0402	-0.0022	0.0932	0.0246	0.1399	0.0166	9.1595
	(0.4610)	(-2.2103)	(1.4207)	(1.0696)	(-0.6017)	(6.4785)	(1.9924)	(0.2369)		(0.0000)
RD=RDMV	0.0222	-0.0014	1.1341	0.0436	-0.0021	0.0853	0.0247	-0.1654	0.0190	10.3699
	(0.4576)	(-2.4789)	(3.0087)	(1.1646)	(-0.5694)	(6.0463)	(2.0020)	(-0.3303)		(0.0000)
INDD4										
RD=RDTA	0.0254	-0.0013	0.7545	0.0388	-0.0024	0.0936	0.0249	0.8491	0.0169	9.3119
	(0.5150)	(-2.2450)	(1.8338)	(1.0282)	(-0.6760)	(6.5104)	(2.0176)	(0.9325)		(0.0000)
RD=RDMV	0.0235	-0.0013	0.9632	0.0416	-0.0023	0.0872	0.0255	2.9038	0.0205	11.1501
	(0.4844)	(-2.4393)	(3.3749)	(1.1098)	(-0.6346)	(6.1546)	(2.0652)	(2.2294)		(0.0000)

In order to control for time period effects that relate to the New Economy years, the regressions are also rerun by including a dummy variable that takes the value of 1 for the years 1998, 1999 and 2000, and zero otherwise when running the regressions for the whole sample period 1990-2002.

Appendix 5B.C regression run for the sample period 1990-2002 by including a dummy variable that takes the value of 1 for the years 1998, 1999 and 2000, and zero otherwise.

Dependent variable: Cumulative return

6 month prior to year end EPS forecast data

	c	D	RD	PASTS	MV	BM	MEANEPS	Time Dummy	Adjusted R-squared	F-statistic
RD=RDTA	0.0316	-0.0014	0.8705	0.0447	-0.0024	0.0990	0.0260	-0.0592	0.0234	12.6138
	(0.6621)	(-2.5000)	(2.2998)	(1.2104)	(-0.6810)	(6.8923)	(2.1635)	(-4.5997)		(0.0000)
RD=RDMV	0.0309	-0.0015	1.0572	0.0482	-0.0022	0.0906	0.0260	-0.0581	0.0256	(13.7163)
	(0.6548)	(-0.7322)	(3.7692)	(1.3109)	(-0.6258)	(6.3996)	(2.1670)	(-4.5111)		(0.0000)

APPENDIX 5B.D

Appendix 5B.D Part A: Appendix 5B.D Part A shows the sample period average signed forecast errors according to TA, MV and BM quintiles.

The table reports the average signed forecast errors for quartiles formed according to TA, MV, BM Forecast errors have been calculated as a) (Forecasted EPS-Actual EPS)/Absolute value of Actual EPS and b) (Forecasted EPS-Actual EPS)/Stock Price 12 months prior to year end. In the case of the mean forecasted one year ahead EPS, there have been used all of the minus 12, 6 and 3 month prior to year end median forecasts. Actual and forecasted EPS observations above the 0.98 and below the 0.02 percentile have been eliminated.

Error (F-A)/A Abs	Forecast -12m	Forecast -6m	Forecast -1m	Error (F-A)/P	Forecast -12m	Forecast -6m	Forecast -1m
According to TA							
Low	1.069	0.616	-0.824		0.325	0.305	0.272
	0.727	0.672	0.545		0.223	0.200	0.178
	0.861	0.542	0.417		0.106	0.103	0.122
High	0.543	0.308	0.233		0.086	0.070	0.083
According to MV							
Low	1.541	1.001	-0.598		0.596	0.516	0.439
	0.815	0.492	0.348		0.143	0.136	0.134
	0.444	0.360	0.353		0.027	0.043	0.076
High	0.404	0.273	0.191		0.005	0.017	0.041
According to BM							
Low	0.249	0.438	0.043		-0.012	0.032	0.071
	0.538	0.544	0.423		0.044	0.064	0.083
	1.078	0.687	0.484		0.135	0.117	0.119
High	1.240	0.408	-0.528		0.539	0.437	0.359

Appendix 5B.D Part B: Appendix 5B.D Part B shows the sample period absolute forecast errors for the whole sample, R&D and zero R&D firms and according to R&D/Sales, R&D/TA, R&D/MV, TA, MV and BM quartiles.
Forecast errors have been calculated (using absolute values) as a) (Forecasted EPS-Actual EPS)/Absolute value of Actual EPS and b) (Forecasted EPS-Actual EPS)/Stock Price 12 months prior to year end. In the case of the mean forecasted one year ahead EPS, there have been used all of the minus 12, 6 and 3 month prior to year end median forecasts. Actual and forecasted EPS observations above the 0.98 and below the 0.02 percentile have been eliminated.

Error (F-A)/A Abs	Forecast - 12m	Forecast - 6m	Forecast - 1m	Error (F-A)/P	Forecast - 12m	Forecast - 6m	Forecast - 1m
Sample	1.615	1.449	1.213		0.345	0.268	0.195
R&D firms	1.657	1.494	1.218		0.347	0.271	0.197
Zero R&D firms	1.671	1.569	1.327		0.368	0.285	0.206
R&D firms according to R&D/Sales							
Low	1.187	0.906	0.796		0.293	0.226	0.167
	1.315	1.111	0.893		0.302	0.231	0.174
	1.482	1.197	0.928		0.275	0.216	0.158
High	2.172	1.816	1.631		0.352	0.284	0.204
R&D firms according to R&D/TA							
Low	1.003	0.773	0.620		0.273	0.207	0.151
	1.377	0.940	0.929		0.324	0.246	0.188
	1.755	1.562	1.231		0.284	0.229	0.166
High	1.998	1.708	1.453		0.337	0.270	0.195
R&D firms according to R&D/MV							
Low	0.756	0.534	0.407		0.216	0.162	0.112
	0.941	0.841	0.680		0.260	0.188	0.146
	2.021	1.690	1.512		0.309	0.244	0.187
High	2.486	1.913	1.634		0.445	0.372	0.266
Sample firms according to TA							
Low	3.028	2.921	2.818		0.499	0.400	0.291
	1.591	1.182	0.963		0.365	0.283	0.216
	1.307	1.162	0.721		0.309	0.245	0.176
High	0.807	0.661	0.553		0.248	0.183	0.131
Sample firms according to MV							
Low	3.586	3.444	3.172		0.611	0.488	0.374
	1.453	1.090	0.868		0.372	0.295	0.212
	1.012	0.809	0.627		0.259	0.204	0.148
High	0.704	0.623	0.512		0.201	0.146	0.104
Sample firms according to BM							
Low	1.103	1.043	0.530		0.241	0.188	0.129
	1.156	0.897	0.689		0.262	0.202	0.150
	1.470	1.118	0.907		0.342	0.271	0.192
High	2.757	2.806	2.861		0.547	0.426	0.322

APPENDIX 5B.E

Appendix 5B.E Part A: Appendix 5B.E Part A shows the average sample period signed forecast revisions according to quartiles formed by TA, MV and BM (from low to high). There are used four types of forecast revisions defined as follows:

Scaling revisions by stock price:

Forecast Revision: 12 6 (Forecast 6m prior to year end-Forecast 12m prior to year end)/Share price 12m prior to year end*100

Forecast Revision: 12 1(Forecast 1m prior to year end-Forecast 12m prior to year end)/Share price 12m prior to year end *100

Scaling revisions by the absolute value of median forecast 12m prior to year end:

Forecast Revision: 12 6 (Forecast 6m prior to year end-Forecast 12m prior to year end)/Abs value of median forecast 12m prior to year end *100

Forecast Revision: 12 1(Forecast 1m prior to year end-Forecast 12m prior to year end)/Abs value of median forecast 12m prior to year end *100

One year ahead mean forecasts are used. If revision exceeds +/-100% data are considered outliers and are removed.

	Scaled by Price	12 6	12 1	Scaled by Median	12 6	12 1
TA						
Low		2.525	1.663		2.957	1.765
		1.790	1.757		3.139	4.419
		0.691	1.643		2.999	4.600
High		-0.181	1.630		0.754	3.534
MV						
Low		-0.389	-3.796		-0.425	-4.953
		0.577	0.852		1.778	2.427
		1.928	4.060		4.389	8.076
High		1.677	3.890		3.059	6.811
BM						
Low		4.867	7.835		7.586	13.451
		1.958	3.980		3.416	6.131
		0.998	0.441		1.611	1.145
High		-3.875	-6.237		-3.395	-6.765

Appendix 5B.E Part B: Appendix 5B.E Part B shows the sample period absolute forecast revisions for the whole sample, R&D and zero R&D firms and according to R&D/Sales, R&D/TA, R&D/MV, TA, MV and BM quartiles.

Scaled by price	12 6	12 1	Scaled by median 12 6	12 1
Sample	14.790	19.078	18.115	23.602
R&D firms	14.811	19.125	18.274	23.779
Zero R&D firms	15.523	20.049	18.819	24.500
R&D/Sales				
Low	13.502	17.386	14.761	18.997
	14.367	17.944	17.160	21.509
	12.540	16.120	17.449	23.371
High	13.681	17.885	19.428	25.399
R&D/TA				
Low	12.822	16.627	14.273	18.009
	14.570	17.860	17.334	21.861
	12.487	16.881	17.327	23.408
High	14.204	17.849	19.483	25.541
R&D/MV				
Low	11.649	14.691	14.534	17.762
	12.045	15.509	15.388	20.354
	14.160	18.241	17.290	22.815
High	16.631	21.592	21.717	28.629
Sample firms according to TA				
Low	21.426	25.554	24.715	30.019
	16.101	20.031	19.388	24.858
	12.791	17.552	16.789	22.785
High	10.971	15.481	13.847	19.279
Sample firms according to MV				
Low	23.988	28.999	25.818	31.426
	16.253	20.579	19.295	25.022
	12.050	16.644	16.337	22.378
High	9.810	13.575	13.677	18.737
Sample firms according to BM				
Low	11.970	15.605	17.863	23.977
	12.023	15.741	15.766	20.443
	15.859	19.933	18.246	22.762
High	19.304	25.565	20.567	27.679

APPENDIX 5B.F

The impact of R&D intensity on analyst forecast errors without controlling for MV and BM. The table reports the results as in Table 5.12, Panels A (for absolute errors) and B (for non absolute errors) without including the factors of MV and BM in the regressions.

Absolute errors: Errors scaled by price:							Error scaled by actual EPS:					
	c	RD	PASTR	STDEV	Adj. R-sq.	F-stat.	c	RD	PASTR	STDEV	Adj. R-sq.	F-stat.
12 month prior to year end EPS forecast data												
RD=RDS	-2.6229	0.0525	0.5641	0.7513	0.2932	625.2072	-2.2025	0.0406	-2.7336	0.6517	0.2555	541.7747
	(-68.2423)	(5.8135)	(1.7004)	(37.0045)		(0.0000)	(-62.8524)	(4.5534)	(-7.6093)	(31.5351)		(0.0000)
RD=RDTA	-2.6295	0.0487	0.5709	0.7511	0.2926	623.4508	-2.2102	0.0363	-2.7261	0.6518	0.2550	540.3255
	(-68.1591)	(5.3446)	(1.7207)	(36.9530)		(0.0000)	(-62.7388)	(4.0287)	(-7.5854)	(31.5023)		(0.0000)
RD=RDMV	-2.5938	0.0679	0.6006	0.7452	0.2955	632.2442	-2.1788	0.0539	-2.6840	0.6480	0.2571	546.4196
	(-67.5619)	(7.2767)	(1.8061)	(36.8660)		(0.0000)	(-61.8578)	(5.9103)	(-7.4598)	(31.4132)		(0.0000)
6 month prior to year end EPS forecast data												
RD=RDS	-2.7829	0.0531	-1.4464	0.5708	0.2279	429.0145	-2.3370	0.0472	-5.0734	0.5004	0.2308	479.8014
	(-72.7539)	(5.1533)	(-4.1214)	(26.5696)		(0.0000)	(-64.1088)	(4.6334)	(-13.2867)	(24.2836)		(0.0000)
RD=RDTA	-2.7719	0.0598	-1.4281	0.5710	0.2289	431.3797	-2.3314	0.0508	-5.0614	0.5004	0.2312	480.8864
	(-72.5928)	(5.7360)	(-4.0692)	(26.5952)		(0.0000)	(-63.8656)	(4.8815)	(-13.2308)	(24.2722)		(0.0000)
RD=RDMV	-2.7441	0.0752	-1.3850	0.5667	0.2314	437.5555	-2.3068	0.0650	-5.0125	0.4973	0.2331	485.9161
	(-71.6949)	(7.2940)	(-3.9447)	(26.5674)		(0.0000)	(-62.7814)	(6.3221)	(-13.1037)	(24.2040)		(0.0000)
Non Absolute errors: Errors scaled by price:							Errors scaled by actual EPS:					
12 month prior to year end EPS forecast data												
RD=RDS	-0.0004	0.0000	-0.0223	0.0013	0.2395	475.0438	0.0000	-0.0001	-0.0515	0.0018	0.0917	160.0959
	(-3.4545)	(0.3571)	(-13.2205)	(10.7182)		(0.0000)	(0.1640)	(-0.6643)	(-9.5127)	(7.9047)		(0.0000)
RD=RDTA	-0.0004	0.0000	-0.0223	0.0013	0.2395	475.0624	0.0001	-0.0001	-0.0515	0.0018	0.0916	159.9753
	(-3.4527)	(0.4612)	(-13.2188)	(10.7189)		(0.0000)	(0.2523)	(-1.5006)	(-9.5046)	(7.9078)		(0.0000)
RD=RDMV	-0.0003	0.0001	-0.0222	0.0013	0.2405	477.6432	0.0004	0.0001	-0.0511	0.0018	0.0915	159.8086
	(-2.1918)	(3.5009)	(-13.1385)	(10.7168)		(0.0000)	(1.6014)	(1.4078)	(-9.4340)	(7.9190)		(0.0000)
6 month prior to year end EPS forecast data												
RD=RDS	-0.0001	0.0000	-0.0145	0.0009	0.1544	265.8013	0.0005	-0.0001	-0.0320	0.0009	0.0531	90.5265
	(-1.1925)	(1.0675)	(-10.2345)	(9.3128)		(0.0000)	(2.7812)	(-1.6235)	(-6.4884)	(5.6685)		(0.0000)
RD=RDTA	-0.0001	0.0000	-0.0145	0.0009	0.1544	265.7886	0.0006	-0.0001	-0.0320	0.0009	0.0530	90.2818
	(-1.2177)	(1.0820)	(-10.2283)	(9.3124)		(0.0000)	(2.9981)	(-1.2211)	(-6.4754)	(5.6746)		(0.0000)
RD=RDMV	0.0000	0.0001	-0.0144	0.0009	0.1554	267.8429	0.0008	0.0001	-0.0317	0.0009	0.0529	90.2397
	(-0.2661)	(3.3791)	(-10.1294)	(9.3253)		(0.0000)	(4.2204)	(1.3032)	(-6.4181)	(5.6872)		(0.0000)

APPENDIX 5B.G

The impact of R&D intensity on analyst forecast errors when controlling for industry factors. The Appendix reports the regression results as in table 5B.12, when forecast errors (both absolute and non absolute) are scaled by price and R&D intensity is defined as R&D/Sales, minus 12 months prior to year end error data are used and industry dummy variables are used to account for industry factors. In specific, there are used four industry dummy variables to account for four sectors perceived as intensive in R&D activity: Information Technology (INDD1), Chemicals (INDD2), General Industries (INDD3) and Health grouped together with Pharmaceuticals and Biotechnology ('Pharma' -INDD4). INDDUMMY takes the value of 1 if the firm belongs to the specific industry, and 0 otherwise. The industry dummies are used both in a simple form as well as multiplicative with R&D. There are also reported the results from the regression as in Table 5B.12 both with and without including firm size-MV and BM as regressors, as was done in Appendix 5B.F.

Simple industry dummies, including MV and BM as regressors:

	c	RD	BM	MV	PASTR	STDEV	INDDUMMY	Adj. R-sq.	F-stat.
Panel A: Absolute errors:									
INDDUMMY=INDD1	-1.2466	0.0094	0.0299	-0.2666	1.3214	0.7026	0.0743	0.3424	414.3168
	(-17.6705)	(1.1903)	(1.1591)	(-20.0134)	(3.9620)	(36.3106)	(0.7349)		(0.0000)
INDDUMMY=INDD2	-1.2381	0.0089	0.0267	-0.2681	1.3120	0.7030	-0.0249	0.3423	414.1900
	(-17.5944)	(1.1088)	(1.0370)	(-20.1495)	(3.9313)	(36.3495)	(-0.2880)		(0.0000)
INDDUMMY=INDD3	-1.2495	0.0114	0.0284	-0.2666	1.3139	0.7035	0.0464	0.3424	414.3339
	(-17.4107)	(1.3717)	(1.1010)	(-19.8751)	(3.9367)	(36.3689)	(0.8429)		(0.0000)
INDDUMMY=INDD4	-1.2273	0.0091	0.0213	-0.2694	1.3100	0.7022	-0.2018	0.3428	415.0272
	(-17.3590)	(1.1517)	(0.8206)	(-20.2316)	(3.9120)	(36.3379)	(-1.7452)		(0.0000)
Panel B: Non Absolute errors									
INDDUMMY=INDD1	0.0037	-0.0001	0.0009	-0.0007	-0.0206	0.0011	0.0002	0.2704	295.3279
	(10.2421)	(-4.1240)	(6.4942)	(-9.9248)	(-12.2585)	(9.3093)	(0.3977)		(0.0000)
INDDUMMY=INDD2	0.0037	-0.0001	0.0009	-0.0007	-0.0206	0.0011	0.0008	0.2709	295.9553
	(10.2925)	(-3.7763)	(6.5228)	(-10.0449)	(-12.2921)	(9.3534)	(2.3680)		(0.0000)
INDDUMMY=INDD3	0.0037	-0.0001	0.0009	-0.0007	-0.0206	0.0011	0.0002	0.2705	295.3823
	(9.9136)	(-3.7395)	(6.5253)	(-9.7338)	(-12.2989)	(9.3507)	(0.7917)		(0.0000)
INDDUMMY=INDD4	0.0037	-0.0001	0.0009	-0.0007	-0.0206	0.0011	0.0007	0.2707	295.6860
	(10.1458)	(-4.1214)	(6.6454)	(-9.9146)	(-12.3027)	(9.3504)	(1.4111)		(0.0000)

Multiplicative industry dummies, including MV and BM as regressors:

Panel A: Absolute errors	c	RD	BM	MV	PASTR	STDEV	INDDUMMY	RD*INDDUMMY	Adj. R-sq.	F-stat.
INDDUMMY=INDD1	-1.2462	0.0108	0.0299	-0.2665	1.3114	0.7035	-0.0086	-0.0494	0.3424	362.6557
	(-17.6622)	(1.3492)	(1.1571)	(-20.0054)	(3.9300)	(36.3615)	(-0.0689)	(-0.9786)		(0.0000)
INDDUMMY=INDD2	-1.2391	0.0085	0.0266	-0.2680	1.3117	0.7030	0.0195	0.0131	0.3422	362.3659
	(-17.5715)	(1.0455)	(1.0339)	(-20.1248)	(3.9302)	(36.3446)	(0.1114)	(0.2821)		(0.0000)
INDDUMMY=INDD3	-1.2488	0.0119	0.0285	-0.2666	1.3140	0.7035	0.0347	-0.0041	0.3423	362.4821
	(-17.3467)	(1.3473)	(1.1036)	(-19.8773)	(3.9367)	(36.3663)	(0.3810)	(-0.1674)		(0.0000)
INDDUMMY=INDD4	-1.2260	0.0109	0.0224	-0.2689	1.3095	0.7019	-0.3381	-0.0824	0.3429	363.5024
	(-17.3650)	(1.3636)	(0.8614)	(-20.2082)	(3.9003)	(36.3510)	(-2.1223)	(-1.4989)		(0.0000)

Panel B: Non Absolute errors										
INDDUMMY=INDD1	0.0037	-0.0001	0.0009	-0.0007	-0.0206	0.0011	0.0004	0.0001	0.2703	258.4026
	(10.2376)	(-4.1798)	(6.4938)	(-9.9354)	(-12.2630)	(9.2602)	(0.5841)	(0.4265)		(0.0000)
INDDUMMY=INDD2	0.0037	-0.0001	0.0009	-0.0007	-0.0206	0.0011	0.0011	0.0001	0.2708	258.9405
	(10.2685)	(-3.7892)	(6.5204)	(-10.0369)	(-12.2928)	(9.3528)	(1.4247)	(0.4484)		(0.0000)
INDDUMMY=INDD3	0.0037	-0.0001	0.0009	-0.0007	-0.0206	0.0011	0.0003	0.0001	0.2704	258.4559
	(9.8754)	(-3.7364)	(6.5175)	(-9.7401)	(-12.2983)	(9.3519)	(0.8641)	(0.5104)		(0.0000)
INDDUMMY=INDD4	0.0037	-0.0001	0.0009	-0.0007	-0.0206	0.0011	0.0003	-0.0002	0.2706	258.7929
	(10.1460)	(-3.9916)	(6.6397)	(-9.9039)	(-12.2962)	(9.3527)	(0.4712)	(-0.6623)		(0.0000)

Simple industry dummies, excluding MV and BM as regressors:

Panel A: Absolute errors

	c	RD	PASTR	STDEV	INDDUMMY	Adj. R-sq.	F-stat.
INDDUMMY=INDD1	-2.6353	0.0525	0.5795	0.7504	0.2950	0.2939	502.2137
	(-68.3969)	(5.8320)	(1.7499)	(36.9461)	(2.4633)		(0.0000)
INDDUMMY=INDD2	-2.6216	0.0519	0.5629	0.7511	-0.0487	0.2931	500.1344
	(-67.8258)	(5.6872)	(1.6966)	(36.9639)	(-0.4478)		(0.0000)
INDDUMMY=INDD3	-2.6440	0.0603	0.5681	0.7518	0.2147	0.2944	503.2656
	(-67.6782)	(6.5119)	(1.7124)	(37.0670)	(3.3407)		(0.0000)
INDDUMMY=INDD4	-2.6116	0.0525	0.5594	0.7496	-0.2322	0.2935	501.2158
	(-67.7652)	(5.8268)	(1.6805)	(36.9346)	(-1.6582)		(0.0000)

Panel B: Non Absolute errors

	c	RD	PASTR	STDEV	INDDUMMY	Adj. R-sq.	F-stat.
INDDUMMY=INDD1	-0.0005	0.0000	-0.0223	0.0013	0.0006	0.2396	380.4925
	(-3.6461)	(0.3592)	(-13.2075)	(10.7133)	(1.1034)		(0.0000)
INDDUMMY=INDD2	-0.0004	0.0000	-0.0223	0.0013	0.0006	0.2395	380.3808
	(-3.5720)	(0.5591)	(-13.2176)	(10.7287)	(1.5733)		(0.0000)
INDDUMMY=INDD3	-0.0005	0.0000	-0.0223	0.0013	0.0007	0.2401	381.5908
	(-3.9438)	(1.0116)	(-13.2160)	(10.7704)	(2.6101)		(0.0000)
INDDUMMY=INDD4	-0.0004	0.0000	-0.0223	0.0013	0.0003	0.2394	380.0847
	(-3.5371)	(0.3555)	(-13.2204)	(10.7343)	(0.7029)		(0.0000)

Multiplicative industry dummies, excluding MV and BM as regressors:

Panel A: Absolute errors

	c	RD	PASTR	STDEV	INDDUMMY	RD*INDDUMMY	Adj. R-sq.	F-stat.
INDDUMMY=INDD1	-2.6330	0.0547	0.5704	0.7515	0.1706	-0.0741	0.2940	418.8850
	(-68.2916)	(6.0061)	(1.7213)	(36.9761)	(1.1354)	(-1.3097)		(0.0000)
INDDUMMY=INDD2	-2.6234	0.0507	0.5629	0.7511	0.0899	0.0407	0.2930	416.8310
	(-67.8129)	(5.4872)	(1.6966)	(36.9556)	(0.4279)	(0.7313)		(0.0000)
INDDUMMY=INDD3	-2.6423	0.0616	0.5684	0.7519	0.1862	-0.0099	0.2943	419.3475
	(-67.2195)	(6.2515)	(1.7131)	(37.0653)	(1.7668)	(-0.3448)		(0.0000)
INDDUMMY=INDD4	-2.6086	0.0542	0.5559	0.7494	-0.3518	-0.0730	0.2936	417.9407
	(-67.6275)	(5.9569)	(1.6662)	(36.9298)	(-1.9312)	(-1.1666)		(0.0000)

Panel B: Non Absolute errors

	c	RD	PASTR	STDEV	INDDUMMY	RD*INDDUMMY	Adj. R-sq.	F-stat.
INDDUMMY=INDD1	-0.0005	0.0000	-0.0223	0.0013	0.0009	0.0002	0.2395	317.1403
	(-3.6978)	(0.2161)	(-13.2050)	(10.6619)	(1.2421)	(0.6332)		(0.0000)
INDDUMMY=INDD2	-0.0005	0.0000	-0.0223	0.0013	0.0012	0.0002	0.2395	317.0676
	(-3.6289)	(0.4082)	(-13.2163)	(10.7278)	(1.4385)	(0.9001)		(0.0000)
INDDUMMY=INDD3	-0.0005	0.0000	-0.0223	0.0013	0.0011	0.0002	0.2402	318.2873
	(-4.0635)	(0.4640)	(-13.2163)	(10.7678)	(2.3005)	(1.1954)		(0.0000)
INDDUMMY=INDD4	-0.0004	0.0000	-0.0223	0.0013	-0.0001	-0.0003	0.2394	316.9506
	(-3.4389)	(0.5393)	(-13.2199)	(10.7389)	(-0.2093)	(-0.9378)		(0.0000)

APPENDIX 5G.H

The impact of R&D intensity on analyst forecast revisions when controlling for industry factors. The Appendix reports the regression results as in table 5B.13, when forecast revisions (both absolute and non absolute) are scaled by the absolute value of the median minus twelve month 1 year ahead EPS forecast and R&D intensity is defined as R&D/Sales, revisions are the ones between minus 12 an 1 month prior to year end and industry dummy variables are used to account for industry factors. In specific, there are used four industry dummy variables to account for four sectors perceived as intensive in R&D activity: Information Technology (INDD1), Chemicals (INDD2), General Industries (INDD3) and Health grouped together with Pharmaceuticals and Biotechnology ('Pharma' -INDD4). INDDUMMY takes the value of 1 if the firm belongs to the specific industry, and 0 otherwise. The industry dummies are used both in a simple form as well as multiplicative with R&D.

Simple industry dummies, INDD1, INDD2, INDD3 and INDD4 for absolute and non absolute revisions:

Absolute revisions								
c	RD	BM	MV	PASTR	STDEV	INDD1	Adj. R-sq.	F-stat.
2.9734	0.0246	-0.1260	-0.1532	1.1558	0.4285	0.3977	0.1828	175.2145
(42.4404)	(2.9632)	(-4.7231)	(-11.3078)	(3.1848)	(21.6315)	(4.2789)		(0.0000)
Non absolute revisions								
c	RD	BM	MV	PASTR	STDEV	INDD1	Adj. R-sq.	F-stat.
-0.0103	0.0058	-0.0453	0.0109	3.3704	-0.0374	-0.0004	0.1576	143.7850
(-0.4978)	(2.7439)	(-4.5923)	(2.6385)	(19.0980)	(-4.6717)	(-0.0140)		(0.0000)

Absolute revisions								
c	RD	BM	MV	PASTR	STDEV	INDD2	Adj. R-sq.	F-stat.
3.0194	0.0204	-0.1441	-0.1607	1.1300	0.4294	-0.2245	0.1809	173.0431
(43.3628)	(2.4249)	(-5.4435)	(-11.9315)	(3.0783)	(21.5777)	(-2.3743)		(0.0000)
Non absolute revisions								
c	RD	BM	MV	PASTR	STDEV	INDD2	Adj. R-sq.	F-stat.
-0.0100	0.0053	-0.0453	0.0110	3.3672	-0.0376	-0.0326	0.1578	144.0575
(-0.4906)	(2.4641)	(-4.7046)	(2.7267)	(19.0687)	(-4.7045)	(-1.9628)		(0.0000)

Absolute revisions								
c	RD	BM	MV	PASTR	STDEV	INDD3	Adj. R-sq.	F-stat.
2.9966	0.0273	-0.1417	-0.1589	1.1439	0.4319	0.0818	0.1804	172.4488
(42.6551)	(3.0835)	(-5.3012)	(-11.7193)	(3.1111)	(21.6594)	(1.4739)		(0.0000)
Non absolute revisions								
c	RD	BM	MV	PASTR	STDEV	INDD3	Adj. R-sq.	F-stat.
-0.0057	0.0049	-0.0461	0.0103	3.3673	-0.0377	-0.0185	0.1578	144.0444
(-0.2791)	(2.2571)	(-4.7482)	(2.5144)	(19.0932)	(-4.7161)	-(1.3373)		(0.0000)

Absolute revisions								
c	RD	BM	MV	PASTR	STDEV	INDD4	Adj. R-sq.	F-stat.
3.0129	0.0235	-0.1424	-0.1612	1.1409	0.4313	0.0882	0.1802	172.1729
(43.2112)	(2.8230)	(-5.3308)	(-11.9435)	(3.1075)	(21.6100)	(0.8164)		(0.0000)
Non absolute revisions								
c	RD	BM	MV	PASTR	STDEV	INDD4	Adj. R-sq.	F-stat.
-0.0093	0.0058	-0.0463	0.0108	3.3694	-0.0375	-0.0303	0.1577	143.9585
(-0.4587)	(2.7449)	(-4.8992)	(2.6756)	(19.1163)	(-4.6790)	(-0.7459)		(0.0000)

Multiplicative industry dummies, INDD1, INDD2, INDD3 and INDD4 for absolute and non absolute revisions:

Absolute revisions

c	RD	BM	MV	PASTR	STDEV	INDD1	RD*INDD1	Adj. R-sq.	F-stat.
2.9735	0.0260	-0.1262	-0.1530	1.1471	0.4293	0.3092	-0.0519	0.1828	153.4433
(42.4572)	(3.0983)	(-4.7342)	-(11.3023)	(3.1577)	(21.6042)	(2.3897)	(-0.9391)		(0.0000)

Non absolute revisions

c	RD	BM	MV	PASTR	STDEV	INDD1	RD*INDD1	Adj. R-sq.	F-stat.
-0.0103	0.0060	-0.0454	0.0109	3.3688	-0.0373	-0.0140	-0.0078	0.1574	125.8253
(-0.4996)	(2.7869)	-(4.5942)	(2.6446)	(19.0799)	(-4.6387)	(-0.3536)	(-0.5840)		(0.0000)

Absolute revisions

c	RD	BM	MV	PASTR	STDEV	INDD2	RD*INDD2	Adj. R-sq.	F-stat.
3.0177	0.0197	-0.1443	-0.1606	1.1304	0.4294	-0.1439	0.0233	0.1808	151.4213
(43.2801)	(2.3057)	(-5.4488)	(-11.9236)	(3.0789)	(21.5779)	(-0.8568)	(0.5180)		(0.0000)

Non absolute revisions

c	RD	BM	MV	PASTR	STDEV	INDD2	RD*INDD2	Adj. R-sq.	F-stat.
-0.0093	0.0056	-0.0452	0.0110	3.3673	-0.0376	-0.0626	-0.0087	0.1577	126.0921
(-0.4579)	(2.5441)	-(4.6989)	(2.7170)	(19.0680)	(-4.7032)	(-1.4267)	(-0.8556)		(0.0000)

Absolute revisions

c	RD	BM	MV	PASTR	STDEV	INDD3	RD*IND3	Adj. R-sq.	F-stat.
3.0050	0.0335	-0.1403	-0.1585	1.1400	0.4313	-0.0562	-0.0477	0.1808	151.4246
(42.7617)	(3.5731)	(-5.2529)	(-11.7130)	(3.0986)	(21.6520)	-(0.5635)	(-1.7936)		(0.0000)

Non absolute revisions

c	RD	BM	MV	PASTR	STDEV	INDD3	RD*INDD3	Adj. R-sq.	F-stat.
-0.0049	0.0055	-0.0460	0.0103	3.3674	-0.0378	-0.0324	-0.0048	0.1577	126.0851
(-0.2380)	(2.4334)	(-4.7196)	(2.5222)	(19.0960)	(-4.7200)	(-1.2857)	(-0.7168)		(0.0000)

Absolute revisions

c	RD	BM	MV	PASTR	STDEV	INDD4	RD*INDD4	Adj. R-sq.	F-stat.
3.0131	0.0237	-0.1423	-0.1611	1.1412	0.4313	0.0684	-0.0118	0.1800	150.6292
(43.2121)	(2.8146)	(-5.3283)	(-11.9346)	(3.1077)	(21.6146)	(0.4485)	(-0.2262)		(0.0000)

Non absolute revisions

c	RD	BM	MV	PASTR	STDEV	INDD4	RD*INDD4	Adj. R-sq.	F-stat.
-0.0093	0.0059	-0.0463	0.0108	3.3698	-0.0375	-0.0416	-0.0067	0.1576	125.9617
(-0.4555)	(2.7893)	(-4.8803)	(2.6822)	(19.1211)	(-4.6871)	(-0.7176)	(-0.3804)		(0.0000)

APPENDIX 5G.I

Controlling for time period effects as a result of the New Economy. This appendix contains controls for time period effects as a result of the New Economy for the regressions in Tables 5B.12 and 5B.13 for analyst forecast errors and revisions included in Chapter 5 Part 2. These controls involve running the regressions in question by excluding the years 1999-2001, and by running the regressions for the whole sample period 1990-2003 with the inclusion of year dummy variable. This time dummy variable takes the value of 1 if the data refer to year 1999 or 2000 or 2001, and zero otherwise.

Controls for time period bias on forecast errors (using both absolute and non absolute forecast errors, scaled by price and R&D intensity is defined as R&D/Sales, and minus 12 months prior to year end error data are used):

MV and BM are included among the regressors:

Panel A: Absolute errors

Regression run by excluding the base years 1999, 2000 and 2001

c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
-1.1936	0.0063	0.0084	-0.2706	-0.2594	0.6581	0.3425	323.6927
(-14.3367)	(0.6678)	(0.2430)	(-16.7764)	(-0.5921)	(28.3532)		(0.0000)

Regression run using a time dummy variable to account for the years 1999-2000-2001

c	RD	BM	MV	PASTR	STDEV	TIME DUMMY	Adj. R-sq.	F-stat.
-1.2320	0.0095	0.0264	-0.2679	1.2788	0.7034	-0.0328	0.3424	414.3450
(-17.4435)	(1.1932)	(1.0239)	(-20.1119)	(3.7895)	(36.3956)	(-0.8710)		(0.0000)

Panel B: Non Absolute errors

Regression run by excluding the base years 1999, 2000 and 2001

c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
0.0040	-0.0001	0.0011	-0.0007	-0.0308	0.0008	0.2973	263.2101
(9.5503)	(-2.9050)	(6.2606)	(-8.3350)	(-12.4265)	(5.8668)		(0.0000)

Regression run using a time dummy variable to account for the years 1999-2000-2001

c	RD	BM	MV	PASTR	STDEV	TIME DUMMY	Adj. R-sq.	F-stat.
0.0037	-0.0001	0.0009	-0.0007	-0.0207	0.0011	-0.0001	0.2705	295.3732
(10.4359)	(-4.0970)	(6.5285)	(-9.9442)	(-11.9333)	(9.3276)	(-0.6412)		(0.0000)

MV and BM are not included among the regressors:

Panel A: Absolute errors

Regression run by excluding the base years 1999, 2000 and 2001

c	RD	PASTR	STDEV	Adj. R-sq.	F-stat.
-2.5596	0.0550	-1.0979	0.6895	0.2935	409.2779
(-58.1933)	(5.4302)	(-2.4384)	(28.7093)		(0.0000)

Regression run using a time dummy variable to account for the years 1999-2000-2001

c	RD	PASTR	STDEV	TIME DUMMY	Adj. R-sq.	F-stat.
-2.6030	0.0529	0.4946	0.7520	-0.0793	0.2545	501.2775
(-65.9067)	(5.8481)	(1.4722)	(37.0202)	(-2.0104)		(0.0000)

Panel B: Non Absolute errors

Regression run by excluding the base years 1999, 2000 and 2001

c	RD	PASTR	STDEV	Adj. R-sq.	F-stat.
-0.0002	0.0000	-0.0355	0.0010	0.2545	343.2367
(-1.8075)	(0.9993)	(-14.1739)	(6.9857)		(0.0000)

Regression run using a time dummy variable to account for the years 1999-2000-2001

c	RD	PASTR	STDEV	TIME DUMMY	Adj. R-sq.	F-stat.
-0.0004	0.0000	-0.0224	0.0013	-0.0001	0.2394	380.0978
(-3.1344)	(0.3733)	(-12.8371)	(10.7223)	(-0.6270)		(0.0000)

Controls for time period bias on forecast revisions (using both absolute and non absolute forecast revisions, are scaled by the absolute value of the median minus twelve month 1 year ahead EPS forecast, R&D intensity is defined as R&D/Sales and revisions are the ones between minus 12 an 1 month prior to year end):

Panel A: Absolute revisions

Regression run by excluding the base years 1999, 2000 and 2001

c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
3.1127	0.0217	-0.0997	-0.1654	1.0815	0.4287	0.1873	159.2633
(39.7157)	(2.3159)	(-3.1430)	(-10.8451)	(2.2109)	(19.2876)		(0.0000)
Panel B: Non absolute revisions							
-0.0155	0.0056	-0.0501	0.0074	4.6378	-0.0354	0.2109	181.1223
(-0.6953)	(2.3594)	(-4.5819)	(1.6225)	(20.6390)	(-4.3044)		(0.0000)

Regression run using a time dummy variable to account for the years 1999-2000-2001

Panel A: Absolute revisions

c	RD	BM	MV	PASTR	STDEV	Time Dummy	Adj. R-sq.	F-stat.
3.0520	0.0251	-0.1448	-0.1596	0.9454	0.4326	-0.1819	0.1833	175.8526
(43.4597)	(3.0162)	(-5.4554)	(-11.7793)	(2.5593)	(21.6701)	(-4.6319)		(0.0000)

Panel B: Non absolute revisions

c	RD	BM	MV	PASTR	STDEV	Time Dummy	Adj. R-sq.	F-stat.
-0.0238	0.0050	-0.0459	0.0098	3.4681	-0.0385	0.0787	0.1639	150.6816
(-1.1755)	(2.3775)	(-4.8058)	(2.4236)	(19.3112)	(-4.8281)	(6.2646)		(0.0000)

Appendix 5B.J

Controlling for period fixed and random effects in the error and revisions regressions. The regressions from Tables 5B.12 for errors and 5B.13 for revisions (using absolute and non absolute errors, scaled by stock price, with 12 month prior to year end forecast data and absolute and absolute and non absolute revisions, scaled by the absolute value of the median minus 12 months prior to year end 1 year ahead EPS forecast, taking revisions between 12 and 1 month prior to year end) are estimated in the tables below making use of period fixed and random effects model specifications. R&D intensity is defined as R&D/Sales.

Controlling for fixed and random effects in panel data error regression:

Dependent variable: analyst forecast error (Forecasted -Actual 1 year ahead EPS) scaled by stock price 12 months prior to year end, using 12 month prior to year end forecast data)

Period Fixed effects							
Panel A: Absolute errors							
c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
-1.1502	0.0045	0.0697	-0.2361	1.1058	0.5268	0.2912	172.6144
(-26.9285)	(0.8108)	(3.8731)	(-28.0166)	(3.3130)	(36.9620)		(0.0000)
Panel B: Non Absolute errors							
0.0022	-0.0001	0.0008	-0.0004	-0.0285	0.0008	0.2160	116.0844
(10.4106)	(-5.0630)	(8.8993)	(-9.9113)	(-13.6802)	(11.2254)		(0.0000)

Period Random effects							
Panel A: Absolute errors							
c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
-1.1462	0.0049	0.0741	-0.2355	1.0004	0.5286	0.2687	553.6071
(-22.6377)	(0.8890)	(4.1487)	(-27.9929)	(3.0620)	(37.0290)		(0.0000)
Panel B: Non Absolute errors							
0.0022	-0.0001	0.0008	-0.0004	-0.0284	0.0008	0.1534	273.5728
(6.0593)	(-5.0577)	(8.9829)	(-9.9989)	(-13.5666)	(11.1666)		(0.0000)

Controlling for fixed and random effects in panel data revisions regression:

Dependent variable: analyst 1 year ahead EPS forecast revisions, taken between 12 and 1 month prior to year end, scaled by the absolute value of the median minus 12 months prior to year end 1 year ahead EPS forecast

Period Fixed effects

c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
Panel A: Absolute revisions							
3.1659	0.0238	-0.1574	-0.1737	1.3351	0.3873	0.1490	71.9041
(68.0994)	(3.9163)	(-8.0392)	(-19.0022)	(3.5226)	(26.9983)		(0.0000)
Panel B: Non Absolute revisions							
0.0677	0.0051	-0.0462	-0.0038	3.4000	-0.0243	0.1773	87.0316
(3.6735)	(2.6153)	(-5.7254)	(-1.0345)	(19.3561)	(-3.5758)		(0.0000)

Period Random effects

c	RD	BM	MV	PASTR	STDEV	Adj. R-sq.	F-stat.
Panel A: Absolute revisions							
3.1598	0.0239	-0.1573	-0.1725	1.3171	.0.3883	0.1443	246.9444
(55.9869)	(3.9366)	(-8.0951)	(-18.9873)	(3.5354)	(27.1011)		(0.0000)
Panel B: Non Absolute revisions							
0.0631	0.0051	-0.0468	-0.0038	3.3905	-0.0243	0.1207	198.2356
(1.9806)	(2.6375)	(-5.7973)	(-1.0259)	(19.1881)	(-3.5752)		(0.0000)

APPENDIX 5B.K

Appendix 5B.K Part A: Appendix 5B.K Part A contains information on data availability for tables 5B.3, 5B.12, 5B.13 and the main table in the Appendix 5B.C Part H. The table below reports information on the number of cross-sections used and number of the total panel (unbalanced) observations for Tables 5B.3, 5B.12, 5B.13 and the main Table in the Appendix 5B.C Part H.

Data information for Tables 5B.3, 5B.12 and 5B.13 and Appendix 5B.C Part H

	Number of cross-sections used	Total panel (unbalanced) observations
Analyst forecast dispersion		
12 month prior to year end EPS forecast data	868	4,455
6 month prior to year end EPS forecast data	866	4,451
1 month prior to year end EPS forecast data	858	4,368
Regression in Table in Appendix 5B.C Part H	774	3,872
Analyst forecast errors: Errors scaled by price		
12 month prior to year end EPS forecast data	1,075	5,559
6 month prior to year end EPS forecast data	1,055	5,375
Analyst forecast errors: Errors scaled by absolute actual EPS		
12 month prior to year end EPS forecast data	1,084	5,790
6 month prior to year end EPS forecast data	1,117	5,868
Analyst forecast revisions: Revisions scaled by price		
12 6	1,039	5,285
12 1	1,037	5,374
Analyst forecast revisions: Revisions scaled by abs. value of -12 m median EPS forecast		
12 6	1,034	5,235
12 1	1,026	5,345

Appendix 5B.K Part B: Appendix 5B.K Part B shows the Pearson correlation coefficients for independent variables included in the regressions from tables 5B.3, 5B.12, 5B.13 and the main Table in the Appendix 5B.C Part H. (RDS, RDTA, RDMV: R&D/Sales, R&D/TA and R&D/MV; AF12, AF6, AF1: analyst following based on data 12, 6 and 1 month prior to year end as explained in table 5B.3.; MEANEPS 6: average EPS forecast based on data 6 months before year end; PASTR: past return variable as explained in relative regressions; PASTS: past sales variable as explained in relative regressions; D6: analyst forecast dispersion based on data 6 months before year end).

When the variables are used in ln form in the respective regressions, these ln variables are used for Pearson correlation coefficient calculation purposes in the table below.

	RDS	RDTA	RDMV	BM	MV	AGE	STDEV	AF12	AF6	AF1	PASTR	PASTS	D 6
RDS													
RDTA	0.966												
RDMV	0.936	0.949											
BM	-0.245	-0.256	-0.287										
MV	0.051	0.050	0.148	-0.351									
AGE	-0.134	-0.119	-0.095	0.199	0.147								
STDEV	0.007	0.001	0.020	0.010	0.142	-0.004							
AF12	-0.244	-0.250	-0.241	0.712	-0.085	0.258	0.021						
AF6	-0.245	-0.250	-0.241	0.721	-0.086	0.238	0.013	0.930					
AF1	-0.248	-0.251	-0.244	0.703	-0.077	0.225	0.001	0.874	0.928				
PASTR	-0.056	-0.058	-0.089	0.217	-0.259	0.038	-0.099	0.108	0.099	0.089			
PASTS	0.034	0.034	0.014	0.016	-0.125	-0.154	-0.064	-0.076	-0.078	-0.080	0.090		
D 6	0.060	0.047	0.062	-0.119	0.125	-0.012	0.201	-0.065	-0.088	-0.066	-0.088	-0.059	
MEANEPS 6	-0.049	-0.050	-0.058	0.166	0.004	0.020	0.369	0.103	0.101	0.094	0.033	0.045	-0.050

APPENDIX 5B.L

Explanation of why signed errors decrease (implying decrease in optimism as year end approaches), and signed revisions are positive, implying higher forecasts as year end approaches.

Table Appendix 5B.L.I Mean and median signed forecast errors and revisions for 1990-2003
The table shows the mean and median signed errors 1990-2003 using minus 12, 6 and 1 month prior to year end forecast data when actual and forecasted EPS observations above the 0.98 and below the 0.02 percentile have been eliminated (Panel A) and when above the outlier elimination procedure followed for Panel A, error observations above the 0.98 and below the 0.02 percentile have been eliminated (Panel B). Forecast errors are scaled by the absolute value of actual EPS.
At the bottom of the table appear the mean and median signed forecast revisions (revisions +/-100% have been eliminated) between 12 and 6 and 12 and 1 month prior to year end. Forecast revisions are scaled by the absolute value of the median EPS forecast 12 months prior to year end.

Panel A

	12	6	1
mean	0.780	0.530	0.129
median	-0.088	-0.031	-0.012

Panel B

	12	6	1
mean	0.226	0.164	0.117
median	-0.086	-0.031	-0.012

Forecast revisions

	12 6	12 1
mean	2.269	3.545
median	3.694	7.178

Table Appendix 5B.L.II. Positive and negative errors and revisions

The table shows the number of firm-year error observations for the period 1990-2003, using minus 12, 6 and 1 month prior to year end forecast data and the number of positive and negative error observations included, as well as their relative percentages, when actual and forecasted EPS observations above the 0.98 and below the 0.02 percentile have been eliminated (Panel A) and when above the outlier elimination procedure followed for Panel A, error observations above the 0.98 and below the 0.02 percentile have been eliminated (Panel B). Forecast errors are scaled by the absolute value of actual EPS.
At the bottom of the table appear firm year observations for forecast revisions (revisions +/-100% have been eliminated) between 12 and 6 and 12 and 1 month prior to year end and the number of positive and negative revision observations included, as well as their relative percentages. Forecast revisions are scaled by the absolute value of the median EPS forecast 12 months prior to year end.

Panel A				Panel B			
			%				%
12	>0	3914	0.423	12	>0	3728	0.421
	<0	5329	0.577		<0	5137	0.579
	Total	9243	1.000		Total	8865	1.000
6	>0	4459	0.468	6	>0	4265	0.467
	<0	5065	0.532		<0	4869	0.533
	Total	9524	1.000		Total	9134	
1	>0	4708	0.492	1	>0	4523	0.492
	<0	4862	0.508		<0	4665	0.508
	Total	9570	1.000		Total	9188	1.000

Forecast revisions

12 6			%
	>0	4621	0.581
	<0	3335	0.419
	Total	7956	1.000

12 1			%
	>0	4941	0.626
	<0	2949	0.374
	Total	7890	1.000

Table Appendix 5B.L.III. The magnitude of positive and negative errors and revisions

The table shows the magnitude (mean and median values) of forecast errors and revisions for the whole sample, and then for positive and negative errors and revisions separately for the period 1990-2003. For the calculation of errors, there have been used minus 12, 6 and 1 month prior to year end forecast data when actual and forecasted EPS observations above the 0.98 and below the 0.02 percentile have been eliminated (Panel A) and when above the outlier elimination procedure followed for Panel A, error observations above the 0.98 and below the 0.02 percentile have been eliminated (Panel B).Forecast errors are scaled by the absolute value of actual EPS.

At the bottom of the table appears the same information (mean and median revisions for the sample and then for positive and negative revisions) for forecast revisions (revisions +/-100% have been eliminated) between 12 and 6 and 12 and 1 month prior to year end. Forecast revisions are scaled by the absolute value of the median EPS forecast 12 months prior to year end.

Panel A

	Sample			>0			<0		
	12	6	1	12	6	1	12	6	1
mean	0.780	0.530	0.129	2.727	2.098	1.364	-0.730	-0.848	-1.000
median	-0.088	-0.031	-0.012	0.400	0.267	0.202	-0.211	-0.167	-0.089

Panel B

	Sample			>0			<0		
	12	6	1	12	6	1	12	6	1
mean	0.226	0.164	0.117	0.874	0.653	0.479	-0.312	-0.300	-0.245
median	-0.086	-0.031	-0.012	0.365	0.243	0.180	-0.203	-0.158	-0.084

Forecast revisions

	Sample		>0		<0	
	12 6	12 1	12 6	12 1	12 6	12 1
mean	2.269	3.545	17.602	21.614	-18.107	-24.987
median	3.694	7.178	13.021	16.753	-10.732	-18.683

APPENDIX 5B.M

Appendix 5B.M Part A: Appendix 5B.M Part A reports the average signed errors and revisions, (errors scaled by price or by absolute actual EPS, using 12-6-1 month prior to year end forecast data, and revisions scaled by price and absolute value of median EPS, between 12-6 and 12-1 months prior to year end) according to 5 Dispersion quintiles from D1 (low) to D5 (High) using 12-6-1 month prior to year end data for dispersion calculation.

Appendix 5B.M Part B: Appendix 5B.M Part B reports the same information as Appendix 5B.M Part A but this time for absolute errors and revisions.

Appendix 5B.M Part C: Appendix 5B.M Part C reports the Pearson correlation coefficients between the various definitions of errors, revisions (both non absolute) and analyst forecast dispersion.

Appendix 5B.M Part A:

Signed errors:

(D12m, D6m D1m equals dispersion calculated with 12, 6, 1 month prior to year end data)

Error (F-A)/P	-12 month error data			Error (F-A)/A Abs	-12 month error data		
	D12m	D6m	D1m		D12m	D6m	D1m
D1	0.182	0.206	0.226	D1	0.760	0.794	0.597
D2	0.052	-0.013	-0.031	D2	0.498	0.310	0.241
D3	0.118	0.051	0.006	D3	0.709	0.601	0.315
D4	0.202	0.205	0.126	D4	1.150	0.954	1.121
D5	0.289	0.348	0.431	D5	1.188	1.426	2.319
	-6 month error data				-6 month error data		
	D12m	D6m	D1m		D12m	D6m	D1m
D1	0.169	0.175	0.202	D1	0.535	0.532	0.430
D2	0.076	0.031	0.010	D2	0.407	0.374	0.257
D3	0.113	0.081	0.021	D3	0.560	0.729	0.387
D4	0.164	0.203	0.118	D4	0.955	0.838	0.778
D5	0.244	0.262	0.356	D5	0.464	0.441	1.229
	-1 month error data				-1month error data		
	D12m	D6m	D1m		D12m	D6m	D1m
D1	0.167	0.167	0.178	D1	-0.161	-0.103	-0.180
D2	0.071	0.049	0.042	D2	0.391	0.337	0.250
D3	0.112	0.076	0.051	D3	0.473	0.516	0.363
D4	0.148	0.184	0.124	D4	0.791	0.674	0.709
D5	0.249	0.277	0.340	D5	0.338	0.350	0.734

Signed revisions:

Revisions scaled by price

12 6	D12m	D6m	D1m	12 1	D12m	D6m	D1m
D1	3.331	2.542	2.625	D1	3.977	3.581	3.515
D2	2.870	4.089	4.264	D2	3.024	5.832	7.259
D3	0.003	2.856	1.557	D3	0.539	3.452	4.482
D4	-2.027	0.417	-0.528	D4	-1.082	-1.299	-0.119
D5	-3.118	-7.876	-6.377	D5	-2.438	-7.531	-11.085

Revisions scaled by median

12 6	D12m	D6m	D1m	12 1	D12m	D6m	D1m
D1	4.931	4.094	4.118	D1	5.980	5.765	5.653
D2	4.260	6.157	6.371	D2	5.566	9.230	10.630
D3	1.325	4.736	3.184	D3	2.843	6.046	7.461
D4	-0.678	2.046	0.679	D4	0.972	0.642	1.759
D5	-3.383	-9.794	-7.403	D5	-1.741	-9.338	-13.302

Appendix 5B.M Part B:

Absolute errors:

Error (F-A)/P	-12 month error data			Error (F-A)/A Abs	-12 month error data		
	D12m	D6m	D1m		D12m	D6m	D1m
D1	0.367	0.373	0.385	D1	1.957	1.954	1.869
D2	0.232	0.208	0.190	D2	0.723	0.548	0.485
D3	0.265	0.247	0.227	D3	0.972	0.852	0.603
D4	0.342	0.332	0.322	D4	1.443	1.287	1.420
D5	0.470	0.497	0.509	D5	2.039	2.439	2.965
	-6 month error data				-6 month error data		
	D12m	D6m	D1m		D12m	D6m	D1m
D1	0.292	0.288	0.294	D1	1.893	1.767	1.714
D2	0.182	0.164	0.141	D2	0.567	0.524	0.406
D3	0.201	0.191	0.185	D3	0.750	0.901	0.623
D4	0.252	0.274	0.255	D4	1.233	1.123	1.392
D5	0.369	0.385	0.417	D5	1.401	1.968	2.195
	-1 month error data				-1month error data		
	D12m	D6m	D1m		D12m	D6m	D1m
D1	0.209	0.207	0.211	D1	1.530	1.418	1.420
D2	0.124	0.118	0.106	D2	0.506	0.428	0.330
D3	0.153	0.136	0.131	D3	0.628	0.646	0.521
D4	0.186	0.205	0.183	D4	1.034	0.894	1.249
D5	0.274	0.283	0.314	D5	1.140	1.599	1.610

Absolute Revisions:

Revisions scaled by price

12 6	D12m	D6m	D1m	12 1	D12m	D6m	D1m
D1	15.978	16.173	16.519	D1	19.737	20.250	20.613
D2	9.238	9.024	9.875	D2	13.520	13.259	13.176
D3	10.743	10.881	10.806	D3	15.686	15.386	14.554
D4	14.854	13.637	13.970	D4	19.839	18.677	19.135
D5	21.339	22.209	19.863	D5	26.026	26.743	25.758

Revisions scaled by median

12 6	D12m	D6m	D1m	12 1	D12m	D6m	D1m
D1	19.181	19.446	19.986	D1	24.019	24.521	25.254
D2	12.091	11.743	12.800	D2	17.372	17.383	17.554
D3	13.353	13.710	13.560	D3	19.380	19.334	18.763
D4	18.434	17.530	17.724	D4	24.494	23.588	23.558
D5	26.862	27.410	24.208	D5	33.344	33.687	31.805

Appendix 5B.M Part C:

The table reports the Pearson correlation coefficients between dispersion (D12-D6-D1, using minus 12-6-1 month forecast data prior to year end for its calculation), signed forecast errors (FE 12-6-1 using minus 12-6-1 month forecast data prior to year end for their calculation, scaled by price (P) or by the absolute value of actual EPS (M)) and signed forecast revisions (FR between 12 and 6 (12-6) and 12 and 1 (12-1) month prior to year end, scaled by Price (P) or by the absolute value of median EPS (M)).

	D12	D6	D1	FE12 P	FE6 P	FE1 P	FE12 M	FE6 M	FE1 M	FR 12 6 P	FR 12 1 P	FR 12 6 M
D12												
D6	0.519											
D1	0.417	0.565										
FE12 P	0.022	0.101	0.218									
FE6 P	0.073	0.050	0.187	0.943								
FE1 P	0.095	0.072	0.177	0.893	0.935							
FE12 M	0.010	0.033	0.073	0.080	0.063	0.042						
FE6 M	-0.043	-0.018	0.025	0.047	0.060	0.045	0.803					
FE1 M	0.003	-0.007	0.003	0.016	0.022	0.032	0.260	0.813				
FR 12 6 P	-0.015	-0.212	-0.168	-0.329	-0.086	-0.101	-0.057	0.033	0.016			
FR 12 1 P	0.002	-0.152	-0.213	-0.455	-0.294	-0.150	-0.157	-0.022	0.033	0.673		
FR 12 6 M	-0.098	-0.257	-0.199	-0.322	-0.098	-0.109	-0.059	-0.003	-0.025	0.879	0.594	
FR 12 1 M	-0.064	-0.201	-0.257	-0.422	-0.288	-0.164	-0.105	-0.060	-0.019	0.594	0.894	0.659

APPENDIX 5B.N

Appendix 5B.N Part A: Appendix 5B.N Part A presents the results when rerunning the regression as in Appendix 5B.C Part H (dependent variable: Cumulative Returns for next year, e.g. July of year t-June of year t+1 for the base year t-1) by adding factors one by one in order to assess the relative influence of each factor upon its addition in the model. MV and BM are used as single regressors in the model (one by one and both together) and then and R&D intensity variable is added (defining R&D intensity as R&D/Sales, R&D/TA and R&D/MV). Then I add a forecast dispersion variable (D) using -1, -6 and -12 month forecast data for dispersion calculation, when R&D intensity is defined in all these different ways. Appendix 5B.N Part B proceeds with adding Forecast Error (FE) and Forecast Revision (FR) regressors.

c	MV	Adjusted R-squared	F-statistic
0.1719	-0.0110	0.0027	25.1951
(14.5684)	(-5.0479)		(0.0000)

c	BM	Adjusted R-squared	F-statistic
0.0772	0.0619	0.0087	79.2483
(12.1740)	(7.9950)		(0.0000)

c	MV	BM	Adjusted R-squared	F-statistic *
0.0813	-0.0028	0.0817	0.0152	35.2675
(4.3776)	(-1.0175)	(7.8746)		(0.0000)

	c	MV	BM	RD	Adjusted R-squared	F-statistic *
RD=RDS	0.0836	-0.0029	0.0807	-0.0391	0.0157	27.7304
	(4.5052)	(-1.0717)	(7.7874)	(-1.5237)		(0.0000)
RD=RDTA	0.0764	-0.0025	0.0835	0.2086	0.0154	27.1184
	(4.0821)	(-0.9164)	(8.0286)	(0.9910)		(0.0000)
RD=RDMV	0.0703	-0.0018	0.0794	0.7146	0.0203	35.5454
	(3.7672)	(-0.6663)	(7.6556)	(4.5895)		(0.0000)

	c	MV	BM	RD	D	Adjusted R-squared	F-statistic *
RD=RDS							
D=D1	0.0779	-0.0012	0.0832	0.1849	-0.0014	0.0122	11.3478
	(3.2234)	(-0.3680)	(6.0951)	(2.0235)	(-0.0535)		(0.0000)
D=D6	0.0834	-0.0019	0.0806	0.0140	-0.0016	0.0127	11.6284
	(3.3664)	(-0.5463)	(6.0922)	(0.2707)	(-2.9298)		(0.0000)
D=D12	0.0862	-0.0029	0.0789	0.1247	-0.0003	0.0137	12.3239
	(3.3523)	(-0.8384)	(6.2847)	(1.0125)	(-0.5575)		(0.0000)

	c	MV	BM	RD	D	Adjusted R-squared	F-statistic *
RD=RDTA							
D=D1	0.0663	-0.0009	0.0895	0.9038	-0.0014	0.0155	14.1369
	(2.7238)	(-0.2689)	(6.5340)	(2.9233)	(-2.1471)		(0.0000)
D=D6	0.0721	-0.0016	0.0866	0.7926	-0.0016	0.0156	14.1823
	(2.8909)	(-0.4748)	(6.5182)	(2.4710)	(-3.0706)		(0.0000)
D=D12	0.0767	-0.0023	0.0756	1.0839	-0.0004	0.0192	16.9670
	(2.9819)	(-0.6659)	(6.0531)	(3.8610)	(-0.6681)		(0.0000)

	c	MV	BM	RD	D	Adjusted R-squared	F-statistic *
RD=RDMV							
D=D1	0.0761	-0.0014	0.0780	0.8933	-0.0017	0.0175	15.7672
	(3.0791)	(-0.4229)	(5.9143)	(3.9652)	(-3.3117)		(0.0000)
D=D6	0.0710	-0.0007	0.0800	1.0478	-0.0015	0.0172	15.6300
	(2.9442)	(-0.2253)	(5.8906)	(4.0216)	(-2.2569)		(0.0000)
D=D12	0.0767	-0.0023	0.0756	1.0839	-0.0004	0.0192	16.9670
	(2.9819)	(-0.6659)	(6.0531)	(3.8610)	(-0.6681)		(0.0000)

Appendix 5B.N Part B: Appendix 5B.N Part B presents the results when rerunning the regression as in Appendix 5B.C Part H by replacing the independent variable Dispersion (D) by forecast revisions-FR (12 6 and 12 1) and Forecast errors-FE (using -6m data, because dispersion is calculated in Appendix 5B.C Part H with -6m data) and also by including all of Dispersion, FE and FR in the regression, with and without the PASTS (past sales growth during last 2 years) variable when all of D, FE and FR are included in the regressions.

A) Errors and revisions: scaled by price and are non absolute

All of D, FE FR (FR 12 6 and FR 12 1) included in regression, with and without the PASTS variable:

	c	D	RD	PASTS	MV	BM	MEANEPS	FR 12 1	FE	Adjusted R-squared	F-statistic
RD=RDTA	0.0424	-0.0014	0.9237	0.0285	-0.0041	0.0951	0.0414	-0.0013	-0.1020	0.0237	10.3539
	(0.8096)	(-2.0675)	(2.2746)	(0.6967)	(-1.1051)	(6.3859)	(2.6612)	(-4.0775)	(-4.6550)		(0.0000)
RD=RDMV	0.0448	-0.0015	1.1930	0.0300	-0.0041	0.0866	0.0414	-0.0012	-0.1042	0.0267	11.5352
	(0.8684)	(-2.3447)	(3.9847)	(0.7377)	(-1.1037)	(5.9647)	(2.6645)	(-3.8863)	(-4.6827)		(0.0000)

	c	D	RD	MV	BM	MEANEPS	FR 12 1	FE	Adjusted R-squared	F-statistic
RD=RDTA	0.0843	-0.0017	0.8488	-0.0053	0.0888	0.0439	-0.0012	-0.1002	0.0234	11.9522
	(3.2090)	(-2.6676)	(2.5165)	(-1.4611)	(6.3248)	(2.8891)	(-4.0370)	(-4.5824)		(0.0000)
RD=RDMV	0.0894	-0.0018	0.9812	-0.0053	0.0797	0.0435	-0.0011	-0.1014	0.0258	13.0708
	(3.4399)	(-2.9172)	(3.8991)	(-1.4598)	(5.7358)	(2.8693)	(-3.7706)	(-4.5788)		(0.0000)

	c	D	RD	PASTS	MV	BM	MEANEPS	FR 12 6	FE	Adjusted R-squared	F-statistic
RD=RDTA	0.0522	-0.0016	0.8521	0.0177	-0.0038	0.0945	0.0300	-0.0009	-0.0568	0.0179	8.0786
	(0.9976)	(-2.4750)	(2.0530)	(0.4369)	(-0.9988)	(6.0649)	(2.1853)	(-2.4453)	(-2.7824)		(0.0000)
RD=RDMV	0.0544	-0.0018	1.1248	0.0195	-0.0038	0.0862	0.0305	-0.0009	-0.0608	0.0206	9.1965
	(1.0543)	(-2.8035)	(3.5672)	(0.4855)	(-1.0063)	(5.6826)	(2.2224)	(-2.5140)	(-2.9563)		(0.0000)

	c	D	RD	MV	BM	MEANEPS	FR 12 6	FE	Adjusted R-squared	F-statistic
RD=RDTA	0.0831	-0.0020	0.8101	-0.0050	0.0888	0.0313	-0.0008	-0.0587	0.0184	9.6488
	(3.1045)	(-3.1267)	(2.3057)	(-1.3749)	(6.0709)	(2.2979)	(-2.2900)	(-2.9786)		(0.0000)
RD=RDMV	0.0885	-0.0021	0.9360	-0.0050	0.0799	0.0315	-0.0008	-0.0621	0.0206	10.7251
	(3.3411)	(-3.4500)	(3.7035)	(-1.3741)	(5.5266)	(2.3163)	(-2.3355)	(-3.1210)		(0.0000)

D, FE and FR (12 6 and 12 1) are included one by one in the regressions:

	c	RD	PASTS	MV	BM	MEANEPS	D	Adjusted R-squared	F-statistic
RD=RDTA	0.023	0.8421	0.04	-0.0022	0.0933	0.0246	-0.0012	0.0168	10.4578
	(-0.4683)	(2.2126)	(-1.0647)	(-0.6151)	(6.4904)	(-1.9921)	(-2.2251)		(0.0000)
RD=RDMV	0.0219	1.0626	0.0437	-0.002	0.0852	0.0247	-0.0014	0.0192	11.8333
	(-0.4512)	(3.8013)	(-1.1670)	(-0.5598)	(6.0309)	(-2.0043)	(-2.4636)		(0.0000)

	c	RD	PASTS	MV	BM	MEANEPS	FR 12 1	Adjusted R-squared	F-statistic
RD=RDTA	0.0012	0.6420	0.0547	-0.0011	0.0796	0.0322	-0.0006	0.0165	11.8359
	(0.0256)	(1.8634)	(1.4749)	(-0.3235)	(6.0719)	(2.4015)	(-2.4152)		(0.0000)
RD=RDMV	0.0015	0.9028	0.0555	-0.0009	0.0727	0.0327	-0.0005	0.0186	13.2561
	(0.0319)	(3.2640)	(1.4939)	(-0.2815)	(5.6390)	(2.4371)	(-2.2059)		(0.0000)

	c	RD	PASTS	MV	BM	MEANEPS	FR 12 6	Adjusted R-squared	F-statistic
RD=RDTA	0.0187	0.7081	0.0372	-0.0019	0.0889	0.0277	-0.0002	0.0169	12.2728
	(0.4135)	(2.2005)	(1.0538)	(-0.5902)	(6.7588)	(2.3436)	(-0.8927)		(0.0000)
RD=RDMV	0.0179	0.9885	0.0401	-0.0019	0.0807	0.0279	-0.0002	0.0194	13.9438
	(0.3993)	(3.8072)	(1.1380)	(-0.5601)	(6.2689)	(2.3661)	(-0.8115)		(0.0000)

	c	RD	PASTS	MV	BM	MEANEPS	FE	Adjusted R-squared	F-statistic
RD=RDTA	0.0858	0.6044	-0.0006	-0.0057	0.0827	0.0271	-0.0451	0.0146	10.9489
	(1.9011)	(1.8668)	(-0.0179)	(-1.7615)	(6.4691)	(2.5177)	(-2.6995)		(0.0000)
RD=RDMV	0.0871	0.9407	-0.0001	-0.0057	0.0755	0.0278	-0.0489	0.0173	12.8030
	(1.9394)	(3.5907)	(-0.0041)	(-1.7648)	(6.0267)	(2.5940)	(-2.9002)		(0.0000)

B) Errors and revisions: scaled by price and are absolute

All of D, FE FR (FR 12 6 and FR 12 1) included in regression, with and without the PASTS variable:

	c	D	RD	PASTS	MV	BM	MEANEPS	FR 12 1	FE	Adjusted R-squared	F-statistic
RD=RDTA	0.0097	-0.0016	0.8909	0.0254	-0.0003	0.0797	0.0324	0.0018	-0.0410	0.0225	9.9599
	(0.1879)	(-2.4894)	(2.1700)	(0.6449)	(-0.0865)	(5.3753)	(2.1344)	(5.4846)	(-1.7201)		(0.0000)
RD=RDMV	0.0113	-0.0018	1.1541	0.0285	-0.0003	0.0712	0.0325	0.0018	-0.0421	0.0253	11.1029
	(0.2236)	(-2.7851)	(3.8704)	(0.7271)	(-0.0911)	(4.9180)	(2.1430)	(5.4139)	(-1.7699)		(0.0000)

	c	D	RD	MV	BM	MEANEPS	FR 12 1	FE	Adjusted R-squared	F-statistic
RD=RDTA	0.0522	-0.0020	0.8094	-0.0018	0.0753	0.0349	0.0016	-0.0386	0.0208	10.7891
	(1.9460)	(-3.1608)	(2.3525)	(-0.4879)	(5.3795)	(2.3445)	(4.9283)	(-1.6434)		(0.0000)
RD=RDMV	0.0578	-0.0021	0.9649	-0.0018	0.0661	0.0349	0.0015	-0.0389		12.0048
	(2.1675)	(-3.4626)	(3.9357)	(-0.4824)	(4.7687)	(2.3502)	(4.8933)	(-1.6571)	(0.0233)	(0.0000)

	c	D	RD	PASTS	MV	BM	MEANEPS	FR 12 6	FE	Adjusted R-squared	F-statistic
RD=RDTA	0.0409	-0.0016	0.7856	0.0270	-0.0027	0.0840	0.0261	-0.0003	-0.0012	0.0135	6.3606
	(0.7838)	(-0.4480)	(1.8894)	(0.6728)	(-0.7023)	(5.4125)	(1.8741)	(0.8421)	(-0.0501)		(0.0000)
RD=RDMV	0.0422	-0.0018	1.0531	0.0297	-0.0027	0.0760	0.0265	-0.0003	-0.0040	0.0161	7.3789
	(0.8189)	(-2.7461)	(3.3912)	(0.7430)	(-0.7025)	(5.0336)	(1.9059)	(0.9037)	(-0.1643)		(0.0000)

	c	D	RD	MV	BM	MEANEPS	FR 12 6	FE	Adjusted R-squared	F-statistic
RD=RDTA	0.0822	-0.0020	0.7495	-0.0040	0.0786	0.0280	-0.0003	-0.0068	0.0140	7.6027
	(2.9957)	(-3.1354)	(2.1706)	(-1.0749)	(5.4172)	(2.0218)	(-0.7945)	(-0.2863)		(0.0000)
RD=RDMV	0.0873	-0.0021	0.8864	-0.0040	0.0699	0.0280	-0.0003	-0.0081	0.0161	8.6116
	(3.2097)	(-3.4287)	(3.6553)	(-0.0671)	(4.8702)	(2.0341)	(-0.7979)	(-0.3420)		(0.0000)

D, FE and FR (12 6 and 12 1) are included one by one in the regressions:

	c	RD	PASTS	MV	BM	MEANEPS	FR 12 1	Adjusted R-squared	F-statistic
RD=RDTA	-0.0168	0.6476	0.0489	0.0007	0.0752	0.0351	0.0008	0.0189	13.8722
	(-0.3762)	(1.9765)	(1.4160)	(0.2060)	(5.9770)	(2.7395)	(4.1551)		(0.0000)
RD=RDMV	-0.0165	0.9015	0.0501	0.0008	0.0681	0.0354	0.0008	0.0210	15.3487
	(-0.3719)	(3.4023)	(1.4474)	(0.2524)	(5.5219)	(2.7666)	(4.1083)		(0.0000)

	c	RD	PASTS	MV	BM	MEANEPS	FR 12 6	Adjusted R-squared	F-statistic
RD=RDTA	0.0352	0.6775	0.0277	-0.0027	0.0855	0.0266	-0.0001	0.0160	11.8058
	(0.7999)	(2.1729)	(0.8031)	(-0.8167)	(6.6953)	(2.2702)	(-0.3835)		(0.0000)
RD=RDMV	0.0365	0.8855	0.0287	-0.0025	0.0777	0.0269	-0.0001	0.0179	13.1170
	(0.8353)	(3.4521)	(0.8328)	(-0.7794)	(6.2049)	(2.2950)	(-0.3939)		(0.0000)

	c	RD	PASTS	MV	BM	MEANEPS	FE	Adjusted R-squared	F-statistic
RD=RDTA	0.0702	0.5588	0.0103	-0.0043	0.0746	0.0259	-0.0006	0.0124	9.3891
	(1.5450)	(1.7190)	(0.2881)	(-0.3098)	(5.7450)	(2.3710)	(-0.0270)		(0.0000)
RD=RDMV	0.0715	0.8723	0.0112	-0.0043	0.0679	0.0265	-0.0041	0.0147	10.9796
	(1.5811)	(3.2829)	(0.3140)	(-0.3230)	(5.3277)	(2.4289)	(-0.1933)		(0.0000)

APPENDIX 5B.O

Appendix 5B.O Part A: Appendix 5B.O Part A reports the regression results as in Tables 5B.12 and 5B.13 (the impact of R&D intensity on forecast errors and revisions) by including this time the same regressors as in Table 5B.3. This practically means removing the Past return PASTR regressor and adding a variable to account for analyst following-AF. Simple removal of the PASTR variable without adding AF does not change the results qualitatively compared to the results reported below. AF refers to the number of analysts issuing forecasts 12 or 6 months prior to year end for errors, depending on whether -12m or -6m data are used, and in the case of revisions, -6m data every time.

Errors:

Absolute errors								
Panel A: Errors scaled by price:								
	c	RD	BM	MV	STDEV	AF	Adj. R-sq.	F-stat.
12 month prior to year end EPS forecast data								
RD=RDS	-1.2949	0.0145	0.0411	-0.2649	0.7157	0.0309	0.3576	428.1276
	(-16.2898)	(1.7532)	(1.4392)	(-13.6688)	(35.5003)	(0.8226)		(0.0000)
RD=RDTA	-1.2951	0.0082	0.0413	-0.2663	0.7155	0.0293	0.3574	427.6113
	(-16.2789)	(0.9817)	(1.4464)	(-13.6670)	(35.4752)	(0.7810)		(0.0000)
RD=RDMV	-1.3016	0.0186	0.0383	-0.2627	0.7150	0.0304	0.3579	428.5207
	(-16.4001)	(2.1119)	(1.3397)	(-13.5303)	(35.4437)	(0.8117)		(0.0000)
6 month prior to year end EPS forecast data								
RD=RDS	-1.2616	0.0146	0.1140	-0.2771	0.5588	-0.0193	0.2800	284.4997
	(-14.3692)	(1.4946)	(3.4280)	(-12.4304)	(25.3022)	(-0.4443)		(0.0000)
RD=RDTA	-1.2655	0.0188	0.1155	-0.2750	0.5588	-0.0191	0.2803	284.8295
	(-14.4164)	(1.8709)	(3.4727)	(-12.2872)	(25.2950)	(-0.4388)		(0.0000)
RD=RDMV	-1.2713	0.0227	0.1109	-0.2732	0.5584	-0.0194	0.2805	285.1733
	(-14.4832)	(2.2119)	(3.3407)	(-12.2292)	(25.3061)	(-0.4471)		(0.0000)
Panel B: Errors scaled by actual EPS:								
12 month prior to year end EPS forecast data								
RD=RDS	-1.1140	0.0161	0.0757	-0.2081	0.6507	0.0125	0.2782	307.4280
	(-12.3042)	(1.7549)	(2.3179)	(-9.1814)	(28.1077)	(0.2930)		(0.0000)
RD=RDTA	-1.1146	0.0105	0.0763	-0.2093	0.6506	0.0111	0.2780	307.0441
	(-12.3038)	(1.1300)	(2.3335)	(-9.1872)	(28.0888)	(0.2608)		(0.0000)
RD=RDMV	-1.1219	0.0219	0.0723	-0.2053	0.6499	0.0122	0.2785	307.9151
	(-12.4223)	(2.2871)	(2.2082)	(-0.0624)	(28.0793)	(0.2859)		(0.0000)
6 month prior to year end EPS forecast data								
RD=RDS	-1.1110	0.0207	0.1535	-0.2262	0.5300	-0.0111	0.0977	87.1234
	(-10.7207)	(1.9015)	(4.1686)	(-8.4889)	(22.2163)	(-0.2258)		(0.0000)
RD=RDTA	-1.1149	0.0233	0.1553	-0.2244	0.5299	-0.0113	0.0978	87.1539
	(-10.7645)	(2.0636)	(4.2148)	(-8.3930)	(22.2066)	(-0.2291)		(0.0000)
RD=RDMV	-1.1218	0.0271	0.1495	-0.2226	0.5294	-0.0121	0.0970	86.3693
	(-10.8379)	(2.3854)	(4.0634)	(-8.3379)	(22.2060)	(-0.2444)		(0.0000)

Non Absolute Errors								
Panel A: Errors scaled by price:								
	c	RD	BM	MV	STDEV	AF	Adj. R-sq.	F-stat.
12 month prior to year end EPS forecast data								
RD=RDS	0.0045	-0.0001	0.0008	-0.0011	0.0013	0.0007	0.2559	264.9400
	(10.1183)	(-3.3890)	(4.8251)	(-10.2156)	(9.8801)	(4.0530)		(0.0000)
RD=RDTA	0.0045	-0.0001	0.0008	-0.0011	0.0013	0.0007	0.2565	265.7124
	(10.1751)	(-3.7256)	(4.7832)	(-10.3726)	(9.9053)	(4.0444)		(0.0000)
RD=RDMV	0.0045	-0.0001	0.0008	-0.0011	0.0013	0.0007	0.2552	263.8842
	(10.1823)	(-2.1998)	(4.8790)	(-10.2622)	(9.9050)	(4.1120)		(0.0000)
6 month prior to year end EPS forecast data								
RD=RDS	0.0035	0.0000	0.0007	-0.0008	0.0009	0.0006	0.1863	167.8900
	(11.2158)	(-0.2937)	(5.4628)	(-9.5271)	(8.3276)	(4.1756)		(0.0000)
RD=RDTA	0.0035	-0.0001	0.0006	-0.0008	0.0009	0.0006	0.1874	169.1279
	(11.2539)	(-2.7468)	(5.4044)	(-9.6526)	(8.3243)	(4.1053)		(0.0000)
RD=RDMV	0.0035	0.0000	0.0007	-0.0008	0.0009	0.0006	0.1863	167.8900
	(11.2158)	(-1.2937)	(5.4628)	(-9.5271)	(8.3276)	(4.1756)		(0.0000)
Panel B: Errors scaled by actual EPS:								
12 month prior to year end EPS forecast data								
RD=RDS	0.0059	-0.0002	0.0028	-0.0011	0.0018	0.0012	0.2359	238.1405
	(6.5410)	(-2.6628)	(8.0324)	(-4.9952)	(7.3377)	(2.9247)		(0.0000)
RD=RDTA	0.0059	-0.0002	0.0028	-0.0011	0.0018	0.0012	0.2360	238.3349
	(6.5581)	(-2.7054)	(7.9984)	(-5.0127)	(7.3445)	(2.9382)		(0.0000)
RD=RDMV	0.0059	-0.0001	0.0028	-0.0011	0.0018	0.0012	0.2363	238.6179
	(6.5128)	(-1.4997)	(8.0783)	(-4.8774)	(7.3592)	(2.9872)		(0.0000)
6 month prior to year end EPS forecast data								
RD=RDS	0.0049	-0.0001	0.0016	-0.0009	0.0010	0.0009	0.0622	51.9307
	(6.8514)	(-2.0511)	(6.2175)	(-5.1414)	(5.5512)	(2.8410)		(0.0000)
RD=RDTA	0.0049	-0.0001	0.0016	-0.0009	0.0010	0.0009	0.0622	51.9399
	(6.8569)	(-2.0484)	(6.1906)	(-5.1473)	(5.5589)	(2.8557)		(0.0000)
RD=RDMV	0.0049	-0.0001	0.0016	-0.0009	0.0011	0.0009	0.0616	51.4218
	(6.7996)	(-0.9664)	(6.2506)	(-5.0165)	(5.5766)	(2.8988)		(0.0000)

Revisions:

Panel A: Absolute revisions, revisions scaled by price								
12 6	c	RD	BM	MV	STDEV	AF 6	Adj. R-sq.	F-stat.
RD=RDS	2.7501	-0.0084	0.0559	-0.2174	0.3073	-0.0026	0.1825	204.5143
	(32.5735)	(-0.8513)	(1.7276)	(-10.3467)	(13.6760)	(-0.4732)		(0.0000)
RD=RDTA	2.7510	-0.0150	0.0550	-0.2195	0.3074	-0.0028	0.1827	204.8157
	(32.6143)	(-1.5135)	(1.6991)	(-10.4242)	(13.6898)	(-0.5107)		(0.0000)
RD=RDMV	2.7527	-0.0084	0.0574	-0.2178	0.3075	-0.0025	0.1825	204.5041
	(32.5937)	(-0.8183)	(1.7710)	(-10.3100)	(13.6818)	(-0.4582)		(0.0000)
12 1								
RD=RDS	2.8716	0.0126	-0.0183	-0.1797	0.4481	-0.0072	0.2113	248.0344
	(41.9427)	(1.6445)	(-0.7500)	(-10.4432)	(24.4761)	(-1.5642)		(0.0000)
RD=RDTA	2.8692	0.0087	-0.0179	-0.1801	0.4479	-0.0074	0.2111	247.7278
	(41.9403)	(1.1244)	(-0.7329)	(-10.4265)	(24.4711)	(-1.6198)		(0.0000)
RD=RDMV	2.8677	0.0171	-0.0212	-0.1781	0.4477	-0.0071	0.2116	248.4405
	(41.9826)	(2.1580)	(-0.8663)	(-10.3319)	(24.4575)	(-1.5566)		(0.0000)

Panel A: Absolute Revisions, Revisions scaled by abs. value of -12m median EPS forecast:								
12 6	c	RD	BM	MV	STDEV	AF 6	Adj. R-sq.	F-stat.
RD=RDS	2.7097	0.0112	-0.0358	-0.1276	0.3008	-0.0846	0.1525	139.3073
	(27.0090)	(1.0395)	(-0.9906)	(-5.2974)	(12.1490)	(-1.8253)		(0.0000)
RD=RDTA	2.7102	0.0050	-0.0358	-0.1291	0.3005	-0.0862	0.1523	139.1467
	(26.9916)	(0.4667)	(-0.9909)	(-5.3357)	(12.1346)	(-1.8601)		(0.0000)
RD=RDMV	2.7073	0.0086	-0.0373	-0.1278	0.3004	-0.0858	0.1524	139.2188
	(26.9352)	(0.7727)	(-1.0334)	(-5.2635)	(12.1315)	(-1.8532)		(0.0000)
12 1								
RD=RDS	2.9711	0.0304	-0.1668	-0.1258	0.4616	-0.1017	0.1950	187.9302
	(36.5461)	(3.4475)	(-5.9397)	(-6.3568)	(21.6595)	(-2.5943)		(0.0000)
RD=RDTA	2.9677	0.0280	-0.1651	-0.1252	0.4612	-0.1035	0.1947	187.5212
	(36.4527)	(3.1696)	(-5.8720)	(-6.2770)	(21.6241)	(-2.6384)		(0.0000)
RD=RDMV	2.9600	0.0344	-0.1722	-0.1229	0.4607	-0.1032	0.1955	188.4242
	(36.4302)	(3.7420)	(-6.1100)	(-6.1848)	(21.6137)	(-2.6336)		(0.0000)

Panel B: Non absolute revisions, Revisions scaled by Price								
12 6	c	RD	BM	MV	STDEV	AF 6	Adj. R-sq.	F-stat.
RD=RDS	-0.0541	0.0045	-0.0360	0.0141	-0.0385	-0.0017	0.0640	62.6052
	(-2.7387)	(2.1228)	(-5.0616)	(3.1355)	(-6.6866)	(-1.6100)		(0.0000)
RD=RDTA	-0.0548	0.0049	-0.0357	0.0144	-0.0386	-0.0017	0.0641	62.7212
	(-2.7697)	(2.2684)	(-5.0251)	(3.1901)	(-6.7006)	(-1.6219)		(0.0000)
RD=RDMV	-0.0554	0.0023	-0.0365	0.0137	-0.0386	-0.0018	0.0634	61.9619
	(-2.7921)	(1.1931)	(-5.0970)	(3.0466)	(-6.7031)	(-1.7501)		(0.0000)
12 1								
RD=RDS	-0.1210	0.0052	-0.0712	0.0243	-0.0437	-0.0014	0.0636	62.2961
	(-5.6063)	(2.5047)	(-8.8906)	(4.7069)	(-6.2856)	(-1.1244)		(0.0000)
RD=RDTA	-0.1218	0.0053	-0.0709	0.0246	-0.0437	-0.0014	0.0636	62.2970
	(-5.6519)	(2.5127)	(-8.8526)	(4.7573)	(-6.2974)	(-1.1523)		(0.0000)
RD=RDMV	-0.1225	0.0036	-0.0718	0.0241	-0.0438	-0.0015	0.0631	61.7674
	(-5.6792)	(1.8624)	(-8.9573)	(4.6659)	(-6.3005)	(-1.2306)		(0.0000)

Panel B, Non Absolute Revisions, Revisions scaled by abs. value of -12m median EPS forecast:								
12 6	c	RD	BM	MV	STDEV	AF 6	Adj. R-sq.	F-stat.
RD=RDS	-0.0469	0.0037	-0.0424	0.0123	-0.0352	-0.0029	0.0693	57.3436
	(-1.7301)	(1.5495)	(-4.6806)	(1.9664)	(-5.2878)	(-0.2226)		(0.0000)
RD=RDTA	-0.0476	0.0040	-0.0421	0.0126	-0.0352	-0.0030	0.0694	57.4104
	(-1.7519)	(1.7130)	(-4.6453)	(2.0152)	(-5.2955)	(-0.2316)		(0.0000)
RD=RDMV	-0.0473	0.0022	-0.0428	0.0120	-0.0353	-0.0034	0.0690	57.0916
	(-1.7383)	(0.9665)	(-4.7339)	(1.9268)	(-5.3090)	(-0.2622)		(0.0000)
12 1								
RD=RDS	-0.1289	0.0059	-0.0777	0.0402	-0.0461	-0.0359	0.0558	45.8317
	(-4.7926)	(2.4017)	(-6.9897)	(5.7655)	(-4.8923)	(-2.5945)		(0.0000)
RD=RDTA	-0.1301	0.0066	-0.0773	0.0407	-0.0461	-0.0361	0.0560	46.0048
	(-4.8257)	(2.6853)	(-6.9440)	(5.8320)	(-4.9004)	(-2.6154)		(0.0000)
RD=RDMV	-0.1293	0.0038	-0.0783	0.0397	-0.0462	-0.0366	0.0552	45.2929
	(-4.8018)	(1.6170)	(-7.0537)	(5.7094)	(-4.9126)	(-2.6516)		(0.0000)

Appendix 5B.O Part B: Appendix 5B.O Part B reports the regression results as in Tables 5B.12 and 5B.13 (the impact of R&D intensity on forecast errors and revisions) by including this time the regressors one by one. This means adding an R&D, MV, BM, and STDEV regressor one by one to see how the results evolve, when defining errors and revisions according to all mentioned definition in the chapter.

Errors:

Non Absolute errors: Errors scaled by price:

12 month prior to year end EPS forecast data

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	0.0013	0.0000	0.1405	537.5289
	(9.0057)	(0.5577)		(0.0000)
RD=RDTA	0.0013	0.0000	0.1405	537.3965
	(8.8679)	(0.2372)		(0.0000)
RD=RDMV	0.0015	0.0002	0.1421	544.5856
	(10.1114)	(3.6498)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	0.0067	-0.0002	-0.0012	0.1822	469.1880
	(14.5091)	(-3.9409)	(-14.7475)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	0.0024	0.0000	0.0020	0.1796	456.8759
	(14.2079)	(-0.3180)	(14.1244)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	0.0054	-0.0001	-0.0007	0.0012	0.1868	347.0051
	(13.3561)	(-3.4273)	(-10.0109)	(8.5199)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	0.0042	-0.0001	-0.0008	0.0010	0.0012	0.2220	331.6308
	(11.5113)	(-3.5399)	(-10.7360)	(7.0588)	(10.2889)		(0.0000)
RD=RDTA	0.0042	-0.0001	-0.0008	0.0010	0.0012	0.2223	332.2113
	(11.5473)	(-3.7986)	(-10.8339)	(7.0122)	(10.3089)		(0.0000)
RD=RDMV	0.0042	-0.0001	-0.0008	0.0011	0.0012	0.2212	329.9640
	(11.5598)	(-2.2559)	(-10.6209)	(7.1697)	(10.2972)		(0.0000)

Non Absolute errors: Errors scaled by price:

6 month prior to year end EPS forecast data

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	0.0011	0.0001	0.0887	309.0729
	(10.6502)	(1.7424)		(0.0000)
RD=RDTA	0.0011	0.0000	0.0886	308.6075
	(10.5878)	(1.4029)		(0.0000)
RD=RDMV	0.0012	0.0001	0.0908	316.9661
	(11.6108)	(4.5370)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	0.0048	-0.0001	-0.0008	0.1271	296.8959
	(14.7308)	(-2.8481)	(-14.3251)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	0.0019	0.0000	0.0014	0.1215	279.0548
	(14.8781)	(-0.5999)	(13.1164)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	0.0040	-0.0001	-0.0005	0.0009	0.1328	223.9649
	(13.8788)	(-2.4567)	(-10.0703)	(8.3450)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	0.0032	-0.0001	-0.0006	0.0007	0.0009	0.1653	222.6594
	(12.1513)	(-2.4653)	(-10.8018)	(6.8523)	(9.2238)		(0.0000)
RD=RDTA	0.0032	-0.0001	-0.0006	0.0007	0.0009	0.1657	223.3113
	(12.1823)	(-2.9370)	(-10.8868)	(6.8117)	(9.2374)		(0.0000)
RD=RDMV	0.0033	0.0000	-0.0006	0.0007	0.0009	0.1648	221.9641
	(12.1820)	(-1.6871)	(-10.7058)	(6.9251)	(9.2298)		(0.0000)

Absolute errors: Errors scaled by price:

12 month prior to year end EPS forecast data

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	-1.7643	0.0507	0.1114	412.0802
	(-64.1833)	(5.4462)		(0.0000)
RD=RDTA	-1.7719	0.0463	0.1107	409.2257
	(-63.9598)	(4.8897)		(0.0000)
RD=RDMV	-1.7303	0.0739	0.1154	428.9329
	(-62.7922)	(7.6763)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	-0.5020	0.0048	-0.2630	0.1590	398.2804
	(-7.4604)	(0.5535)	(-20.8638)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	-1.5323	0.0437	0.3686	0.1345	324.4762
	(-48.2410)	(4.9494)	(13.8386)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	-0.5838	0.0082	-0.2251	0.1633	0.1590	285.8219
	(-8.5357)	(0.9624)	(-16.1241)	(5.8085)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	-1.2571	0.0114	-0.2633	0.0127	0.6919	0.3414	601.2936
	(-18.9283)	(1.4735)	(-20.8911)	(0.5155)	(37.1612)		(0.0000)
RD=RDTA	-1.2581	0.0046	-0.2653	0.0120	0.6919	0.3412	600.7768
	(-18.9532)	(0.5858)	(-20.8245)	(0.4872)	(37.1539)		(0.0000)
RD=RDMV	-1.2610	0.0172	-0.2610	0.0100	0.6913	0.3416	601.9906
	(-19.0166)	(2.0834)	(-20.5986)	(0.4086)	(37.1089)		(0.0000)

Absolute errors: Errors scaled by price:

6 month prior to year end EPS forecast data

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	-2.0993	0.0540	0.1303	474.9949
	(-68.4074)	(5.0440)		(0.0000)
RD=RDTA	-2.0907	0.0594	0.1310	477.9494
	(-67.9081)	(5.4290)		(0.0000)
RD=RDMV	-2.0564	0.0822	0.1348	494.1529
	(-67.0254)	(7.6539)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	-0.6261	0.0034	-0.3038	0.1842	459.7532
	(-8.7661)	(0.3637)	(-22.3911)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	-1.8309	0.0455	0.4202	0.1561	372.8161
	(-51.6207)	(4.5148)	(14.0349)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	-0.7155	0.0062	-0.2589	0.2017	0.1856	332.8258
	(-9.9757)	(0.6674)	(-17.4644)	(6.5637)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	-1.2407	0.0066	-0.2887	0.0899	0.5399	0.2850	447.1816
	(-17.9549)	(0.7524)	(-21.2975)	(3.1303)	(27.9570)		(0.0000)
RD=RDTA	-1.2417	0.0082	-0.2879	0.0905	0.5398	0.2850	447.2640
	(-17.9850)	(0.9087)	(-21.1586)	(3.1484)	(27.9494)		(0.0000)
RD=RDMV	-1.2440	0.0153	-0.2856	0.0879	0.5395	0.2852	447.8203
	(-18.0405)	(1.6592)	(-20.9882)	(3.0594)	(27.9492)		(0.0000)

Non Absolute Errors; Errors scaled by the absolute value of actual EPS

12 month prior to year end EPS forecast data

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	0.0024	-0.0001	0.0415	149.9834
	(10.0526)	(-0.8910)		(0.0000)
RD=RDTA	0.0025	0.0000	0.0414	149.8166
	(10.2790)	(0.6189)		(0.0000)
RD=RDMV	0.0028	0.0002	0.0422	152.5504
	(11.4456)	(3.1679)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	0.0081	-0.0003	-0.0012	0.0569	133.5388
	(10.1207)	(-3.8372)	(-8.4835)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	0.0050	-0.0001	0.0039	0.0780	185.3250
	(12.8823)	(-1.9923)	(12.2329)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	0.0072	-0.0002	-0.0005	0.0034	0.0800	137.7012
	(9.5276)	(-3.2667)	(-3.9467)	(10.8947)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	0.0055	-0.0002	-0.0006	0.0031	0.0017	0.0925	124.3006
	(7.2839)	(-3.2708)	(-4.5210)	(10.0238)	(7.4350)		(0.0000)
RD=RDTA	0.0055	-0.0002	-0.0006	0.0031	0.0017	0.0924	124.0524
	(7.2989)	(-3.0596)	(-4.5066)	(10.0004)	(7.4448)		(0.0000)
RD=RDMV	0.0055	-0.0001	-0.0006	0.0031	0.0017	0.0915	122.7699
	(7.2791)	(-1.7785)	(-4.2279)	(10.0957)	(7.4517)		(0.0000)

Non Absolute Errors: Errors scaled by the absolute value of actual EPS

6 month prior to year end EPS forecast data

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	0.0017	-0.0001	0.0268	98.2194
	(9.5860)	(-0.9639)		(0.0000)
RD=RDTA	0.0018	0.0000	0.0267	97.9529
	(9.9728)	(0.5250)		(0.0000)
RD=RDMV	0.0020	0.0001	0.0273	100.1454
	(10.9924)	(2.7367)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	0.0057	-0.0002	-0.0008	0.0411	97.7013
	(9.1154)	(-3.2246)	(-7.5664)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	0.0034	-0.0001	0.0026	0.0514	121.7524
	(11.5130)	(-2.1546)	(10.3078)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	0.0052	-0.0002	-0.0004	0.0023	0.0573	98.8592
	(8.6327)	(-3.1305)	(-3.9913)	(9.1782)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	0.0044	-0.0002	-0.0005	0.0022	0.0009	0.0635	84.1657
	(7.2367)	(-3.3490)	(-4.3837)	(8.6820)	(5.2751)		(0.0000)
RD=RDTA	0.0045	-0.0002	-0.0005	0.0022	0.0009	0.0632	83.7905
	(7.2514)	(-3.0122)	(-4.3443)	(8.6529)	(5.2829)		(0.0000)
RD=RDMV	0.0045	-0.0001	-0.0004	0.0022	0.0009	0.0623	82.5449
	(7.2264)	(-1.7133)	(-4.0393)	(8.7718)	(5.2909)		(0.0000)

Absolute Errors: Errors scaled by the absolute value of actual EPS

12 month prior to year end EPS forecast data

	c	RD	Adj. R-sq.	F-stat.			
RD=RDS	-1.4162	0.0421	0.0978	373.9362			
	(-52.8203)	(4.5101)		(0.0000)			
RD=RDTA	-1.4234	0.0379	0.0972	371.7311			
	(-52.7289)	(4.0338)		(0.0000)			
RD=RDMV	-1.3861	0.0627	0.1007	386.3491			
	(-51.2421)	(6.6572)		(0.0000)			
	c	RD	MV	Adj. R-sq.	F-stat.		
RD=RDS	-0.4183	0.0050	-0.2085	0.1275	322.3020		
	(-5.8958)	(0.5537)	(-15.8298)		(0.0000)		
	c	RD	BM	Adj. R-sq.	F-stat.		
RD=RDS	-1.2329	0.0323	0.3301	0.1138	280.6383		
	(-36.6437)	(3.5211)	(12.2049)		(0.0000)		
	c	RD	MV	BM	Adj. R-sq.	F-stat.	
RD=RDS	-0.4969	0.0048	-0.1734	0.1766	0.1277	231.0188	
	(-6.8300)	(0.5289)	(-11.9008)	(6.0818)		(0.0000)	
	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	-1.1349	0.0089	-0.2042	0.0455	0.6311	0.2659	438.9443
	(-15.3063)	(1.0373)	(-14.4312)	(1.6331)	(30.4145)		(0.0000)
RD=RDTA	-1.1356	0.0025	-0.2062	0.0450	0.6312	0.2658	438.6916
	(-15.3159)	(0.2881)	(-14.4366)	(1.6133)	(30.4112)		(0.0000)
RD=RDMV	-1.1380	0.0146	-0.2021	0.0432	0.6305	0.2661	439.3616
	(-15.3694)	(1.6259)	(-4.2457)	(1.5499)	(30.3850)		(0.0000)

Absolute Errors: Errors scaled by the absolute value of actual EPS

6 month prior to year end EPS forecast data

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	-1.6972	0.0507	0.1375	563.5487
	(-55.8665)	(4.6774)		(0.0000)
RD=RDTA	-1.6910	0.0548	0.1379	565.5495
	(-55.4792)	(4.9417)		(0.0000)
RD=RDMV	-1.6595	0.0764	0.1409	579.5828
	(-54.2617)	(7.0796)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	-0.4699	0.0066	-0.2592	0.1705	464.1920
	(-6.1215)	(0.6437)	(-17.7386)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	-1.4663	0.0368	0.4117	0.1559	412.6539
	(-39.5576)	(3.4924)	(13.7452)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	-0.5793	0.0050	-0.2098	0.2359	0.1708	332.4411
	(-7.3727)	(0.4860)	(-12.9267)	(7.3675)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	-1.0525	0.0062	-0.2365	0.1397	0.4893	0.2399	387.8341
	(-13.4270)	(0.6270)	(-15.2795)	(4.4839)	(23.8711)		(0.0000)
RD=RDTA	-1.0533	0.0078	-0.2358	0.1403	0.4893	0.2399	387.8902
	(-13.4449)	(0.7560)	(-15.1759)	(4.4987)	(23.8626)		(0.0000)
RD=RDMV	-1.0556	0.0141	-0.2337	0.1376	0.4890	0.2401	388.2381
	(-13.4854)	(1.3723)	(-15.0358)	(4.4145)	(23.8530)		(0.0000)

Revisions:

Non Absolute Revisions scaled by Price

12 6

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	-0.0199	0.0009	0.0379	124.6836
	(-3.1234)	(0.4632)		(0.0000)
RD=RDTA	-0.0198	0.0010	0.0379	124.7015
	(-3.1259)	(0.5019)		(0.0000)
RD=RDMV	-0.0267	-0.0033	0.0383	125.8076
	(-4.1469)	(-1.7467)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	-0.1094	0.0050	0.0189	0.0449	94.7304
	(-5.3006)	(2.3147)	(5.3695)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	-0.0496	0.0030	-0.0543	0.0510	106.9968
	(-5.9223)	(1.5391)	(-8.1244)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	-0.0816	0.0043	0.0077	-0.0465	0.0514	78.4589
	(-4.2496)	(2.1011)	(2.1598)	(-6.4139)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	-0.0426	0.0044	0.0089	-0.0397	-0.0365	0.0593	70.4130
	(-2.2653)	(2.1115)	(2.4645)	(-5.5789)	(-6.4046)		(0.0000)
RD=RDTA	-0.0432	0.0046	0.0091	-0.0394	-0.0366	0.0594	70.4931
	(-2.2907)	(2.1964)	(2.5052)	(-5.5404)	(-6.4163)		(0.0000)
RD=RDMV	-0.0431	0.0021	0.0082	-0.0402	-0.0366	0.0587	69.6576
	(-2.2798)	(1.1092)	(2.2623)	(-5.6443)	(-6.4167)		(0.0000)

Non Absolute Revisions scaled by Price

12 1

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	-0.0193	-0.0006	0.0125	41.4077
	(-2.7323)	(-0.2693)		(0.0000)
RD=RDTA	-0.0196	-0.0008	0.0125	41.4354
	(-2.7934)	(-0.3707)		(0.0000)
RD=RDMV	-0.0278	-0.0060	0.0135	44.6792
	(-3.9202)	(-3.0760)		(0.0000)

	C	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	-0.1804	0.0066	0.0344	0.0313	66.8151
	(-8.1102)	(2.9743)	(9.1669)		(0.0000)

	C	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	-0.0821	0.0015	-0.0998	0.0475	101.3055
	(-8.1797)	(0.7932)	(-12.9885)		(0.0000)

	C	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	-0.1498	0.0045	0.0168	-0.0838	0.0499	77.5709
	(-7.3673)	(2.2402)	(4.9258)	(-10.7150)		(0.0000)

	C	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	-0.1067	0.0045	0.0185	-0.0762	-0.0413	0.0601	72.7673
	(-5.6644)	(2.2363)	(5.2391)	(-9.9408)	(-6.1647)		(0.0000)
RD=RDTA	-0.1072	0.0044	0.0186	-0.0760	-0.0413	0.0601	72.7002
	(-0.6882)	(2.1484)	(5.2333)	(-9.9020)	(-6.1760)		(0.0000)
RD=RDMV	-0.1073	0.0026	0.0179	-0.0768	-0.0413	0.0597	72.1595
	(-5.6874)	(1.3767)	(5.0687)	(-10.0314)	(-6.1748)		(0.0000)

Absolute Revisions scaled by Price

12 6

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	2.0333	0.0304	0.1306	479.4684
	(64.3070)	(2.9231)		(0.0000)
RD=RDTA	2.0280	0.0273	0.1303	478.5345
	(64.0050)	(2.6077)		(0.0000)
RD=RDMV	2.0490	0.0412	0.1314	483.0915
	(65.3217)	(3.9476)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	3.1572	-0.0117	-0.2341	0.1546	371.0330
	(41.5303)	(-1.1822)	(-16.1649)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	2.1826	0.0236	0.2640	0.1357	314.9608
	(61.0216)	(2.3259)	(8.7084)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	3.1521	-0.0083	-0.2206	0.0931	0.1537	264.0670
	(41.1023)	(0.8339)	(-13.7845)	(2.8787)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	2.8086	-0.0105	-0.2338	0.0389	0.3118	0.1838	252.1014
	(35.7436)	(-1.0791)	(-14.9125)	(1.2348)	(14.0230)		(0.0000)
RD=RDTA	2.8108	-0.0176	-0.2367	0.0376	0.3119	0.1841	252.5834
	(35.8052)	(-1.8049)	(-15.0313)	(1.1944)	(14.0416)		(0.0000)
RD=RDMV	2.8115	-0.0115	-0.2344	0.0410	0.3120	0.1838	252.1333
	(35.7329)	(-1.1367)	(-14.8445)	(1.3021)	(14.0320)		(0.0000)

Absolute Revisions scaled by Price

12 1

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	2.4846	0.0381	0.0823	295.8498
	(98.2468)	(4.3678)		(0.0000)
RD=RDTA	2.4848	0.0385	0.0823	295.9068
	(98.4839)	(4.3835)		(0.0000)
RD=RDMV	2.5091	0.0546	0.0850	306.1697
	(100.2645)	(6.1701)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	3.4643	0.0018	-0.2035	0.1190	283.0450
	(54.9804)	(0.2128)	(-17.2783)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	2.6171	0.0345	0.2162	0.0910	207.2168
	(86.8330)	(4.0193)	(8.7821)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	3.4517	0.0045	-0.1931	0.0581	0.1179	200.2925
	(53.7985)	(0.5385)	(-14.8970)	(2.2607)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	2.9552	0.0073	-0.2058	-0.0283	0.4385	0.2088	304.0300
	(47.8695)	(0.9761)	(-17.2977)	(-1.2118)	(24.3739)		(0.0000)
RD=RDTA	2.9548	0.0031	-0.2071	-0.0286	0.4384	0.2087	303.8337
	(47.8597)	(0.4086)	(-17.2517)	(-1.2198)	(24.3778)		(0.0000)
RD=RDMV	2.9527	0.0110	-0.2044	-0.0301	0.4382	0.2089	304.2866
	(47.8558)	(1.4092)	(-17.1045)	(-1.2835)	(24.3603)		(0.0000)

Non Absolute revisions scaled by the absolute value of the -12m median EPS forecast

12 6

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	0.0037	0.0020	0.0346	112.2503
	(0.5266)	(0.9728)		(0.0000)
RD=RDTA	0.0037	0.0020	0.0346	112.2489
	(0.5239)	(0.9833)		(0.0000)
RD=RDMV	-0.0018	-0.0014	0.0345	112.0467
	(-0.2470)	(-0.6590)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	-0.0618	0.0051	0.0141	0.0397	82.7085
	(-2.6715)	(2.2624)	(3.4852)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	-0.0317	0.0041	-0.0583	0.0478	99.1946
	(-3.3404)	(2.0200)	(-7.1633)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	-0.0467	0.0046	0.0039	-0.0535	0.0470	70.8600
	(-1.9914)	(2.0811)	(0.8764)	(-5.7981)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	-0.0171	0.0048	0.0061	-0.0475	-0.0334	0.0539	63.1775
	(-0.7180)	(2.1085)	(1.3118)	(-4.8307)	(-4.5079)		(0.0000)
RD=RDTA	-0.0178	0.0049	0.0063	-0.0473	-0.0334	0.0539	63.1823
	(-0.7445)	(2.1641)	(1.3481)	(-4.7988)	(-4.5158)		(0.0000)
RD=RDMV	-0.0178	0.0029	0.0055	-0.0482	-0.0335	0.0535	62.6826
	(-0.7439)	(1.2744)	(1.1771)	(-4.9367)	(-4.5170)		(0.0000)

Non Absolute revisions scaled by the absolute value of the -12m median EPS forecast

12 1

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	0.0051	0.0004	0.0031	10.7760
	(0.6350)	(0.1865)		(0.0000)
RD=RDTA	0.0054	0.0006	0.0031	10.7921
	(0.6800)	(0.2809)		(0.0000)
RD=RDMV	-0.0043	-0.0055	0.0037	12.8620
	(-0.5211)	(-2.4425)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	-0.1685	0.0080	0.0375	0.0192	40.6193
	(-7.1008)	(3.2970)	(9.0756)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	-0.0696	0.0030	-0.1186	0.0404	85.1831
	(6.6441)	(1.4240)	(-13.8453)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	-0.1411	0.0059	0.0182	-0.1005	0.0408	62.4697
	(-6.3789)	(2.6365)	(4.3552)	(-10.6884)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	-0.0946	0.0059	0.0200	-0.0928	-0.0448	0.0512	61.1051
	(-4.2767)	(2.5849)	(4.5977)	(-9.3771)	(-5.3920)		(0.0000)
RD=RDTA	-0.0953	0.0061	0.0202	-0.0925	-0.0449	0.0512	61.1319
	(-0.3035)	(2.6565)	(4.6255)	(-9.3311)	(-5.4054)		(0.0000)
RD=RDMV	-0.0954	0.0037	0.0193	-0.0936	-0.0449	0.0506	60.3805
	(-4.3004)	(1.6741)	(4.4414)	(-9.4893)	(-5.4090)		(0.0000)

Absolute revisions scaled by the absolute value of the -12m median EPS forecast

12 6

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	2.3846	0.0327	0.1267	460.7585
	(77.9792)	(3.2266)		(0.0000)
RD=RDTA	2.3751	0.0270	0.1262	458.9427
	(77.3297)	(2.6532)		(0.0000)
RD=RDMV	2.3882	0.0359	0.1269	461.7026
	(78.3197)	(3.4934)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	3.1782	0.0049	-0.1646	0.1375	321.9264
	(40.8457)	(0.4854)	(-11.1855)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	2.4204	0.0310	0.0994	0.1231	280.4134
	(66.8540)	(3.0384)	(3.3216)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	3.2139	0.0060	-0.1814	-0.0513	0.1348	225.5845
	(40.1946)	(0.5907)	(-10.9234)	(-1.5546)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	2.9052	0.0062	-0.1942	-0.1065	0.2876	0.1609	213.9172
	(35.1000)	(0.6092)	(-11.7781)	(-3.2877)	(12.7696)		(0.0000)
RD=RDTA	2.9052	-0.0022	-0.1970	-0.1075	0.2877	0.1609	213.8433
	(35.1033)	(0.2114)	(-11.8841)	(-3.3135)	(12.7712)		(0.0000)
RD=RDMV	2.9045	0.0021	-0.1955	-0.1074	0.2876	0.1609	213.8421
	(35.0664)	(0.1960)	(-11.7665)	(-3.3124)	(12.7636)		(0.0000)

Absolute revisions scaled by the absolute value of the -12m median EPS forecast

12 1

	c	RD	Adj. R-sq.	F-stat.
RD=RDS	2.8453	0.0426	0.0934	337.0485
	(113.2752)	(4.8551)		(0.0000)
RD=RDTA	2.8426	0.0413	0.0932	336.0441
	(112.9356)	(4.6722)		(0.0000)
RD=RDMV	2.8606	0.0537	0.0952	344.0585
	(114.3923)	(5.9661)		(0.0000)

	c	RD	MV	Adj. R-sq.	F-stat.
RD=RDS	3.4953	0.0191	-0.1349	0.1082	252.5329
	(52.8167)	(2.1711)	(-10.8752)		(0.0000)

	c	RD	BM	Adj. R-sq.	F-stat.
RD=RDS	2.8620	0.0424	0.0585	0.0906	204.8995
	(93.1153)	(4.7774)	(2.3467)		(0.0000)

	c	RD	MV	BM	Adj. R-sq.	F-stat.
RD=RDS	3.5173	0.0191	-0.1520	-0.0724	0.1065	177.6057
	(51.7978)	(2.1638)	(-11.0026)	(-2.6675)		(0.0000)

	c	RD	MV	BM	STDEV	Adj. R-sq.	F-stat.
RD=RDS	3.0385	0.0239	-0.1669	-0.1696	0.4332	0.1896	267.9373
	(44.7408)	(2.8825)	(-12.7135)	(-6.6704)	(22.3986)		(0.0000)
RD=RDTA	3.0359	0.0189	-0.1679	-0.1691	0.4330	0.1891	267.1468
	(44.6594)	(2.2672)	(-12.6755)	(-6.6416)	(22.3786)		(0.0000)
RD=RDMV	3.0318	0.0271	-0.1653	-0.1743	0.4324	0.1898	268.3385
	(44.6936)	(3.1363)	(-12.5625)	(-6.8304)	(22.3589)		(0.0000)

APPENDIX 5B.P

The Appendix 5B.P contains the results of Fama-French time series regressions according to 5 analyst divergence of opinion portfolios (1-ρ) for the whole sample, the R&D, zero R&D, and R&D/Sales above the sample median firms. When the RD factor is added, this is calculated with equal-weighted returns either by subtracting the returns the zero R&D firms from the returns of the top 30 percentile R&D/Sales firms as in Table 5B.6, or as in Al Horani-Pope and Stark (2003), as is done in Appendix 5B.C Part A. Panel A. The scaling used for (1-ρ) calculation in Appendix 5B.P is by the absolute value of actual EPS and is consistent with the scaling used for D calculation on the Tables on p.85 of this second Volume.

Panel A: No RD factor						
Sample						
	alpha	RM	SMB	HML	Adjusted R-squared	F-statistic
(1-ρ) (low)	0.0008	1.2456	0.8648	0.0950	0.7460	152.7479
	(0.3445)	(19.8931)	(9.2307)	(1.1698)		(0.0000)
(1-ρ)2	-0.0016	1.2982	0.8111	0.3929	0.7172	131.9984
	(-0.6612)	(18.0533)	(10.0001)	(4.7483)		(0.0000)
(1-ρ)3	0.0010	1.1332	0.4595	0.3183	0.7141	130.0541
	(0.4804)	(16.5604)	(6.1429)	(3.7835)		(0.0000)
(1-ρ)4	-0.0005	1.1092	0.3025	0.3209	0.7421	149.6570
	(-0.2643)	(22.1462)	(4.2698)	(4.7910)		(0.0000)
(1-ρ)5 (High)	-0.0035	1.0636	0.8096	0.2579	0.6661	104.0910
	(-1.5111)	(16.4335)	(9.2996)	(3.1913)		(0.0000)
R&D firms						
(1-ρ) (low)	0.0034	1.3141	0.8977	-0.1488	0.6701	105.9595
	(1.1616)	(15.8529)	(6.7435)	(-1.5346)		(0.0000)
(1-ρ)2	-0.0004	1.3791	0.6023	0.1782	0.6727	107.1809
	(-0.1140)	(15.9019)	(5.5715)	(1.7443)		(0.0000)
(1-ρ)3	0.0016	1.0954	0.3586	0.1880	0.7041	123.9707
	(0.7737)	(18.5128)	(5.2520)	(2.1428)		(0.0000)
(1-ρ)4	-0.0004	1.1203	0.2468	0.2439	0.7164	131.5186
	(-0.1792)	(19.7253)	(2.7988)	(3.6563)		(0.0000)
(1-ρ)5 (High)	-0.0030	0.9725	0.6972	0.0614	0.5740	70.6260
	(-1.1545)	(13.8879)	(6.7350)	(0.6994)		(0.0000)
Zero R&D firms						
(1-ρ) (low)	-0.0005	1.1967	0.8491	0.2396	0.7186	132.9120
	(-0.2119)	(19.2573)	(9.0399)	(2.7836)		(0.0000)
(1-ρ)2	-0.0021	1.2601	0.9328	0.5208	0.6797	110.6493
	(-0.8215)	(16.4485)	(9.9919)	(6.0396)		(0.0000)
(1-ρ)3	0.0004	1.1654	0.5527	0.4189	0.6585	100.6143
	(0.1583)	(13.9852)	(5.7486)	(4.5395)		(0.0000)
(1-ρ)4	-0.0011	1.1097	0.3767	0.3884	0.6901	116.0438
	(-0.4937)	(18.4126)	(5.1363)	(4.8433)		(0.0000)
(1-ρ)5 (High)	-0.0037	1.0887	0.8563	0.3362	0.6475	95.8859
	(-1.4986)	(15.4556)	(9.2841)	(3.9065)		(0.0000)

Panel A Continued

R&D firms with RD/Sales> median

(1-ρ) (low)	0.0083	1.3995	1.0920	-0.5738		0.6242	86.8082
	(2.1187)	(12.4376)	(5.7232)	(-4.1137)			(0.0000)
(1-ρ)2	0.0020	1.3877	0.6572	-0.1376		0.6116	82.3496
	(0.5207)	(12.6300)	(5.0715)	(-1.0598)			(0.0000)
(1-ρ)3	0.0069	1.2465	0.4960	-0.2123		0.5627	67.4807
	(2.0102)	(13.6654)	(3.5555)	(-1.4627)			(0.0000)
(1-ρ)4	-0.0043	1.4256	0.6480	-0.0143		0.5492	63.9457
	(-1.1326)	(10.8753)	(3.5920)	(-0.1245)			(0.0000)
(1-ρ)5 (High)	0.0006	0.9527	0.6427	-0.2107		0.4264	39.4097
	(0.1744)	(8.8149)	(4.2752)	(-1.8399)			(0.0000)

Panel B: Time-series regressions run with an RD factor calculated as (High RD-Zero RD) with equal-weighted returns							
Sample							
	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
(1-ρ) (low)	-0.0008	1.1951	0.8186	0.3094	0.2198	0.7565	121.4085
	(-0.3499)	(18.1600)	(8.8494)	(2.6587)	(2.4022)		(0.0000)
(1-ρ)2	-0.0033	1.2433	0.7608	0.6262	0.2393	0.7293	105.4062
	(-1.3768)	(17.4261)	(10.0430)	(5.0657)	(2.5758)		(0.0000)
(1-ρ)3	0.0004	1.1153	0.4431	0.3945	0.0781	0.7142	97.8200
	(0.1892)	(15.4174)	(5.8103)	(3.4455)	(0.9780)		(0.0000)
(1-ρ)4	-0.0013	1.0832	0.2788	0.4312	0.1131	0.7447	114.0337
	(-0.6600)	(20.7101)	(3.9734)	(4.2788)	(1.4476)		(0.0000)
(1-ρ)5 (High)	-0.0036	1.0607	0.8069	0.2705	0.0129	0.6640	77.5733
	(-1.5125)	(15.3680)	(8.9868)	(2.4449)	(0.1414)		(0.0000)
R&D firms							
(1-ρ) (low)	-0.0001	1.2044	0.7973	0.3171	0.4778	0.7096	95.6889
	(-0.0177)	(15.0691)	(6.2952)	(2.1182)	(3.9875)		(0.0000)
(1-ρ)2	-0.0040	1.2649	0.4978	0.6630	0.4972	0.7195	100.3929
	(-1.3687)	(16.0015)	(5.0389)	(4.6605)	(4.3509)		(0.0000)
(1-ρ)3	-0.0001	1.0411	0.3089	0.4183	0.2362	0.7206	100.9209
	(-0.0671)	(16.7532)	(4.7422)	(3.5977)	(2.8545)		(0.0000)
(1-ρ)4	-0.0017	1.0770	0.2071	0.4281	0.1888	0.7258	103.5446
	(-0.8184)	(19.6598)	(2.5008)	(3.7910)	(2.1041)		(0.0000)
(1-ρ)5 (High)	-0.0038	0.9463	0.6733	0.1726	0.1140	0.5753	53.4985
	(-1.4203)	(13.0647)	(6.3691)	(1.3649)	(1.1915)		(0.0000)
Zero RD firms							
(1-ρ) (low)	-0.0010	1.1798	0.8336	0.3115	0.0737	0.7182	99.7590
	(-0.4359)	(17.3493)	(8.7461)	(2.5921)	(0.7896)		(0.0000)
(1-ρ)2	-0.0026	1.2418	0.9160	0.5987	0.0799	0.6792	83.0245
	(-1.0294)	(16.1251)	(10.0545)	(4.3230)	(0.7739)		(0.0000)
(1-ρ)3	0.0007	1.1753	0.5617	0.3770	-0.0430	0.6567	75.1354
	(0.2755)	(13.4241)	(5.7581)	(2.9310)	(-0.4729)		(0.0000)
(1-ρ)4	-0.0014	1.0988	0.3667	0.4347	0.0475	0.6887	86.7477
	(-0.6207)	(17.1929)	(4.7965)	(3.8126)	(0.5400)		(0.0000)
(1-ρ)5 (High)	-0.0035	1.0954	0.8625	0.3076	-0.0293	0.6454	71.5217
	(-1.3959)	(14.4725)	(9.0609)	(2.6272)	(-0.2982)		(0.0000)
R&D firms with RD/Sales> median							
(1-ρ) (low)	0.0015	1.1872	0.8976	0.3278	0.9246	0.7189	100.1054
	(0.4143)	(11.5689)	(5.3787)	(1.6502)	(5.7589)		(0.0000)
(1-ρ)2	-0.0035	1.2153	0.4994	0.5945	0.7507	0.6984	90.7253
	(-1.0070)	(12.0097)	(3.9690)	(3.3921)	(5.2047)		(0.0000)
(1-ρ)3	0.0030	1.1246	0.3844	0.3053	0.5308	0.6088	61.3124
	(0.9482)	(11.0532)	(3.0929)	(1.4803)	(3.2973)		(0.0000)
(1-ρ)4	-0.0086	1.2909	0.5247	0.5578	0.5867	0.5955	58.0434
	(-2.2048)	(12.3565)	(3.5419)	(2.3000)	(2.8495)		(0.0000)
(1-ρ)5 (High)	-0.0014	0.8889	0.5843	0.0601	0.2777	0.4386	31.2755
	(-0.3426)	(8.1982)	(3.9832)	(0.3188)	(2.0327)		(0.0000)

Panel C: Time-series regressions run with an RD factor calculated as in Al Horani et al (2003) with equal-weighted returns

Sample	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
(1-ρ) (low)	0.0006	1.2400	0.8753	0.1115	0.0946	0.7449	114.1654
	(0.2433)	(19.2270)	(9.2741)	(1.2650)	(0.5424)		(0.0000)
(1-ρ)2	-0.0019	1.2895	0.8274	0.4186	0.1474	0.7167	99.0299
	(-0.7840)	(17.9701)	(9.6662)	(4.5530)	(0.8526)		(0.0000)
(1-ρ)3	0.0016	1.1495	0.4288	0.2700	-0.2765	0.7187	100.0270
	(0.8241)	(17.1467)	(5.8495)	(3.1195)	(-1.9778)		(0.0000)
(1-ρ)4	-0.0006	1.1068	0.3069	0.3278	0.0394	0.7405	111.5847
	(-0.3110)	(21.7615)	(4.2283)	(4.6533)	(0.3253)		(0.0000)
(1-ρ)5 (High)	-0.0027	1.0833	0.7725	0.1994	-0.3347	0.6737	80.9884
	(-1.1759)	(16.6508)	(8.9249)	(2.4415)	(-2.3103)		(0.0000)
R&D firms							
(1-ρ) (low)	0.0015	1.2672	0.9862	-0.0095	0.7979	0.6989	90.9569
	(0.5207)	(15.2009)	(7.9346)	(-0.0895)	(3.1923)		(0.0000)
(1-ρ)2	-0.0023	1.3321	0.6907	0.3175	0.7978	0.7041	93.2258
	(-0.7502)	(16.8806)	(6.7101)	(2.8145)	(4.3189)		(0.0000)
(1-ρ)3	0.0010	1.0819	0.3838	0.2278	0.2280	0.7068	94.3914
	(0.5184)	(17.4851)	(5.4017)	(2.5982)	(1.6712)		(0.0000)
(1-ρ)4	-0.0014	1.0940	0.2964	0.3220	0.4471	0.7313	106.4657
	(-0.7224)	(21.0755)	(3.5155)	(4.2895)	(3.1274)		(0.0000)
(1-ρ)5 (High)	-0.0032	0.9675	0.7066	0.0762	0.0847	0.5718	52.7491
	(-1.2132)	(13.6011)	(6.7224)	(0.8245)	(0.5076)		(0.0000)
Zero RD firms							
(1-ρ) (low)	0.0002	1.2148	0.8149	0.1858	-0.3080	0.7237	102.4985
	(0.1089)	(18.9618)	(8.3198)	(2.0985)	(-1.8386)		(0.0000)
(1-ρ)2	-0.0015	1.2750	0.9048	0.4766	-0.2527	0.6818	84.0095
	(-0.5834)	(16.8565)	(8.9096)	(4.9741)	(-1.2887)		(0.0000)
(1-ρ)3	0.0020	1.2045	0.4790	0.3030	-0.6638	0.6894	87.0073
	(0.8805)	(15.5919)	(5.4755)	(3.2663)	(-4.1154)		(0.0000)
(1-ρ)4	-0.0004	1.1270	0.3441	0.3371	-0.2941	0.6954	89.4665
	(-0.1841)	(18.9681)	(4.5442)	(4.1396)	(-2.2360)		(0.0000)
(1-ρ)5 (High)	-0.0025	1.1185	0.8002	0.2477	-0.5064	0.6659	78.2474
	(-1.0348)	(15.9091)	(8.8632)	(2.8684)	(-3.2232)		(0.0000)
R&D firms with RD/Sales> median							
(1-ρ) (low)	0.0053	1.3266	1.2292	-0.3576	1.2379	0.6682	79.0224
	(1.3506)	(11.9392)	(6.7165)	(-2.4391)	(3.5632)		(0.0000)
(1-ρ)2	-0.0005	1.3251	0.7750	0.0479	1.0628	0.6568	75.1488
	(-0.1439)	(13.1237)	(6.1592)	(0.3538)	(5.0001)		(0.0000)
(1-ρ)3	0.0061	1.2258	0.5349	-0.1509	0.3513	0.5655	51.4380
	(1.8040)	(13.0282)	(3.6606)	(-1.0172)	(1.5443)		(0.0000)
(1-ρ)4	-0.0068	1.3650	0.7623	0.1656	1.0304	0.5867	56.0168
	(-1.8435)	(12.8541)	(4.2159)	(1.1343)	(2.8525)		(0.0000)
(1-ρ)5 (High)	0.0012	0.9654	0.6188	-0.2483	-0.2157	0.4252	29.6633
	(0.3046)	(9.1117)	(3.8330)	(-1.9080)	(-0.7320)		(0.0000)

The table reports the average number of observations according to divergence in opinion (1-ρ) quintiles for the whole sample, the R&D, zero R&D and R&D intensive firms (firms with R&D/Sales>median) from (1-ρ)1 (low) to (1-ρ)5 (High). The scaling used for (1-ρ) calculation is by the absolute value of actual EPS.

	Sample	R&D firms	Zero R&D firms	RD/Sales above median
(1-ρ) (low)	94	34	59	11
(1-ρ)2	94	35	59	18
(1-ρ)3	95	42	53	17
(1-ρ)4	95	44	51	17
(1-ρ)5 (High)	92	28	64	14

APPENDIX 5B.Q

The Appendix reports the average 156 month (July 1991-June2004) monthly returns, both raw and risk-adjusted for the whole sample and the R&D, zero R&D, and R&D intensive firms (firms with an R&D/Sales ratio above the sample median for a particular year) according to 5 analysts forecast dispersion (D) and 5 analyst diversity in opinion portfolios (1-ρ) from low (1) to high (5). Dispersion is defined as the standard deviation in 1 year ahead EPS forecasts, standardized by the absolute value of the mean forecast, and (1-ρ) is defined as in text. The scaling used for (1-ρ) calculation is by the absolute value of actual EPS. One month prior to year end data are used for Dispersion and (1-ρ) calculation.

For the calculation of risk-adjusted returns, sample firms are divided into two size portfolios, using the median MVE as of the end of June in each year t. Then the firms in each of the two portfolios are divided into three BM portfolios: one containing the lower 30% of values for BM, another one with the middle 40%, and finally, a portfolio containing the top 30% of BM ratios. The BM ratio is calculated using the book value at the end of the accounting year t-1 and the MVE at the end of December of t-1. In order to allow for financial data to be made public, the first month for which returns are calculated is July at year t. This results in six size-value portfolios, for which the breakpoints are rebalanced every year. The abnormal return for a firm for a specific month equals its return for the month minus the value-weighted return of the corresponding size-value reference portfolio for the specific month. The value weights for the calculation of the value weighted returns are rebalanced every year, and have been calculated according to market values at the end of June in year t. There are used total returns, which include dividends.

Raw average monthly returns for 156 months				
	Sample	R&D firms	Zero R&D firms	RD/Sales above median
(1-ρ) (low)	0.0122	0.0136	0.0116	0.0168
(1-ρ)2	0.0115	0.0109	0.0122	0.0116
(1-ρ)3	0.0120	0.0114	0.0124	0.0151
(1-ρ)4	0.0099	0.0094	0.0100	0.0061
(1-ρ)5 (High)	0.0082	0.0069	0.0087	0.0087

	Sample	R&D firms	Zero R&D firms	RD/Sales above median
D1 (low)	0.0108	0.0106	0.0107	0.0144
D2	0.0099	0.0091	0.0102	0.0085
D3	0.0096	0.0104	0.0089	0.0104
D4	0.0108	0.0116	0.0102	0.0180
D5 (High)	0.0124	0.0109	0.0130	0.0115

Risk-adjusted average monthly returns for 156 months				
	Sample	R&D firms	Zero R&D firms	RD/Sales above median
(1-ρ) (low)	0.0035	0.0056	0.0025	0.0094
(1-ρ)2	0.0029	0.0028	0.0033	0.0041
(1-ρ)3	0.0034	0.0030	0.0036	0.0076
(1-ρ)4	0.0013	0.0012	0.0012	-0.0006
(1-ρ)5 (High)	-0.0005	-0.0012	-0.0002	0.0013

	Sample	R&D firms	Zero R&D firms	RD/Sales above median
D1 (low)	0.0025	0.0026	0.0023	0.0069
D2	0.0014	0.0009	0.0015	0.0014
D3	0.0009	0.0020	0.0002	0.0031
D4	0.0014	0.0025	0.0006	0.0099
D5 (High)	0.0026	0.0018	0.0029	0.0036

APPENDIX 5B.R

Appendix 5B.R Part A: Appendix 5B.R Part A contains the results of Fama-French time series regressions according to 5 analyst divergence of opinion portfolios (1-ρ) for the whole sample, the R&D, zero R&D, and R&D/Sales above the sample median firms. When the RD factor is added, this is calculated with equal-weighted returns either by subtracting the returns the zero R&D firms from the returns of the top 30 percentile R&D/Sales firms as in Table 5B.6, or as in Al Horani-Pope and Stark (2003), as is done in Appendix 5B.C Part A. Panel A.

Appendix 5B.R Part B: Appendix 5B.R Part B contains the results described as in Appendix 5B.R Part A but this time by running Fama-French time series regressions according to 5 analyst forecast uncertainty V portfolios.

The scaling used for (1-ρ) and V calculation in Appendix 5B.R is by the absolute value of the mean EPS forecast 1 month prior to accounting year end, and is therefore consistent with the scaling used for dispersion calculation on the Tables on p.61 of this second Volume.

(1-ρ) and V calculation, using one year ahead EPS forecast data 1 month prior to year end:

D=V(1-ρ),

Where D= ((standard deviation in forecasts) *(standard deviation in forecasts)/(absolute value of mean EPS forecast)) *10, with the standard deviation of forecasts to be the one used on p.61 for dispersion calculation (standard deviation in forecasts scaled by absolute mean EPS forecast equals dispersion reported in p.61)

ρ =h/(h+s)

V=D/(1-ρ), where h=precision of common information and s=precision of idiosyncratic information

$h=(SE-(D/N))/((SE-(D/N))+D)^2$

$s=D/((SE-(D/N))+D)^2$

SE = squared error of the mean forecast (deflated by the absolute value of actual EPS at year end as reported else in the thesis).
D= defined right above
N = the number of forecasts

Appendix 5B.R Part A:

Panel A: No RD factor						
Sample						
	alpha	RM	SMB	HML	Adjusted R-squared	F-statistic
(1-ρ)1 (low)	-0.0007	1.2665	0.8654	0.1839	0.7301	140.7459
	(-0.3157)	(18.8729)	(8.5239)	(2.2194)		(0.0000)
(1-ρ)2	-0.0007	1.1820	0.6333	0.2661	0.6849	113.2933
	(-0.2945)	(16.8024)	(8.4546)	(3.2467)		(0.0000)
(1-ρ)3	-0.0007	1.1442	0.4515	0.3937	0.7533	158.7614
	(-0.3614)	(19.9351)	(7.0590)	(5.6613)		(0.0000)
(1-ρ)4	0.0004	1.1207	0.3508	0.3332	0.7545	159.7717
	(0.2367)	(21.7614)	(5.3905)	(4.8022)		(0.0000)
(1-ρ)5 (High)	-0.0025	1.1301	0.9079	0.2181	0.6865	114.1132
	(-1.0327)	(16.6238)	(10.5584)	(2.5706)		(0.0000)
R&D firms						
(1-ρ)1 (low)	0.0014	1.3114	0.8025	0.0227	0.6639	103.0378
	(0.5021)	(15.5109)	(6.3694)	(0.2512)		(0.0000)
(1-ρ)2	-0.0002	1.2345	0.4132	0.0296	0.6261	87.5299
	(-0.0753)	(15.1219)	(4.2080)	(0.2748)		(0.0000)
(1-ρ)3	-0.0011	1.0888	0.2709	0.3250	0.7241	136.6076
	(-0.5515)	(19.5205)	(4.0805)	(4.5363)		(0.0000)
(1-ρ)4	0.0017	1.1243	0.2734	0.1647	0.7403	148.2845
	(0.8876)	(20.0847)	(3.6740)	(2.3552)		(0.0000)
(1-ρ)5 (High)	-0.0031	1.1313	0.8963	-0.0091	0.6431	94.0917
	(-1.0978)	(16.3900)	(8.9020)	(-0.0904)		(0.0000)
Zero R&D firms						
(1-ρ)1 (low)	-0.0022	1.2316	0.9159	0.2883	0.7007	121.9591
	(-0.8877)	(18.1031)	(8.7152)	(3.1989)		(0.0000)
(1-ρ)2	-0.0009	1.1691	0.7782	0.4114	0.6513	97.4873
	(-0.3825)	(15.0178)	(9.4813)	(4.7825)		(0.0000)
(1-ρ)3	-0.0005	1.1889	0.5740	0.4435	0.7079	126.2066
	(-0.2442)	(17.1529)	(7.2739)	(5.7186)		(0.0000)
(1-ρ)4	-0.0007	1.1140	0.4017	0.4571	0.6898	115.8730
	(-0.3021)	(17.2591)	(5.4464)	(5.6588)		(0.0000)
(1-ρ)5 (High)	-0.0024	1.1250	0.9009	0.3019	0.6492	96.6236
	(-0.9237)	(14.9102)	(9.2798)	(3.4334)		(0.0000)
R&D firms with RD/Sales> median						
(1-ρ)1 (low)	0.0067	1.4312	1.0000	-0.4430	0.6293	88.7203
	(1.8283)	(12.2730)	(5.5384)	(-3.6339)		(0.0000)
(1-ρ)2	0.0033	1.2563	0.4961	-0.2247	0.5429	62.3596
	(0.8560)	(11.7798)	(3.5484)	(-1.7550)		(0.0000)
(1-ρ)3	-0.0012	1.3159	0.4188	0.0314	0.5281	58.8200
	(-0.3111)	(10.3407)	(2.5045)	(0.2411)		(0.0000)
(1-ρ)4	0.0007	1.3556	0.6016	-0.2229	0.6318	89.6416
	(0.2222)	(13.1160)	(4.7039)	(-1.9999)		(0.0000)
(1-ρ)5 (High)	-0.0001	1.1898	1.1149	-0.2667	0.5329	59.9373
	(-0.0278)	(11.8839)	(7.1613)	(-2.1603)		(0.0000)

Panel B: Time-series regressions run with an RD factor calculated as in Al Horani et al (2003) with EW returns							
Sample							
	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
(1-ρ)1 (low)	-0.0010	1.2594	0.8787	0.2048	0.1199	0.7292	105.3651
	(-0.4320)	(18.6236)	(8.4718)	(2.2549)	(0.6475)		(0.0000)
(1-ρ)2	-0.0007	1.1802	0.6366	0.2712	0.0296	0.6829	84.4364
	(-0.3148)	(16.5575)	(8.0939)	(3.0516)	(0.1925)		(0.0000)
(1-ρ)3	-0.0003	1.1549	0.4313	0.3619	-0.1819	0.7546	120.1458
	(-0.1331)	(19.8454)	(6.4826)	(4.8835)	(-1.3845)		(0.0000)
(1-ρ)4	0.0006	1.1259	0.3410	0.3177	-0.0884	0.7536	119.4921
	(0.3563)	(21.7187)	(4.9232)	(4.3388)	(-0.7265)		(0.0000)
(1-ρ)5 (High)	-0.0020	1.1425	0.8844	0.1811	-0.2116	0.6878	86.3725
	(-0.8362)	(16.6719)	(10.2496)	(2.1129)	(-1.5469)		(0.0000)
R&D firms							
(1-ρ)1 (low)	-0.0003	1.2679	0.8845	0.1519	0.7399	0.6910	87.6741
	(-0.1237)	(15.6921)	(7.6553)	(1.5223)	(3.4272)		(0.0000)
(1-ρ)2	-0.0018	1.1952	0.4873	0.1462	0.6679	0.6499	72.9206
	(-0.6279)	(15.2971)	(5.0871)	(1.2972)	(4.1630)		(0.0000)
(1-ρ)3	-0.0017	1.0742	0.2984	0.3682	0.2473	0.7278	104.6300
	(-0.8342)	(19.1353)	(4.4428)	(4.6480)	(1.7263)		(0.0000)
(1-ρ)4	0.0008	1.1032	0.3132	0.2274	0.3596	0.7497	117.0338
	(0.4395)	(20.5502)	(4.2740)	(3.1498)	(2.7208)		(0.0000)
(1-ρ)5 (High)	-0.0038	1.1119	0.9327	0.0483	0.3286	0.6477	72.2568
	(-1.3746)	(16.0620)	(9.2907)	(0.4651)	(1.9468)		(0.0000)
Zero RD firms							
(1-ρ)1 (low)	-0.0014	1.2503	0.8807	0.2329	-0.3178	0.7056	93.8742
	-(0.5946)	(18.2881)	(7.8913)	(2.4960)	(-1.7370)		(0.0000)
(1-ρ)2	-0.0001	1.1896	0.7396	0.3506	-0.3481	0.6578	75.5024
	(-0.0350)	(15.5170)	(8.4112)	(3.6679)	(-1.8797)		(0.0000)
(1-ρ)3	0.0007	1.2193	0.5167	0.3533	-0.5165	0.7267	104.0206
	(0.3292)	(17.8898)	(6.4368)	(4.2547)	(-3.3887)		(0.0000)
(1-ρ)4	0.0004	1.1404	0.3521	0.3790	-0.4470	0.7046	93.4113
	(0.1949)	(18.6836)	(4.5732)	(4.5053)	(-3.2159)		(0.0000)
(1-ρ)5 (High)	-0.0013	1.1513	0.8514	0.2240	-0.4464	0.6619	76.8530
	(-0.5384)	(15.3759)	(9.0401)	(2.5556)	(-3.0982)		(0.0000)
R&D firms with RD/Sales> median							
(1-ρ)1 (low)	0.0041	1.3652	1.1242	-0.2473	1.1205	0.6682	79.0292
	(1.1727)	(12.6195)	(6.6078)	(-1.9244)	(4.0629)		(0.0000)
(1-ρ)2	0.0009	1.1981	0.6055	-0.0523	0.9872	0.5826	55.0888
	(0.2417)	(11.2802)	(4.2001)	(-0.3843)	(3.6207)		(0.0000)
(1-ρ)3	-0.0033	1.2636	0.5172	0.1863	0.8874	0.5595	50.2097
	(-0.8418)	(12.5742)	(2.8792)	(1.1462)	(2.4648)		(0.0000)
(1-ρ)4	-0.0009	1.3167	0.6748	-0.1076	0.6608	0.6485	72.4882
	(-0.2729)	(13.7158)	(5.1269)	(-0.9364)	(2.6946)		(0.0000)
(1-ρ)5 (High)	-0.0006	1.1784	1.1363	-0.2330	0.1931	0.5312	44.9141
	(-0.1405)	(11.7441)	(6.8292)	(-1.6686)	(0.6571)		(0.0000)

Panel C: Time-series regressions run with an RD factor calculated from the returns of (High RD-Zero RD) firms

	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
Sample							
(1-ρ)1 (low)	-0.0022	1.2192	0.8221	0.3848	0.2060	0.7388	110.6067
	(-0.9324)	(17.9304)	(8.1972)	(3.1548)	(2.0739)		(0.0000)
(1-ρ)2	-0.0018	1.1450	0.5994	0.4231	0.1611	0.6901	87.2879
	(-0.7586)	(15.7263)	(8.0346)	(3.4592)	(1.8637)		(0.0000)
(1-ρ)3	-0.0013	1.1249	0.4339	0.4755	0.0839	0.7540	119.7658
	(-0.6661)	(18.4244)	(6.7720)	(4.5689)	(1.1057)		(0.0000)
(1-ρ)4	-0.0002	1.1019	0.3336	0.4131	0.0819	0.7551	120.5027
	(-0.0917)	(20.7091)	(5.2701)	(4.0860)	(1.0894)		(0.0000)
(1-ρ)5 (High)	-0.0033	1.1054	0.8852	0.3231	0.1077	0.6877	86.3325
	(-1.3466)	(15.2971)	(9.9217)	(2.8263)	(1.1331)		(0.0000)
R&D firms							
(1-ρ)1 (low)	-0.0016	1.2175	0.7165	0.4217	0.4092	0.6954	89.4574
	(-0.5644)	(15.3016)	(5.8878)	(3.0252)	(3.5477)		(0.0000)
(1-ρ)2	-0.0032	1.1404	0.3271	0.4292	0.4098	0.6607	76.4395
	(-1.1072)	(14.8299)	(3.4194)	(2.9038)	(4.0053)		(0.0000)
(1-ρ)3	-0.0024	1.0479	0.2335	0.4986	0.1780	0.7331	107.4205
	(-1.1787)	(18.4012)	(3.6642)	(4.4733)	(2.1398)		(0.0000)
(1-ρ)4	0.0004	1.0838	0.2362	0.3369	0.1766	0.7486	116.3863
	(0.1968)	(20.6773)	(3.3118)	(3.4452)	(2.2472)		(0.0000)
(1-ρ)5 (High)	-0.0048	1.0755	0.8452	0.2280	0.2431	0.6551	74.6153
	(-1.7055)	(15.3636)	(8.5434)	(1.7115)	(2.3706)		(0.0000)
Zero RD firms							
(1-ρ)1 (low)	-0.0027	1.2167	0.9023	0.3515	0.0648	0.6998	91.3269
	(-1.0449)	(17.1363)	(8.5248)	(2.7990)	(0.6538)		(0.0000)
(1-ρ)2	-0.0010	1.1650	0.7746	0.4286	0.0176	0.6490	72.6612
	(-0.4110)	(14.3529)	(9.3906)	(3.1414)	(0.1775)		(0.0000)
(1-ρ)3	-0.0005	1.1886	0.5738	0.4444	0.0010	0.7060	94.0323
	(-0.2392)	(15.9893)	(7.1909)	(3.8353)	(0.0115)		(0.0000)
(1-ρ)4	-0.0006	1.1154	0.4030	0.4511	-0.0061	0.6877	86.3377
	(-0.2735)	(16.6106)	(5.6044)	(3.6216)	(-0.0677)		(0.0000)
(1-ρ)5 (High)	-0.0027	1.1153	0.8921	0.3431	0.0422	0.6474	72.1475
	(-1.0325)	(13.7790)	(8.8070)	(2.8266)	(0.4147)		(0.0000)
R&D firms with RD/Sales> median							
(1-ρ)1 (low)	0.0007	1.2417	0.8265	0.3616	0.8251	0.7109	96.2647
	(0.2127)	(12.1413)	(5.3522)	(2.0081)	(5.2262)		(0.0000)
(1-ρ)2	-0.0020	1.0894	0.3433	0.4842	0.7269	0.6268	66.0827
	(-0.5993)	(11.2739)	(2.5907)	(2.3786)	(4.7203)		(0.0000)
(1-ρ)3	-0.0069	1.1370	0.2551	0.7908	0.7788	0.6246	65.4669
	(-1.8925)	(11.5741)	(1.9873)	(3.6031)	(4.4905)		(0.0000)
(1-ρ)4	-0.0028	1.2443	0.4997	0.2498	0.4848	0.6680	78.9710
	(-0.8784)	(13.7907)	(4.3638)	(1.5264)	(3.4382)		(0.0000)
(1-ρ)5 (High)	-0.0029	1.1023	1.0348	0.1049	0.3811	0.5511	48.5778
	(-0.7417)	(9.7040)	(6.6160)	(0.4594)	(2.0463)		(0.0000)

Appendix 5B.R Part B:

Panel A: No RD factor						
Sample						
	alpha	RM	SMB	HML	Adjusted R-squared	F-statistic
V1 (low)	0.0003	0.9390	0.3364	0.1579	0.6957	119.0939
	(0.1898)	(18.4291)	(5.1780)	(2.3519)		(0.0000)
V2	0.0003	1.0588	0.4567	0.2228	0.7210	134.4904
	(0.1557)	(19.2243)	(6.8048)	(3.3823)		(0.0000)
V3	-0.0006	1.1054	0.5111	0.3536	0.7060	125.0997
	(-0.2649)	(17.1939)	(7.2149)	(5.1762)		(0.0000)
V4	-0.0013	1.2472	0.7960	0.3497	0.7184	132.8312
	(-0.5442)	(19.4082)	(10.5029)	(4.0485)		(0.0000)
V5 (High)	-0.0031	1.5055	1.1223	0.3193	0.7481	154.4090
	(-1.1399)	(20.0309)	(12.0088)	(3.1914)		(0.0000)
R&D firms						
V1 (low)	-0.0007	0.9202	0.2294	0.0234	0.6977	120.2385
	(-0.3706)	(19.2170)	(3.3341)	(0.3775)		(0.0000)
V2	0.0016	1.0475	0.4304	0.1465	0.6878	114.8299
	(0.7674)	(19.5430)	(5.7201)	(1.8903)		(0.0000)
V3	0.0003	1.0882	0.2981	0.2568	0.6320	89.7181
	(0.1064)	(14.2973)	(3.4343)	(3.3413)		(0.0000)
V4	-0.0005	1.2805	0.6777	0.1976	0.6920	117.0808
	(-0.1904)	(17.4902)	(6.6442)	(1.9643)		(0.0000)
V5 (High)	0.0000	1.4944	0.9575	0.0290	0.6723	106.9761
	(0.0139)	(16.1215)	(6.8496)	(0.2836)		(0.0000)
Zero R&D firms						
V1 (low)	0.0006	0.9455	0.4131	0.2357	0.6213	85.7491
	(0.2751)	(15.5234)	(5.3841)	(2.8881)		(0.0000)
V2	-0.0007	1.0784	0.4999	0.2888	0.6763	108.9402
	(-0.3245)	(16.9810)	(6.2568)	(3.7608)		(0.0000)
V3	-0.0014	1.1175	0.6672	0.4181	0.6869	114.3734
	(-0.6043)	(15.9367)	(7.7351)	(5.6534)		(0.0000)
V4	-0.0015	1.2208	0.8522	0.4372	0.6675	104.7172
	(-0.6080)	(16.7922)	(9.8337)	(4.9176)		(0.0000)
V5 (High)	-0.0042	1.4779	1.1818	0.4905	0.6996	121.3018
	(-1.3960)	(18.1371)	(11.4809)	(4.4120)		(0.0000)
R&D firms with RD/Sales> median						
V1 (low)	0.0012	0.9124	0.3076	-0.2419	0.6269	87.8072
	(0.4984)	(13.4187)	(3.0848)	(-3.3593)		(0.0000)
V2	0.0033	1.1631	0.5100	-0.2338	0.5588	66.4312
	(1.0068)	(12.3944)	(3.7287)	(-2.5568)		(0.0000)
V3	0.0014	1.2394	0.4659	0.0264	0.4204	38.4700
	(0.3069)	(8.1943)	(2.8863)	(0.2073)		(0.0000)
V4	0.0018	1.4733	1.0777	-0.1927	0.5773	71.5756
	(0.4222)	(12.7216)	(6.2725)	(-1.3429)		(0.0000)
V5 (High)	0.0049	1.5449	1.0418	-0.4804	0.6720	106.8525
	(1.2931)	(15.6878)	(6.5935)	(-3.5814)		(0.0000)

Panel B: Time-series regressions run with an RD factor calculated as in Al Horani et al (2003) with EW returns

Sample	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
V1 (low)	0.0007	0.9487	0.3182	0.1294	-0.1636	0.6968	90.0560
	(0.4023)	(18.7360)	(4.7685)	(1.8425)	(-1.5729)		(0.0000)
V2	0.0004	1.0603	0.4538	0.2183	-0.0259	0.7192	100.2364
	(0.1853)	(18.7693)	(6.6184)	(3.0908)	(-0.2095)		(0.0000)
V3	-0.0001	1.1172	0.4888	0.3185	-0.2009	0.7077	94.8262
	(-0.0347)	(17.0912)	(6.6751)	(4.3080)	(-1.3771)		(0.0000)
V4	-0.0011	1.2516	0.7879	0.3368	-0.0737	0.7170	99.1532
	(-0.4654)	(19.2518)	(10.2066)	(3.8354)	(-0.4835)		(0.0000)
V5 (High)	-0.0035	1.4962	1.1398	0.3468	0.1571	0.7476	115.7660
	(-1.2913)	(20.0274)	(11.8080)	(3.2937)	(0.7953)		(0.0000)
R&D firms							
V1 (low)	-0.0011	0.9108	0.2471	0.0514	0.1603	0.6987	90.8476
	(-0.5490)	(18.6611)	(3.4102)	(0.7490)	(1.2949)		(0.0000)
V2	0.0005	1.0199	0.4824	0.2284	0.4689	0.7064	94.2189
	(0.2283)	(18.9929)	(6.9161)	(2.8520)	(3.7148)		(0.0000)
V3	-0.0004	1.0730	0.3268	0.3020	0.2584	0.6349	68.3771
	(-0.1408)	(14.4971)	(3.6913)	(3.4445)	(1.3360)		(0.0000)
V4	-0.0007	1.2752	0.6876	0.2132	0.0894	0.6905	87.4373
	(-0.2700)	(17.4909)	(6.4872)	(2.0358)	(0.4605)		(0.0000)
V5 (High)	-0.0025	1.4319	1.0752	0.2143	1.0617	0.7170	99.1868
	(-0.8369)	(17.7680)	(8.6633)	(1.9925)	(4.5301)		(0.0000)
Zero RD firms							
V1 (low)	0.0015	0.9694	0.3680	0.1648	-0.4066	0.6365	68.8409
	(0.7588)	(16.3791)	(4.5716)	(1.9497)	(-3.2137)		(0.0000)
V2	0.0001	1.0975	0.4640	0.2322	-0.3238	0.6836	84.7059
	(0.0398)	(17.2962)	(5.7498)	(2.9278)	(-2.3613)		(0.0000)
V3	-0.0001	1.1493	0.6073	0.3238	-0.5401	0.7098	95.7582
	(-0.0285)	(16.8327)	(7.2377)	(4.2147)	(-3.9164)		(0.0000)
V4	-0.0011	1.2322	0.8307	0.4034	-0.1939	0.6679	78.9194
	(-0.4224)	(16.9168)	(8.9594)	(4.2853)	(-1.0370)		(0.0000)
V5 (High)	-0.0031	1.5030	1.1346	0.4160	-0.4264	0.7062	94.1442
	(-1.0944)	(18.7271)	(10.2852)	(3.6120)	(-1.9071)		(0.0000)
R&D firms with RD/Sales> median							
V1 (low)	0.0007	0.8992	0.3324	-0.2028	0.2235	0.6289	66.6719
	(0.2649)	(13.2405)	(3.1022)	(-2.5685)	(1.3115)		(0.0000)
V2	0.0020	1.1322	0.5681	-0.1423	0.5241	0.5700	52.3707
	(0.6386)	(12.3068)	(3.9271)	(-1.3864)	(2.1285)		(0.0000)
V3	-0.0001	1.2041	0.5324	0.1310	0.5995	0.4308	30.3296
	(-0.0174)	(8.7396)	(3.0436)	(0.8133)	(1.3648)		(0.0000)
V4	0.0011	1.4572	1.1079	-0.1451	0.2730	0.5770	53.8507
	(0.2572)	(12.7192)	(6.0877)	(-0.9102)	(0.7861)		(0.0000)
V5 (High)	0.0019	1.4723	1.1784	-0.2652	1.2323	0.7158	98.6160
	(0.5635)	(16.7927)	(7.9213)	(-2.0779)	(5.1740)		(0.0000)

Panel C: Time-series regressions run with an RD factor calculated from the returns of (High RD-Zero RD) firms							
Sample							
	alpha	RM	SMB	HML	RD Factor	Adjusted R-squared	F-statistic
V1 (low)	0.0003	0.9375	0.3350	0.1644	0.0066	0.6937	88.7409
	(0.1520)	(17.3133)	(5.0502)	(1.7660)	(0.1023)		(0.0000)
V2	-0.0002	1.0435	0.4426	0.2878	0.0667	0.7207	101.0113
	(-0.0986)	(18.0030)	(6.6133)	(2.9171)	(0.9731)		(0.0000)
V3	-0.0010	1.0907	0.4976	0.4161	0.0641	0.7055	93.8206
	(-0.4787)	(16.1081)	(6.6894)	(3.8384)	(0.7364)		(0.0000)
V4	-0.0021	1.2212	0.7722	0.4601	0.1133	0.7200	100.6253
	(-0.8732)	(18.2684)	(9.7244)	(4.0688)	(1.2211)		(0.0000)
V5 (High)	-0.0060	1.4123	1.0371	0.7149	0.4057	0.7762	135.3732
	(-2.3718)	(19.3603)	(12.3222)	(5.4362)	(3.8576)		(0.0000)
R&D firms							
V1 (low)	-0.0007	0.5690	0.0043	0.0166	0.2350	0.7466	115.1450
	(-0.4019)	(6.4702)	(0.0537)	(0.3276)	(4.5698)		(0.0000)
V2	0.0016	0.5132	0.0881	0.1361	0.3576	0.7808	139.0180
	(0.8852)	(6.5082)	(1.0561)	(2.0177)	(7.5946)		(0.0000)
V3	-0.0007	1.0564	0.2690	0.3921	0.1387	0.6353	68.5027
	(-0.2937)	(13.9331)	(2.9749)	(2.8815)	(1.1928)		(0.0000)
V4	-0.0018	1.2378	0.6386	0.3789	0.1859	0.6982	90.6313
	(-0.7127)	(17.0931)	(6.2543)	(2.8367)	(1.7235)		(0.0000)
V5 (High)	-0.0049	1.3374	0.8138	0.6956	0.6836	0.7431	113.0719
	(-1.6977)	(17.2803)	(6.4841)	(4.9648)	(6.0863)		(0.0000)
Zero RD firms							
V1 (low)	0.0009	0.9553	0.4220	0.1943	-0.0425	0.6195	64.0825
	(0.3960)	(14.6833)	(5.3926)	(1.6814)	(-0.5360)		(0.0000)
V2	-0.0007	1.0787	0.5002	0.2874	-0.0014	0.6741	81.1679
	(-0.3096)	(16.1538)	(6.1138)	(2.6670)	(-0.0184)		(0.0000)
V3	-0.0013	1.1192	0.6687	0.4112	-0.0071	0.6849	85.2220
	(-0.5585)	(15.0605)	(7.6888)	(3.6004)	(-0.0817)		(0.0000)
V4	-0.0019	1.2077	0.8402	0.4928	0.0570	0.6661	78.3106
	(-0.7478)	(16.1440)	(9.4399)	(3.7232)	(0.5269)		(0.0000)
V5 (High)	-0.0056	1.4314	1.1392	0.6881	0.2027	0.7049	93.5559
	(-1.9597)	(17.0724)	(11.1054)	(4.3490)	(1.5511)		(0.0000)
R&D firms with RD/Sales> median							
V1 (low)	-0.0001	0.8727	0.2712	-0.0731	0.1731	0.6345	68.2778
	(-0.0296)	(12.8818)	(2.7739)	(0.6742)	(2.1918)		(0.0000)
V2	-0.0001	1.0574	0.4133	0.2149	0.4601	0.5968	58.3586
	(-0.0254)	(11.2245)	(3.3508)	(1.3088)	(3.2511)		(0.0000)
V3	-0.0021	1.1310	0.3666	0.4869	0.4723	0.4498	32.6757
	(-0.4978)	(8.4344)	(2.4550)	(1.7293)	(1.8376)		(0.0000)
V4	-0.0023	1.3448	0.9601	0.3529	0.5596	0.6128	62.3159
	(-0.5559)	(11.5400)	(5.8450)	(1.6524)	(2.9162)		(0.0000)
V5 (High)	-0.0018	1.3337	0.8484	0.4166	0.9198	0.7660	127.8305
	(-0.5803)	(15.8420)	(6.2066)	(2.6672)	(7.6322)		(0.0000)

Chapter 6: The Impact of R&D on the Persistence of Stock Returns: Compensation for Risk or Market Mispricing: A Brief Note

In Chapter 5 Part A, there have been observed exceptionally high and persistent abnormal stock returns for R&D intensive firms. The hypothesis was in favour of a positive relation between R&D and persistence in excess market returns, that could in theory be attributed to either some form of mispricing or risk compensation, while not attempting to explain whether such patterns were due to mispricing or risk; my aim was to broaden the understanding on the implications of R&D investment. There were indeed testified empirically such high and persistent returns for very R&D intensive firms, and the Chapter did not attempt to separate the two possible effects, despite the fact that after having adjusted stock returns for risk arising from differences in firm size and the book-to-market factor, I interpreted the weight of my evidence as consistent with al least some form of mispricing related to the market's slow adjustment to the emerging evidence of significant enhancement in operating performance following recent R&D investment.

Despite this last observation, there is made in this Chapter a short attempt to investigate into the causes of these high and persistent returns for R&D intensive firms. It may seem contradictory that on one hand, I state that the scope of this study is not to decide whether R&D-related market performance is the result of risk or mispricing, and on the other hand there is much discussion dedicated to whether the observed high and persistent returns of R&D intensive firms are due to risk or mispricing. I view though that when research is undertaken on R&D and any aspect or attribute of future market performance, the discussion on the risk versus mispricing issue is inevitable merely because of the need to interpret the results. In other words, this study may not wish to examine whether R&D-related market performance persistence is the result of risk versus mispricing, the need though to put the empirical findings of this study into the more general perspective of the empirical evidence on the valuation implications of R&D investments, as well as to provide a very thorough examination of the research question, justifies the discussion on the risk-mispricing matter that has been dedicated in this Chapter.

Until this point of time in the literature, there have been proposed two explanations with respect to the testified positive relationship between R&D and excess stock returns: a compensation for risk or a market mispricing explanation, as discussed for example in Chan, Lakonishok and Sougiannis (2001). In this context, there have been performed some simple tests in order to assess whether these high and persistent returns reflect indications for the risk of R&D intensive firms or could be evidence of market mispricing.

The above mentioned mispricing explanation, as in Chambers, Jennings and Thomson (2002), predicts that the excess returns of R&D intensive firms would be simply the result of increased earnings due to R&D investment reductions and vice versa. Therefore close to a similar control by Chambers, Jennings and Thomson (2002), I calculate the median ratios of the change in the R&D intensity, over the next one to five years from each base year in the sample period, according to four R&D intensity portfolios. R&D intensity is expressed as R&D/Sales or R&D/TA or R&D/MVE. The relevant results are presented in Table 6.1. As can be observed from the table, there exists no pattern of increases or decreases in R&D activity depending on the degree of R&D intensity that a firm exhibits. Low R&D intensity firms in terms of R&D/Sales or R&D/TA appear to show larger decreases in R&D activity in the long run, whereas high R&D intensity firms in terms of R&D/MVE realise the largest decreases in R&D activity

Insert Table 6.1 here.

In order now to assess directly the impact of changes in R&D on stock returns, I regress stock returns on both the level as well as the change in R&D activity, after controlling for operating performance.

I run the following regression using panel data for the period 1991-2002:

$$RET = \beta_0 + \beta_1 RD + \beta_2 DRD + \beta_3 GI + \varepsilon_{it}$$

(6.1) where:

RET - the 12 month risk-adjusted equal weighted abnormal 1) CAR and 2) BAH, from July of year t until June of year t+1. CAR and abnormal BAHR have been calculated with respect to the monthly value-weighted total returns of 6 annually rebalanced MV-BM portfolios. The first month for which the return is included is July 1992 for the base year 1991 and the last one is June 2004. Returns have been calculated as in Section 5A.4 of the study.

RD - R&D/Sales or R&D/TA or R&D/MVE ratio as at the end of year t-1. R&D represents the R&D expense for the accounting year that ended during the calendar year t-1, and Sales and TA also refer to the year t-1. MV is the market value of equity at the end of December of year t-1.

DRD- the change in the R&D/Sales or R&D/TA or R&D/MVE (depending on what RD represents each time) ratio between the accounting years that end in t-2 and t-1 respectively.

GI -. the per share growth in Gross Income (Sales -COGS) between the accounting years t-2 and t-1.

The regression is run using OLS and White's heteroskedasticity robust errors. Observations above the 0.98 or below the 0.2 percentile have been eliminated. The starting year is 1991 (and not 1990) in order to allow for financial results to become public, given that two independent variables represent changes in operating figures and thus I lose one year in the calculation of the change. The results for this regression are presented in Table 6.2.

Insert Table 6.2 here.

As can be observed from the table, the R&D intensity variable is generally positive and significant, with the exception of the case when it is defined as R&D/Sales where it is not significant in either the CAR or BAH regressions and also negative in the BAH regression. GI is also always positive and significant. The change in R&D intensity variable though DRD though is always negative and of limited significance in the CAR regressions but generally negative and significant at 10% significance level in the BAH ones. This negative sign of DRD is not influenced by time period effects that relate to the New Economy years, as can be observed from the Appendix of the Chapter. This negative sign is the consistent with the mispricing scenario, in which when R&D decreases, earnings increase and so do returns, and also consistent with the results of Chambers, Jennings and Thomson (2002) and Eberhart, Maxwell and Sidique (2004) about the existence of mispricing as a result of changes in R&D activity.

On the other hand, in order to assess whether R&D intensity implies more risk in terms of volatility of measures of operating performance, I go one step further and calculate the average three-year median standard deviation in growth in sales, gross income and EPS for the R&D, zero R&D, and R&D intensive firms in the sample (firms with R&D/Sales or R&D/TA ratios above the median for a particular year). Standard deviation of growth has been calculated using three consecutive year growth observations, for example using the growth rates in operating measures between 1990-1991, 1991-1992 and 1992-1993 in order to calculate the three-year standard deviation in growth for the period 1990-1993. R&D intensity is measured as of the starting year used for the calculation of standard deviation in growth, for example as of the base year 1990 when assessing the three-year standard deviation for the period 1990-1993. As can be observed from Table 6.3, R&D and R&D intensive firms do not exhibit more volatile growth in terms of sales, GI or EPS than zero R&D firms, without controlling for other firms characteristics.

I then assess the average three-year median standard deviation in growth in sales, gross income and EPS for the R&D, zero R&D, and R&D intensive firms according to six MVE-BM portfolios, rebalanced every year. The MVE-BM portfolios have been constructed as in Section 5A.3 of the study. As can be observed from Table 6.3, when one controls for firm size and BM, the R&D reporting and R&D intensive firms do not exhibit greater standard deviation in their growth in sales and gross income compared to the zero R&D firms. They do though exhibit greater standard deviation in the growth of EPS, when one takes firm size and BM characteristics into account (when not controlling for MV-BM, R&D reporting and R&D intensive firms still do not exhibit greater standard deviation in the growth of EPS than zero R&D firms). In the extent to which the volatility in operating growth is perceived as a proxy for risk, the overall results from Table 6.3 result constitute quite mixed evidence regarding the validity of the risk hypothesis as an explanation for persistence in excess stock returns due to R&D.

Insert Table 6.3 here.

In other words, if one controls for the firm characteristics of size and BM, R&D intensive firms are found to exhibit greater volatility in growth than R&D in general and zero R&D firms in terms of EPS, but not so in terms of sales or GI. The fact that the R&D intensive firms do not exhibit greater volatility in Sales or GI growth than R&D in general or zero R&D firms would be a counter indication for risk for these firms. They do though exhibit greater volatility in terms of EPS growth when taking firm size and BM into account, and EPS is the only measure of operating performance after the expensing of R&D. This latter fact could provide the financial markets with risk indications. The issue here is whether one should expect that the financial markets reflect the behaviour of Sales /GI as opposed to EPS at this point. Depending on whether one expects that all available information is incorporated into stock prices, if one assumes that returns are influenced by the behaviour of Sales/GI, the risk explanation for excess stock returns as a result of R&D intensity is not strong and therefore evidence is in favour of the mispricing scenario. The opposite way, if stock prices reflect EPS growth patterns, stock returns for R&D intensive firms should be compensated for the greater risk they carry and therefore the excess risk-adjusted stock returns could very well be a compensation for risk.

Another source of information on the validity of the risk as opposed to the mispricing explanation for excess stock returns would be the characteristics of analyst forecasts for R&D intensive firms. As seen on Chapter 5 Part B, I find that R&D intensity is positively associated with higher dispersion in analyst forecasts, after controlling for other firm characteristics. The decomposition of forecast dispersion into an uncertainty and a divergence of opinion component, gives us though indications that the influence of R&D is primarily on the uncertainty component of analyst forecasts.

In addition, there is confirmed a negative relationship between dispersion and returns, consistent with Diether, Malloy and Scherbina (2002) for the US, with the bottom dispersion portfolio to exhibit a positive alpha in the traditional Fama-French time-series three factor model, which is not statistically significant, and alphas tend to get negative for higher dispersion portfolios, which are also most times not statistically significant. After decomposing dispersion into uncertainty and pure differences in opinion, there is found that as R&D intensity increases, the ability of R&D to influence returns also increases for high dispersion and high forecast uncertainty firms, but the ability of R&D to influence returns is very week for high divergence of opinion firms. This finding implies that in the presence of high R&D intensity, dispersion has an impact on returns mainly through the forecast uncertainty component of forecast dispersion, and not through the divergence of opinion component. Finally, the influence of R&D intensity on both errors and revisions was found to be positive although statistically significant only in the case of long-time revisions, after controlling for other factors.

Taking the findings from the characteristics of analyst forecasts for R&D intensive firms into consideration, there is not a clear indication as to whether there is more risk involved for these firms compared to their non R&D counterparts. On the one hand, R&D intensity is found to be associated with greater analyst forecast dispersion, which would be an indication for greater risk for these firms, if one assumes that dispersion is indeed a purely risk proxy, which is a issue in debate in the literature (Barron and Stuerke, 1998). In the same direction, R&D intensity is found to relate positively to analyst forecast errors and revisions, with a stronger influence on revisions. On the other hand though, decomposing dispersion into uncertainty and pure differences in opinion shows that in the presence of high R&D intensity, dispersion has an impact on returns mainly through the forecast uncertainty component of forecast dispersion, and not through the divergence of opinion component. When trying to interpret this finding by using the Doukas, Kim and Pantzalis (2006) conceptual framework, high uncertainty in forecasts should be associated with lower returns, and therefore this testified strong uncertainty component should be driving returns downwards for these high R&D intensity firms. This is not the case at all though for high R&D firms, given that high R&D firms have been generally associated with very high returns. Following this line of reasoning, the returns of these high R&D and high forecast uncertainty firms should be more due to market mispricing.

Under these circumstances, the risk and the mispricing explanation for the observed high and particularly persistent excess returns for R&D intensive firms appear to co-exist: we get evidence on the existence of both, and the existence of one would not preclude the other. A very useful insight into this discussion was provided by the finding that after having made use of stock returns adjusted for risk arising from differences in firm size and the book-to-market factor, there has been still observed undervaluation of R&D intensive firms for a number of years after R&D investments are initially undertaken, and therefore I interpret my evidence at this point to be consistent with *at least some* form of market mispricing mainly related to the market's slow adjustment to emerging evidence of significant enhancement in operating performance due to R&D. The fact that the observed relation between R&D and persistence in market performance is observed at the sample level independent of industry factors, while the link of R&D and operating growth is at the industry level only provides further weight to the mispricing interpretation. Despite this evidence though that led to clearly stating that the mispricing explanation cannot be precluded, I cannot completely discard the risk compensation explanation given other kinds of evidence discussed in Chapter 6 on R&D and risk. In addition, evidence on R&D, the attributes of analyst forecasts and subsequent stock returns from Chapter 5B also indicates the existence of possible market mispricing for R&D

intensive firms. Therefore this study may not have the scope to assess whether the association between R&D and market performance is due to risk or mispricing, but thorough its empirical findings and their interpretation there are observed some evidence on market mispricing as a result of R&D investment. Having argued that the empirical evidence of this study does not provide (and was not meant to provide) an definitive answer on whether R&D-related market performance is due to risk or mispricing, despite getting evidence that is in some support of the direction of the mispricing explanation, a final comment would be that both of these explanations could be valid to some extent, and the direction to which they can lead is the existence of high and persistent excess returns for R&D intensive firms, which is exactly what is testified empirically.

Chapter 6 Tables:

Table 6.1. Changes in R&D investment for firms that differ in R&D intensity

The table reports the median change in R&D intensity over the next 1 to 5 years after each base year 1990-1998 (from t+1 to t+5), according to R&D intensity portfolios (1=lowest, 4 highest). R&D intensity portfolios are defined as R&D/Sales, R&D/Total Assets and R&D/Market value of equity, with MVE as of the end of the calendar year.

R&D intensity=R&D/Sales				
	1	2	3	4
t+1	-0.056	-0.018	-0.015	-0.026
t+2	-0.114	-0.078	-0.027	-0.058
t+3	-0.222	-0.183	-0.069	-0.075
t+4	-0.310	-0.247	-0.150	-0.184
t+5	-0.667	-0.330	-0.257	-0.147

R&D intensity=R&D/TA				
	1	2	3	4
t+1	-0.087	0.010	-0.013	-0.022
t+2	-0.152	-0.025	-0.035	-0.069
t+3	-0.333	-0.111	-0.068	-0.105
t+4	-0.479	-0.209	-0.193	-0.197
t+5	-0.692	-0.357	-0.329	-0.258

R&D intensity=R&D/MVE				
	1	2	3	4
t+1	-0.058	0.030	-0.095	-0.130
t+2	-0.128	0.082	-0.095	-0.314
t+3	-0.229	0.027	-0.110	-0.428
t+4	-0.360	-0.145	-0.162	-0.561
t+5	-0.481	-0.181	-0.304	-0.656

Table 6.2. Control for mispricing in stock returns due to the level and change in R&D activity

The table reports the coefficient estimates and values of t-statistics (in parentheses) that have been estimated by running the following panel data regression: RET = $\beta_{0+}\,\beta_1$RD+ β_2DRD+β_3GI++ε_{it} for the period 1991-2002. The dependent variable RET equals the 12 month risk-adjusted equal-weighted abnormal 1) CAR and 2) BAH, from July of year t until June of year t+1. CAR and abnormal BAHR have been calculated with respect to the monthly value-weighted total returns of 6 annually rebalanced MV-BM portfolios, as explained in Chapter 5.4. RD represents the R&D expense for the accounting year that ended during the calendar year t-1, scaled either by Sales at t-1, Total Assets at t-1 or MV, that is the market value of equity at the end of December of year t-1. DRD equals the change in the R&D/Sales or R&D/Total assets or R&D/MV (depending on what RD represents each time) ratio between the accounting years that end in t-2 and t-1 respectively. GI denotes the change in Gross Income (Sales -COGS) between the accounting years t-1 and t. The regression is run using OLS and White's Heteroskedasticity robust standard errors. Observations of CAR and BAHR above the 98 and below the 2 percentile were eliminated. In the last column appear the p-values of the F statistics.*

	Dependent variable: CAR						Dependent variable: BAHR					
	Constant	RD	DRD	GI	Adj. R2	F statistic	Constant	RD	DRD	GI	Adj. R2	F statistic
RD=RD/Sales	-0.0816	0.0027	-0.0105	0.0929	0.0103		-0.1073	-0.0425	-0.0111	0.0920	0.0104	
	(-2.9987)	(0.0441)	(-1.4852)	(3.6706)		(0.0000)	(-3.9848)	(-0.8562)	(-1.8357)	(3.7259)		(0.0000)
RD=RD/TA	-0.0961	0.8246	-0.0107	0.0856	0.0210		-0.1193	0.7580	-0.0117	0.0816	0.0183	
	(-3.5224)	(3.4377)	(-1.2859)	(3.4987)		(0.0000)	(-4.2559)	(2.6621)	(-1.7569)	(3.2721)		(0.0000)
RD=RD/MV	-0.1024	0.8837	-0.0065	0.0932	0.0241		-0.1024	0.8837	-0.0065	0.0932	0.0241	
	(-3.7097)	(3.7098)	(-1.2188)	(3.6804)		(0.0000)	(-3.7097)	(3.7098)	(-1.2188)	(3.6804)		(0.0000)

Table 6.3. Volatility in operating growth for R&D, zero R&D and R&D intensive firms

The table reports the sample period average of the median three-year standard deviation in growth in sales, gross income (GI) and positive EPS for the R&D, zero R&D and R&D intensive firms (firms with R&D/Sales or R&D/TA ratios above the sample median for a particular year) according to 6 MV-BM portfolios for the period 1990-2003. The portfolios have been constructed as explained in Chapter 5.3. Standard deviation of growth has been calculated using three consecutive year growth observations, for example using the growth rates in operating measures between 1990-1991, 1991-1992 and 1992-1993 in order to calculate the three-year standard deviation in growth for the period 1990-1993. R&D intensity is measured as of the starting year used for the calculation of standard deviation in growth, for example as of the base year 1990 when assessing the three-year standard deviation for the period 1990-1993. The table also reports the averages of the median three-year standard deviation in growth in sales, gross income and EPS for all the R&D, zero R&D and R&D intensive firms in the sample.

	MVE-BM	R&D firms	Zero R&D firms	R&D/TA above median firms	R&D/Sales above median firms
Sales	low-low	0.193	0.205	0.204	0.199
	low-mid	0.141	0.153	0.141	0.146
	low-high	0.127	0.138	0.138	0.138
	high-low	0.155	0.172	0.164	0.168
	high-mid	0.116	0.121	0.112	0.109
	high-high	0.099	0.123	0.176	0.173
	All firms	0.129	0.147	0.142	0.144
GI	low-low	0.228	0.249	0.233	0.253
	low-mid	0.173	0.190	0.171	0.178
	low-high	0.221	0.204	0.195	0.217
	high-low	0.186	0.205	0.201	0.202
	high-mid	0.148	0.157	0.144	0.144
	high-high	0.134	0.169	0.170	0.168
	All firms	0.164	0.193	0.179	0.176
EPS	low-low	0.354	0.318	0.360	0.375
	low-mid	0.469	0.371	0.383	0.438
	low-high	0.621	0.496	0.647	0.454
	high-low	0.286	0.231	0.269	0.265
	high-mid	0.313	0.235	0.332	0.337
	high-high	0.307	0.278	0.460	0.316
	All firms	0.325	0.300	0.303	0.291

APPENDIX CHAPTER 6

This appendix contains controls for time period effects as a result of the New Economy in the late 1990's/early 2000 on stock returns in the regressions in Table 6.2 of the Chapter.

The regression in Table 6.2 is repeated by excluding the base years 1998 to 2000. The relevant results are presented in the table below. I also repeat the regressions for the whole sample period 1990-2002 by including a dummy variable that takes the value of 1 if the data refers to the base years 1998 or 1999 or 2000, and zero other wise. The relevant results are also presented in the table below.

Table 6.2: Controls for the New Economy time effects

Panel A: Regression as in Table 6.2 run by excluding the base years 1998, 1999 and 2000

	Dependent variable: CAR						Dependent variable: BAHR					
	Constant	RD	DRD	GI	Adj R2	F statistic	Constant	RD	DRD	GI	Adj R2	F statistic
RD=RD/Sales	-0.0693	-0.0054	-0.0075	0.0684	0.0066		-0.1059	-0.0673	-0.007	0.0826	0.0094	
	(-2.7794)	(-0.1156)	(-1.1846)	(3.0177)		(0.0057)	(-3.5530)	(-1.4433)	(-1.3388)	(3.0324)		-0.0008
RD=RD/TA	-0.0781	0.7141	-0.0096	0.0579	0.0149		-0.1094	0.6823	-0.009	0.0647	0.0138	
	(-3.227)	(2.6521)	(-1.1807)	(2.7190)		(0.0000)	(-3.6250)	(2.1409)	(-1.3270)	(2.4124)		(0.0000)
RD=RD/MV	-0.0862	0.7686	-0.0056	0.0646	0.0210		-0.119	0.6807	-0.006	0.0744	0.0174	
	(-3.5055)	(3.1398)	(-1.017)	(2.9114)		(0.0000)	(-3.8181)	(1.8419)	(-1.3165)	(2.6615)		(0.0000)

Panel B: Regression as in Table 6.2 run for the sample period 1990-2002 by including a dummy variable that takes the value of 1 for the years 1998, 1999 and 2000, and zero otherwise.

	Dependent variable: CAR							Dependent variable: BAHR						
	Constant	RD	DRD	GI	Time Dummy	Adj R2	F statistic	Constant	RD	DRD	GI	Time Dummy	Adj R2	F statistic
RD=RD/Sales	-0.0941	0.0000	-0.0106	0.0923	0.0553	0.0148		-0.1158	-0.045	-0.0112	0.0916	0.0379	0.012	
	(-3.4558)	(0.0002)	(-1.4609)	(3.6819)	(2.7872)		(0.0000)	(-4.2660)	(-0.9187)	(-1.8168)	(3.7193)	(1.8733)		(0.0000)
RD=RD/TA	-0.1089	0.806	-0.0098	0.085	0.057	0.0259		-0.1281	0.7441	-0.0113	0.0811	0.04	0.0201	
	(-3.9912)	(3.3938)	(-1.2113)	(3.5047)	(2.9370)		(0.0000)	(-4.5493)	(2.6273)	(-1.7066)	(3.2617)	(2.0308)		(0.0000)
RD=RD/MV	-0.1185	0.9094	-0.0065	0.092	0.0672	0.0313		-0.138	0.8324	-0.0074	0.0891	0.0519	0.0237	
	(-4.2975)	(3.822)	(-1.2231)	(3.6809)	(3.6358)		(0.0000)	(-4.7570)	(2.3520)	(-1.7386)	(3.4755)	(2.7306)		(0.0000)

Chapter 7: Conclusion

The first scope of this PhD thesis is to build on existing evidence about the relation between R&D and future operating and stock market performance by focusing for the first time on the consistency and persistence aspect of future performance. At the same time there is provided, for the first time, a complete characterisation of the UK pattern of growth and persistence of sales, gross earnings and earnings per share across the whole spectrum of firms listed on the London Stock Exchange (LSE) and the Alternative Investment Market (AIM). The Thesis extends previous UK evidence by assessing the impact of R&D on consistency in operating performance, when previous research for the UK on R&D-related valuation issues has simply focused on the relation between R&D and market performance. Unlike previous studies, the Thesis also covers the period 1999-2003, which is a period of increased R&D activity for the UK. There is examined for the first time whether R&D investments lead to higher subsequent operating growth in a persistent manner, defining persistence as achieving growth rates above the sample growth rate median for a consecutive number of years. The research hypothesis is in favour of a positive relation between R&D intensity and future persistent operating growth due to certain fundamental economic characteristics of the R&D investment. Furthermore, this study performs industry sector analysis on R&D and subsequent consistency in operating performance growth, which is an issue that provides better understanding of the implications of R&D investments depending on the R&D intensity of the sector in which the investment is undertaken.

There are used all UK listed non financial firms for the period 1990-2003 and after controlling for firm size and the book-to-market factors, there is indeed found a relation between R&D intensity and consistent growth is sales and gross income, but only in the cases when taking the sector in which a firm operates into account. On average, an R&D intensive firm is not found to show more persistent growth compared to a non-R&D firm. But when I assess persistence in growth among firms that engage in R&D, because of the sector in which they belong or the general nature of their operations, R&D intensity appears to be playing a role for persistent growth. This result could also be a manifestation of the fact that company resilience depends not only on the amount of R&D spent being wise and balanced, but also on good choices from a strategic point of view and excellence in firm operations. The above finding though is found to apply only to measures of operating performance in the higher steps of the income statement, sales and gross income specifically; R&D does not appear to play a role for EPS persistence for R&D intensive industries. Finally, judging from the results about the significance of the R&D intensity variable when I regress future growth in sales, gross income and EPS on R&D intensity and other control variables, R&D intensity appears to be consistently an influencing factor for future growth in operating performance, which constitutes the first evidence of this kind on the impact of R&D investments on future operating performance for the UK.

The study also builds on the existing literature on R&D and subsequent stock market performance by examining for the first time explicitly the relation between R&D intensity and *persistence* in risk-adjusted excess stock returns for up to five years ahead, taking into account risk differences that arise from differences in firm size and book-to-market ratios, when previous research on R&D and future market performance has mainly focused on the association between R&D and future stock returns in general, without assessing the sustainability of these returns. I hypothesise in favour of a positive relation between R&D and consistency in stock market performance that could in theory be attributed to either some form of mispricing or risk compensation. There is indeed found for the UK market a positive relation between R&D intensity and subsequent abnormal risk-adjusted stock returns, both cumulative and buy-and-hold. But the returns of the R&D firms are on average, not found to be higher than the returns of the zero-R&D firms, with the exception of the highest R&D intensity portfolios, which exhibit the highest returns. More importantly though, I build on existing literature by finding that R&D intensity also improves *persistence* in stock returns, expressed as achieving excess returns above the median excess return of the sample for a consecutive number of years: the highest R&D intensity firms are found to earn higher risk-adjusted excess returns than the sample median return more consistently, compared to lower R&D intensity, as well as zero-R&D firms. Although the underlying rationale for the positive relation between R&D intensity and stock market performance basically goes beyond the scope of the thesis, these findings provide some insight into the discussion of whether R&D-related market performance is the result of market compensation for risk or market mispricing. Having made use of stock returns adjusted for risk arising from differences in firm size and the book-to-market factor, there has been still observed undervaluation of R&D intensive firms for a number of years after R&D investments are initially undertaken, and therefore I interpret the weight of my evidence as consistent with some form of mispricing related to the market's slow adjustment to the emerging evidence of significant enhancement in operating performance following recent R&D investment.

A limitation that exists by construction in this type of study has to do with the existence of possible survivorship biases: when assessing persistence in growth or stock returns for the next one to five years, there are taken into account only the firms that survive during this time period. Given that they survive, these firms could be more successful. By including the growth rates and returns of the surviving firms, I could be including the rates and returns of the more successful firms, and thus the growth rates and returns could be biased upwards. This problem is also recognised by Chan, Karceski and Lakonishok (2003) as a limitation of their study on persistent growth. This problem, on the other hand, although well admitted, appears to be self-built in a study on persistent performance, and therefore the study is undertaken despite recognising a limitation it contains by construction.

The PhD thesis also examines two research questions that relate to analysts' earnings forecasts in the presence of R&D investments. Existing literature has associated R&D intensity both theoretically and empirically with higher analyst forecast dispersion and stock returns. At the same time, existing research testifies that high analyst dispersion is associated with lower returns. In this context, there is examined for the first time whether R&D plays a role in the relationship between dispersion and returns, given that it has be testified empirically that it has an influencing power on both forecast dispersion and stock returns individually. This examination is performed by additionally contributing to existing literature with the assessment of this issue using a very detailed definition of forecast dispersion, by decomposing dispersion in analyst forecasts into pure lack of consensus among analysts and uncertainty in analyst forecasts.

There are again used all UK listed firms during the period 1990-2003 with analyst forecasts on the IBES database and there is found for the first time that R&D intensity is a contributing factor for analyst forecast dispersion for the UK, even after controlling for other firm characteristics. The finding is consistent with prior findings for the US. Forecast dispersion is further decomposed into an uncertainty and a divergence of opinion component, and I get indications that the influence of R&D is primarily on the uncertainty component of analyst forecasts.

I also confirm a negative relationship between dispersion and returns, consistent with Diether, Malloy and Scherbina (2002) for the US, with the bottom forecast dispersion portfolio to be exhibiting a positive but not statistically significant excess return (alpha), and alphas to be getting negative for higher dispersion portfolios, which are generally not statistically significant as well, even after controlling for the role of R&D for returns After decomposing dispersion into analyst forecast uncertainty and a pure differences in opinion part, as R&D intensity increases, the ability of R&D to influence returns is also found to increase for high dispersion and high forecast uncertainty firms, but the ability of R&D to influence returns is found to be very weak for high divergence of opinion firms. This finding implies at the same time that in the presence of high R&D intensity, dispersion has an impact on returns mainly through the forecast uncertainty component of forecast dispersion, and not through the divergence of opinion component. Despite the fact that the theoretical relation between dispersion and subsequent returns is an issue of fierce academic debate this moment, with contradicting views in the field, when trying to interpret this finding by using the Doukas, Kim and Pantzalis (2006) conceptual framework, high uncertainty in forecasts should be associated with lower returns. Therefore this testified strong uncertainty component should be driving returns downwards for these high R&D intensity firms, which is not the case at all though for high R&D firms, given that high R&D firms have been generally associated with very high returns in the literature in general and also in this study in specific in Chapter 5A. Following this line of reasoning, the returns of these high R&D and high forecast uncertainty firms should be more due to market mispricing, and thus the empirical findings at this point also provide some insight into the discussion on whether R&D intensity and high market returns are due to market mispricing.

In addition, existing empirical research has identified R&D intensity as a factor to contribute to analyst forecast errors, implying more optimism. Starting from forecast errors, the study goes one step further and assesses for the first time the impact of R&D intensity on the magnitude of forecast revisions. The research hypothesis states that when financial analysts revise their earnings forecasts for R&D intensive firms, they are called to improve their accuracy in the presence of a highly uncertain investment. In such case, the amount by which they adjust their predictions can also be uncertain and therefore earnings revisions are expected to be greater in the presence of high R&D intensity. The assumption underneath this expectation is that analysts improve their learning as the end of the financial year approaches, but the outcome of this learning process is influenced by the uncertain nature of R&D, leading to higher revisions in the presence of high R&D investments. In the process of assessing the impact of R&D investments on analyst forecast revisions, the study also examines for the first time the impact of R&D on analyst forecast errors for the UK context, and also provides some insight into the joint impact of the analyst forecast characteristics of dispersion, errors and revisions on subsequent stock returns.

The study finds no steady linear positive trend for signed errors and revisions to increase as R&D intensity increases, without controlling for other factors, regardless of the definition of R&D intensity. There is though found such a relationship when using unsigned errors and revisions. There is also observed a contradiction in the behaviour of errors and revisions: forecast errors indicate a decrease in analyst optimism as year end approaches, but at the same time forecast revisions are found to be positive, which implies that forecasts get *more* optimistic as year end approaches, when we get indications from errors that earnings' forecasts become *less* optimistic. There is observed though that optimism decreases for forecast errors in terms of mean and median errors, but the values in absolute terms of the positive errors are much larger than the ones of the negative errors, providing this way an explanation on why revisions are positive in terms of mean and median values when the magnitude of the errors indicates a decrease in optimism as year end approaches. There is also found that R&D intensity is associated positively with (mostly unsigned) forecast errors and revisions, and that this relationship is generally statistically significant in the case of revisions, when there exists a reasonable amount of time between the initial and the revised analyst forecast, but not for errors, after controlling for other factors.

There is also found evidence that both signed and unsigned analyst forecast errors and revisions increase as analyst forecast dispersion increases. Finally, I get evidence that stock returns relate negatively with revisions and errors, well and above analyst forecast dispersion, and this relationship is statistically significant in all cases, which constitutes evidence for the first time of for the UK that forecast dispersion, errors and revisions can both individually as well as in terms of joint influence be negatively associated with subsequent stock returns in a statistically significant manner.

As a final comment, there are certainly two issues that have to taken into consideration as possible study limitations, present in any type of research on R&D and related valuation issues. The first one relates to the probability that a firm may try to manage/smooth its earnings by deciding on how much R&D it should spend. This way, the amount of R&D that is observed on the income statement and that I use in the study will receive influence by factors that cannot be controlled. This issue becomes even more serious if one considers that a firm may try to meet analyst EPS targets by managing the amount of R&D spending. In such cases, the R&D amount is clearly affected by managerial/earnings management decisions and would not reflect the real amount of R&D that a firm may need to spend in order to reach analyst or corporate or competition targets.

The second issue relates to the fact that the EPS figures, used particularly in the second part of the study on R&D and analyst forecasts, actual or forecasted, refer to earnings *after* the expensing of R&D. Therefore any change in R&D spending, or major managerial decision to increase/decrease R&D will affect the final EPS figures and show increased or decreased earnings that simply reflect changes in R&D spending, and not sales or gross income changes. This problem exists by definition when an earnings measure in the lower steps of the income statement such as EPS is used. These issues though, appear more or less self built in the very design of the study, but nonetheless there is recognised the need to acknowledge them.

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