Capitalization of R&D and the Informativeness of Stock Prices*

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August 2007

Keywords: Research & Development, Informativeness, Capitalization

*We thank Philip Joos, L. Shivakumar, two anonymous referees and workshop participants at University of Wales-Aberystwyth, Queen's University Belfast, European Accounting Association 2004 Annual Congress, 2004 American Accounting Association Annual Meeting and the London Business School Accounting Symposium 2003 for useful comments. Dennis Oswald acknowledges financial support from London Business School. Paul Zarowin acknowledges financial support from New York University.

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Abstract

This paper presents both a new approach to studying the consequences of accounting choice and a unique sample to examine the effects of accounting choice in the R&D context. We investigate the effect of firms' decision to capitalize R&D expenditures on the amount of information about future earnings reflected in current stock returns, as captured by the association between current-year returns and future earnings (FERC). We use a sample of U.K. firms, which includes both R&D capitalizers and expensers. An important feature of our tests is our use of a two equation system to control for the endogeneity of the accounting choice (i.e., self selection). Proponents of capitalization claim that it enables management to better communicate information about the success of projects and their probable future benefits. Consistent with this, we find that capitalization is associated with higher FERC than expensing.

I. Introduction

In this paper, we present both a new approach to studying the consequences of accounting choice, and we use a unique sample to examine the effects of accounting choice in the R&D context. We examine whether capitalization of R&D expenditures is associated with more informative stock prices, relative to expensing R&D. We define stock price informativeness as the amount of information about future earnings that is reflected in current period stock returns, as captured by the association between current-year returns and future earnings. We use a sample that includes both R&D capitalizers and expensers. Almost all other R&D studies (with the primary exceptions of and Green, Stark and Thomas (1996) and Aboody and Lev (1998)) only include expensers. Our investigation is important, because as Fields, Lys, and Vincent (2001) discuss in their review of the accounting choice literature during the 1990's, the consequences of accounting choice are largely unknown.

The R&D accounting choice is an important choice to study, because there has been much debate about the pros and cons of capitalization (Lev and Sougiannis (1996), Lev and Zarowin (1999), Healy, Myers, and Howe (2002)). Moreover, for firms that engage in R&D activities, R&D expenditures are likely to have a material impact on their earnings and stock returns. So, if there are stock price effects associated with the capitalize vs expense choice, these effects may be statistically detectable.

We use a sample of U.K. firms that engaged in R&D activities during the 1990s. While R&D capitalization is not allowed in the U.S. (except in the case of the software industry - SFAS #86), it is an available alternative in the U.K.[1] Having capitalizers in our sample is critical, because R&D studies on U.S. firms, such as Lev and Sougiannis (1996), Monahan (2005), Chan, Lakonishok, and Sougiannis (2001), Chambers, Jennings, and Thompson (2002), Healy, Myers, and Howe (2002), and Lev, Nissim, and Thomas (2002) must hypothesize the unobservable effects of capitalization on R&D expensers, but we can actually observe and test hypotheses about the consequences of capitalization. Since the U.K. capital market is a well developed, liquid market that is similar to the U.S. (as well as to the stock markets of other developed nations), our results might be generalized to other countries.[2]

We measure informativeness as the coefficient on future earnings in a regression of current stock return against current and future earnings. We refer to this as the future earnings response coefficient, FERC. Ceteris paribus, firms whose stock returns reflect more information about future earnings have higher stock price informativeness, and thus higher FERC. Our tests are based on those in Gelb and Zarowin (2002) and Lundholm and Myers (2002), who relate measures of voluntary corporate disclosure to the FERC. In their case, the disclosure metric was based on analysts' rankings. In our case, the disclosure metric is based on the R&D accounting method.

The relation between R&D capitalization and stock price informativeness is important for both academics and policymakers, because it addresses the fundamental issues of whether and how accounting matters. In the U.S., there has recently been much debate about the potential benefits of R&D capitalization. For example, Lev and Zarowin (1999) argue that capitalization enables better matching of R&D costs and benefits, thus providing more information for financial statement users, and Healy, Myers, and Howe (2002) show that successful efforts capitalization can provide information benefits relative to immediate expensing. The central point is that capitalization, by providing information about the percentage of outlays capitalized vs expensed and about the period of amortization, enables management to communicate information about the success of projects and their probable future benefits. This information is not recognized under expensing; thus, capitalization can lead to more informative stock prices.

For example, Hughes and Kao (1991) argue that capitalization is more informative than expensing, because it requires estimates of future benefits and auditor verification of such estimates, and Vigeland (1981) argues that the switch to full expensing of R&D in the U.S. under SFAS # 2 reduced the amount of information available, since it is difficult for the market to estimate the unobserved capitalized benefits. Lev and Sougiannis' (1996) and Chan, Lakonishok, and Sougiannis' (2001) findings of excess returns to R&D intensive firms in the U.S. is consistent with this view, because the lack of capitalization makes it difficult to evaluate these firms, thus leading to market inefficiencies.

On the other hand, capitalization might not result in more informative (efficient) prices for at least three reasons. First, the market may doubt management's information, based on the belief that management is manipulating earnings for its own benefit, such as in the case of an earnings-based bonus plan. Since the success of R&D activities is so difficult to measure and forecast, the auditing system does not necessarily alleviate such concerns. Second, even if management is honest, and this can be attested, the high uncertainty of R&D activities may render the ex-ante information made available by capitalization relatively worthless, since this information relies on estimates based on future projections. In this view, even the best forecast is a poor one. Third, even if management is honest and R&D capitalization information is reliable, expensers can simply disclose the information, as an alternative to balance sheet recognition (although such disclosure is not costless, since it might reveal proprietary information). Thus, whether or not capitalization provides information benefits to the market, resulting in more informative prices, is ultimately an empirical question, which this paper seeks to answer. If R&D

capitalization makes stock prices more informative, capitalizing firms should have higher FERC, ceteris paribus.

A fundamental issue for any test of the effects of accounting choice is self-selection (endogeneity of the choice: Watts and Zimmerman, 1990; Skinner, 1993). This is especially important here, because the decision to capitalize vs expense R&D is endogenous and is associated with factors that affect the relation between current returns and future earnings. In particular, capitalizers are "early life cycle" firms, while expensers are more "mature" firms, and more mature firms have a stronger returns-earnings relation. Thus, a crucial feature of our tests is that we use a two equation system to control for the endogeneity of the accounting choice.

Using a sample of firms from the U.K.'s three largest R&D industries (based on number of firms with R&D outlays) during the 1990's, we regress current returns against current and future earnings for R&D capitalizers and expensers (with capitalizers' earnings re-stated to be on an as-if expense basis, so the earnings of the two groups are comparable), and we compare the coefficients on the future earnings. We find that capitalization is associated with higher FERC than expensing. While we remain cautious in drawing strong inferences or policy implications given the short time period and small number of industries, our results suggest that capitalization is more informative than expensing, as capitalization's proponents have suggested. Thus, we provide the first empirical evidence that an accounting choice may affect the amount of information about future earnings reflected in stock returns. In summary, we contribute both a new approach to studying the effects of accounting choice and a unique sample to test the effects of accounting choice in the R&D context.

The rest of the paper is organized as follows. Section 2 reviews prior research on accounting choice and R&D capitalization. Section 3 discusses our measure of stock price informativeness and the test methodology. Section 4 discusses the data and sample. Section 5 reports the results of the empirical tests. Section 6 concludes.

2. Relation to Prior Research

Our study is at the intersection of two research streams: research on the consequences of accounting choice and research on the value relevance of R&D capitalization. As summarized by Fields, Lys, and Vincent (2001), research on the consequences of accounting choice has focused on the stock market's reaction to a given choice, as evidenced by abnormal returns around the time of the decision. The maintained hypothesis, based on market efficiency, is that if the choice does not have an effect on cash flows, there should be no abnormal stock returns. In general, this is what has been found. Motivated by Watts and Zimmerman's (1978, 1986) positive accounting theory, studies also focused on examining stock price effects related to debt covenants, incentive compensation, or political costs. In general, the issues were never really resolved, and the economic consequences of accounting choices are mostly unknown.

Our tests contrast with those based on the abnormal returns methodology, and our approach has a number of advantages over calculating abnormal returns. First, since we examine relative informativeness, our tests do not imply, require, or test that stock prices are (semi-strong form) efficient. Because of the Fama (1970) joint test problem, tests based on abnormal returns can never be sure whether they are really finding excess returns or mis-measured risk.

More important, in many contexts it is not clear over what period to calculate excess returns, or in which firms to take long vs short positions (i.e., which firms are over- or under-valued), which is necessary to calculate portfolio abnormal returns. These are central problems in testing whether a particular accounting policy, disclosure choice, or accounting method is superior to an alternative policy, choice, or method. The informativeness methodology avoids these problems by examining how much current returns reflect future information, rather than whether future returns can be earned based on current information.

Finally, tests of abnormal returns focus on private benefits, whereas tests of informativeness focus on social benefits. Whether or not private benefits can be earned, it is important to know whether the market as a whole is better off. If accounting choices in general, and the R&D capitalization vs expense choice in particular, cause more (less) information to be impounded into stock prices, they likely improve (aggravate) resource allocation.[3]

The value-relevance of recognized intangibles has been examined by Green, Stark, and Thomas (1996), Ely and Waymire (1999), and Barth and Clinch (1998). Green, Stark, and Thomas study U.K. firms in the 1990's, Ely and Waymire study U.S. firms in the pre-SEC era (when capitalization of internally developed intangibles was allowed),and Barth and Clinch study Australian firms that revalue their intangible assets. These authors' findings generally support the claim that recognized intangibles assets are valued by the market. However, these papers do not compare the effects of capitalization vs expensing.

Lev and Sougiannis (1996), Monahan (2005), Chan, Lakonishok, and Sougiannis (2001), Chambers, Jennings, and Thompson (2002), Healy, Myers, and Howe (2002), and Lev, Nissim, and Thomas (2002) examine the value relevance of capitalized R&D for U.S. firms, and universally find that the stock market treats R&D as an asset. However, these papers must hypothesize the unobservable effects of capitalization on R&D expensers, since R&D capitalization is not allowed in the U.S. Thus, by definition, they cannot compare the effects of capitalization vs. expensing.

Perhaps the closest papers to ours are Loudder and Behn (1995) and Aboody and Lev (1998). Loudder and Behn compare the earnings usefulness of U.S. firms that capitalized vs expensed R&D before SFAS #2, and the change in earnings usefulness for firms that were forced to switch from capitalization to expensing. They define usefulness by the contemporaneous price-earnings relation. The contemporaneous relation, however, does not directly address the issue of whether capitalization makes prices more informative (efficient) by revealing information about the firm's future prospects. Aboody and Lev compare U.S. firms that capitalize vs expense software R&D outlays under SFAS #86. They find that the balance sheet (book) value of capitalized software R&D predicts future earnings. However, this finding does not imply that the stock prices of capitalizers' are more informative (efficient): since expensers can disclose the unrecognized information, it could be reflected in their prices even though their R&D book value is zero.[4] Thus, since price or return is not one of Aboody and Lev's forecasting variables, they do not address the issue of how much information about future earnings is reflected in prices. Most important, no other papers examine the consequences of accounting choice by focusing on the relation between current prices and future information (earnings).

Our paper is in the spirit of Fields, Lys, and Vincent's (2001) call for research assessing the economic implications of accounting choice in relation to the market imperfections that drive such choices. As they discuss, one key market imperfection is the information asymmetry between manager-insiders and shareholder-outsiders. In this context, accounting choice is one way in which managers convey their private information to shareholders, which makes prices more informative. "Accounting choice may provide a mechanism by which better informed insiders can impart information to less well-informed parties about the timing, magnitude, and risk of future cash flows". (Fields, Lys, and Vincent, 2001: 262)[5]

Ours is the first study to examine the consequences of accounting choice in terms of its affects on stock price informativeness. Thus, this paper presents a new approach to studying the effects of accounting choice.

3. Measure of Stock Price Informativeness

Our stock price informativeness measure (how much information about future earnings is capitalized into price) is based on Collins, Kothari, Shanken, and Sloan (CKSS, 1994). CKSS assume revisions in expected dividends to be correlated with revisions in expected earnings, which allows them to express current stock returns as a function of the current period's unexpected earnings and (discounted) changes in expected future earnings. Of course, the expectations imbedded in the returns are unobservable. The goal of this paper is to see whether the market's future earnings expectations, as implied in stock returns, are closer to future earnings realizations for firms that capitalize R&D costs; i.e., whether capitalization results in current returns that are more highly associated with future earnings. CKSS proxy for current unexpected earnings using observed current change in earnings, and for changes in expected future earnings using changes in reported future earnings. This results in a regression of current annual stock returns, R_t on current and future annual earnings changes (firm subscripts omitted):[6]

$$R_t = a + b_0\Delta E_t + b_1\Delta E_{t+1} + u_t \qquad (1)$$

where the earnings variables are in per share form and are scaled by the share price at the beginning of the current year (to avoid having to delete firms with negative or zero beginning-of-period earnings), and the stock returns are total annual stock returns, defined as capital gain plus dividend yield (measured over the period from nine months prior to fiscal year end to three months after fiscal year end).

Using earnings changes as explanatory variables assumes that earnings follow a random walk. Rather than impose this condition, we follow Lundholm and Myers (2002) and estimate the levels form of the regression:

$$R_t = a + b_0E_{t-1} + b_1E_t + b_2E_{t+1} + u_t \qquad (2)$$

As Lundholm and Myers note, (2) allows the random walk as a special case, if $b_0 = -b_1$: the more mean reverting earnings are, the smaller (in absolute value) is b_0 relative to b_1. In (2), b_2 is the future earnings response coefficient, FERC, and is hypothesized to be positive; b_1, often referred to as the contemporaneous ERC, is also hypothesized to be positive, and b_0 is hypothesized to be negative.[7]

In order to make the regression results comparable for capitalizers and expensers, we adjust capitalizers' earnings to be on a "pro-forma" expense basis. We construct capitalizers' pro-forma earnings by subtracting the excess (or adding the deficit) after-tax amount of development costs capitalized minus amortization expense, from reported net income.

CKSS argue that using the actual future earnings introduces an error in variables bias in estimates of the future earnings coefficients, since the theoretically correct regressor is the unobservable expected future earnings. To help mitigate the errors in variables bias, we follow CKSS and include the future return as a control variable and estimate the model:

$$R_t = a + b_0E_{t-1} + b_1E_t + b_2E_{t+1} + b_3R_{t+1} + u_t \qquad (3)$$

The hypothesized coefficient on R_{t+1} is negative. Based on CKSS's evidence that the relation between current returns and future earnings is statistically insignificant beyond three years, we follow them and use a three year future earnings horizon. Based on Lundholm and Myers, we aggregate all three years into one future variable, for ease of exposition. Lundholm and Myers show that their results are unchanged whether the three future years are entered separately or aggregated.

Our goal is to compare the future earnings response coefficient, between capitalizers and expensers. The null hypothesis is that FERC is equal for both groups. If capitalizers' FERC is greater than expensers' FERC, then capitalization of R&D is associated with more informative stock prices. Our tests are based on those in Gelb and Zarowin (2002) and Lundholm and Myers (2002), who show that increased voluntary disclosure results in higher FERC, implying that the disclosure reveals information that results in returns impounding more information about future earnings. In their case, the disclosure metric was based on analysts' rankings. In our case, the disclosure metric is based on the R&D accounting choice.[8]

We compare FERC for capitalizers vs expensers separately for each industry in our sample. Estimation by industry is important, because R&D activities are industry specific; thus R&D intensive firms are likely to be homogeneous within an industry and heterogeneous across industries. Conducting tests on similar firms in an industry decreases the probability of omitted correlated variables driving the results. Indeed, literally by definition, firms in a given industry are buffeted by the same economic shocks, have similar production and sales cycles, and tend to use similar accounting methods. By conducting an intra-industry analysis, we can control for these economic and accounting factors (without having to use potentially noisy proxy variables), and thereby focus on the effect on FERC of differences in information between capitalization and expensing.

4. Data and Sample

We examine U.K. firms because U.K. GAAP permits, but does not require, the capitalization and subsequent amortization of development expenditures if five conditions are met: (1) There is a clearly defined project; (2) The related expenditure is separately identifiable; (3) The outcome of the project is examined for its technical feasibility and its ultimate commercial viability considered in light of factors such as likely market conditions (including competing products), public opinion, and consumer and environmental legislation; (4) The aggregate of deferred development costs, any further development costs, and related production, selling and administrative costs is reasonably expected to be exceeded by related future sales or other revenues; and (5) Adequate resources exist, or are reasonably expected to be available, to enable the project to be completed and to provide any consequential increases in working capital [Statement of Standard Accounting Practice (SSAP) No. 13, 1989]. Any expenditures on research (pure or applied) must be expensed in the period incurred. In summary, the five conditions are intended to ensure that an asset is indeed created by the R&D expenditures. [9]

Our initial sample includes all U.K. firms on Datastream (active and dead files) that disclosed either a R&D asset (item #342) or R&D expense (item #119) in any year t = 1990 - 1999. We begin in 1990 because prior to the revised SSAP No. 13 in 1989 many firms did not voluntarily report their R&D expenditure (the revised SSAP No. 13 made this disclosure mandatory). This search yields 4,566 firm-year observations (840 firms). For observations with a positive value of R&D asset, we examine the firm's notes to the financial statements to ensure that the amount recorded by Datastream in fact relates to an R&D asset.[10] We also require data on industry membership, earnings, number of shares outstanding and corporate tax rate (lagged, contemporaneous and the subsequent three years), stock price and stock return (contemporaneous annual return and the subsequent three-year buy-and-hold return) to be available on Datastream. Removal of inappropriate observations and observations with missing data reduces the sample to 3,091 firm-year observations (520 firms). We classify each firm-year observation as a capitalizer in that year if the firm reported either a non-zero value for the R&D asset or a non-zero amount for R&D amortization; otherwise the firm-year observation is classified as an expenser. Since we perform our analysis by industry, we use the top three R&D industries (defined by number of firm-year observations) in order to have enough observations to estimate our informativeness regression. This gives us a sample of 1,098 firm-year observations (205 firms). Finally, in later tests we require our firms to have lagged values of R&D expenditures, therefore we remove observations in 1990. This gives us our final sample of 1,002 firm-year observations (201 firms), ranging from 112 firms in 1991, to a high number of 115 firms in 1994, 1995 and 1998, and ending with 108 firms in 1999.

Table 1, Panel A reports the number of firm-year observations by industry. We use Datastream Level 4 industry classifications, in order to have the finest industry classification possible to ensure maximum homogeneity of the observations in any given industry. The large number of expensers relative to capitalizers suggests either that development expenditures rarely meet the five conditions necessary for capitalization or that, when the conditions are met, managers are reluctant to capitalize development costs. In our tests below, we empirically model the capitalization vs expensing choice.

Insert Table 1 here

Table 2, Panel A reports descriptive statistics on many firm characteristics for our sample observations. Expensers tend to be larger than capitalizers (indicated by a significantly larger median market value and book value of equity). Expensers and capitalizers have similar average earnings, with expensers having a significantly higher median earnings as compared to capitalizers. For the current and sum of the future three years reported EPS (Reported EPS_t and Reported $EPS_{t+\tau}$, respectively), expensers are significantly (at conventional levels) more profitable. However, there is no significant difference between the average lagged reported EPS between expensers and capitalizers.

Expensers have a larger median share price than capitalizers (£1.25 versus £1.04, respectively). Capitalizers are riskier than expensers, with significantly greater earnings variability measured as $\sigma^2(EPS_t/P_{t-1})$ (calculated over the period 1990 - 2002), and the median capitalizer is significantly more levered. Additionally, expensers are significantly older than capitalizers, with an average age of 38.9 years versus 32.1 years, respectively (age is defined as the number of years since incorporation). The average market-to-book ratio is significantly higher for capitalizers (although the median market-to-book ratios are not significantly different). Capitalizers also have a significantly larger R&D intensity. However, the two groups are not significantly different in terms of their betas.[11]

Table 2, Panel B shows that the mean and median contemporaneous returns for expensers are 33.5% and 15.8%, while for capitalizers they are 25.4% and 6.7%. While there is no statistical (at conventional levels) difference in the means, there is in the medians. Both Basu (1997) with U.S. data and Pope and Walker (1999) with U.K. data show that due to the conservatism principle, timeliness is related to good vs bad news, as measured by the sign of the contemporaneous stock return. Since delayed recognition of good news enhances the relation between current returns and future earnings, the higher median return for expensers works against our finding a higher FERC for capitalizers.

Finally, this table shows that the pro-forma earnings per share (which are used in the informativeness tests) are slightly lower than the reported earnings per share for the capitalizers. This indicates that the policy of capitalization generally increases reported earnings.[12]

Overall, Table 2 shows that capitalizers are younger, smaller, riskier, and less profitable than expensers, characteristics typical of "early life cycle" firms. This is consistent with Skinner (1993), who finds that larger firms tend to use income decreasing accounting methods, and with Lev, Sarath, and Sougiannis (1999), and Beaver and Ryan (2000), who show that for early life cycle firms, measured profitability is higher under capitalization, which might explain their capitalization decision.

Insert Table 2 here

These group differences are important for our tests, because they indicate that the choice to capitalize or expense is endogenous, and is associated with firm characteristics that affect FERC. In addition to informativeness, the primary determinants of the relation between current returns and future earnings are earnings timeliness and forecastability (variability). Earnings that are less timely have a weaker relation with contemporaneous returns, but a stronger relation with lagged returns, because price impounds information instantaneously, but the accounting system recognizes it with a lag. Earnings that are more variable (uncertain, difficult to forecast) have a weaker relation with (lagged) returns, because price reflects the market's forecast.

Timeliness and forecastability are related to size, profitability, and earnings variability. Smaller firms have a poorer information environment than larger firms, poor profitability is associated with lower earnings persistence, and more variable earnings are less persistent, riskier and harder to forecast.[13]

In summary, capitalizers' characteristics imply that they should have a lower FERC than expensers, absent any information advantage due to capitalization. In order to isolate the effect of capitalization on FERC, we must control for the endogeneity of the capitalization vs expensing decision.

5. Empirical Tests and Results

5.1 Explaining the Capitalize vs Expense Choice

As pointed out above, a crucial issue for any test of the effects of accounting choice is self selection (endogeneity of the accounting choice). In our case, the issue is that firms self select as expensers vs capitalizers based on factors that are associated with the relation between current returns and future earnings, and we must control for these factors (Watts and Zimmerman, 1990; Skinner, 1993). In particular, Section 4 discussed evidence that capitalizers are earlier life cycle firms than expensers, and that less mature firms have a weaker returns-earnings relation than more mature firms. Because of this endogeneity, we cannot simply estimate the returns regression (3) for each group.

To control for the endogeneity, we use the method used by Ball and Shivakumar (2005), when the group dummy variable (CAP in our case) is endogeneous and is used interactively in the regression, as we do. The model is estimated using the two-stage approach of Heckman (1979) and Lee (1979). In the first stage, the capitalization choice equation is estimated as a Probit model and, using the parameters from this model, the inverse Mills ratio is computed for all firms. In the second stage, the returns regression is estimated, including the inverse Mills ratio as a control, and allowing its coefficient to vary between the two groups.[14]

Our Probit model explains the capitalization vs expense decision as a function of a firm's life cycle stage, and whether the firm meets the five conditions for capitalization (i.e., whether the firm is able to capitalize). As pointed out above, relating the accounting choice to the firm's life cycle is consistent with Lev, Sarath, and Sougiannis (1999), and Beaver and Ryan (2000), who show that the effects of capitalization on measured profitability is related to the firm's life cycle stage. As empirical proxies to capture life cycle, we use six explanatory variables: earnings variability (a measure of risk and persistence), profitability, firm size (market value of equity), the market-to-book ratio (a measure of risk and growth), R&D intensity, and Beta.[15] Earnings variability (EARN_VAR) is calculated as $\sigma^2(EPS_t/P_{t-1})$ using all available data from 1990-2002 (we require a minimum of three observations per firm to estimate variability).[16]

Like Lundholm and Myers, we proxy for earnings profitability using a dummy variable (EARN_SIGN) that equals 'one' if contemporaneous earnings are positive and 'zero' otherwise. Firm size (SIZE) is measured as the market value of equity. Market-to-Book (M/B) is market value divided by book value (converted to an 'as-if-expense' basis for the capitalizers). R&D intensity (RDINT) is total R&D expenditures divided by total assets (converted to an 'as-if-expense' basis for the capitalizers). Beta (BETA) is the market model beta calculated using monthly returns ending in the month of the firm's fiscal year end (requiring a minimum of 12 months and maximum of 60 months of returns) and the FTSE All Share Index.

While there are many potential proxies, we use these because it is well known that they are related to timeliness and forecastability, which determine FERC. For example, Lundholm and Myers (2002) control for risk, growth, persistence, profitability, and size in their study of disclosure and FERC. R&D intensity relates to timeliness and forecastability, because greater R&D intensity is associated with more variable earnings (Kothari, Laguerre, and Leone (2002)) and with higher growth. We control for Beta, as a proxy for the firm's discount rate, because the coefficient on earnings is related to the rate at which earnings are discounted (Collins and Kothari, 1989).[17]

As an empirical proxy to capture whether a firm meets the 5 capitalization conditions, we use the ratio:

$$RD\_VALUE = \frac{MV - BV}{\text{R\&D Expenditure}}$$

The numerator is the difference between the firm's market value of equity and its book value of equity at the end of the firm's fiscal year, an estimate of the unrecognized economic asset created by the R&D expenditures (capitalizers' BV is adjusted to BV under expensing). The denominator is the sum of the firm's current and lagged annual R&D expenditures.[18]

By definition, all capitalizers meet the 5 conditions. Although we cannot observe whether expensers meet the five capitalization conditions, firms that are forced to expense (mandatory expensers) are less successful in their R&D endeavors than capitalizers or optional expensers; i.e., mandatory expensers' payoffs from their R&D expenditures are less certain than those of the capitalizers or optional expensers, so it is questionable whether an asset is created by the R&D expenditures. RD_VALUE exploits the links between R&D uncertainty, expected R&D success, and the ability to capitalize. By definition, since more successful R&D firms create greater economic assets per pound sterling of R&D expenditure, more successful firms have a higher value of the ratio. Mandatory expensers' greater uncertainty of their R&D payoffs causes the market to discount their expected future cash flows at a higher rate, resulting in lower RD_VALUEs than optional expensers or capitalizers.

We conducted numerous tests to confirm the efficacy of RD_VALUE as a measure of R&D success (and thus as a filter for mandatory expensers). As reported in Table 3, we find that RD_VALUE is significantly positively rank correlated both with return on equity (both raw ROE and with capitalizers adjusted to be on an 'as-if-expense' basis) and with revenue growth for all of our industries. We also find that in the large majority of years for each industry in our sample (89%, 89%, and 56% for Electronics, Engineering, and Software, respectively), expensers have the lowest values of the ratio (results not reported). This is exactly what we expect if RD_VALUE is a measure of success, and the least successful firms are required to expense.[19] Based on this evidence, we believe that RD_VALUE is an appropriate proxy for R&D success, and for whether a firm meets the 5 capitalization conditions.

Insert Table 3 here

Thus, our Probit model is: [20]

$$CAP_{it} = \beta_0 + \beta_1 EARN\_VAR_{it} + \beta_2 EARN\_SIGN_{it} + \beta_3 SIZE_{it} + \beta_4 M/B_{it} \qquad (4)$$

$$+ \beta_5 RDINT_{it} + \beta_6 BETA_{it} + \beta_7 RD\_VALUE_{it} + \varepsilon_{it}$$

Panel A of Table 4 reports the results of our Probit models on our full sample. We estimate separate models for each industry, because the nature of R&D activities is industry specific. To avoid overfitting, we emphasize parsimony and use the above seven explanatory variables for each industry, rather than empirically search for the “best” industry model. Consistent with the life cycle story, firms more likely to capitalize have more variable earnings (the signs on EARN_VAR is significantly positive in two industries). The coefficient on RD_VALUE is significantly negative for Electrical firms. The negative coefficient on RD_VALUE indicates that in this industry, the most successful firms choose to expense. In the other two industries, RD_VALUE is of mixed sign and is not significant. In Section 5.3, below, we discuss further the Probit results for RD_VALUE. The results for the other five factors are mixed. The Probit model classifies approximately 70% of the firm-year observations correctly (ranging from 67.6% in Engineering to 72.3% in Electrical).[21]

Insert Table 4 here

5.2 Returns Regression

The second stage returns regression includes the inverse Mills ratio as a control, allowing its coefficient to vary between the two groups:

$$R_t = \alpha_0 + \Phi_1 E_{t-1} + \Phi_2 E_t + \Phi_3 E_{t+\tau} + \Phi_4 R_{t+\tau} + \Phi_5 CAP_t + \Phi_6 CAP_t{*}E_{t-1} + \Phi_7 CAP_t{*}E_t + \Phi_8 CAP_t{*}E_{t+\tau} + \Phi_9 CAP_t{*}R_{t+\tau} + \Phi_{10} MILLS_t + \Phi_{11} MILLS_t{*}CAP_t + \mu_t \qquad (5)$$

where CAP_t is a dummy variable equal to one if the firm is classified as a capitalizer in year t, zero otherwise. The estimated coefficient on $CAP_t{*}E_{t+\tau}$ (Φ_8) represents the incremental stock price informativeness for capitalizers relative to expensers.[22]

Results of estimating equation (5) on our full sample are reported in column 1 of Table 5, which reports mean coefficients across the industries, and the Z statistic (Barth, 1994) for testing whether the mean coefficient is significantly different from zero.[23]

The average ERC (Φ_2) and FERC (Φ_3) are significantly positive, and the average coefficients on lagged earnings (Φ_1) and future returns (Φ_4) are significantly negative, as expected. The coefficient of the inverse Mills ratio multiplied by the capitalization dummy is significant, supporting the importance of the endogeneity control. Most important, the mean incremental FERC is positive ($\Phi_8 = 0.25$) and statistically significant (Z=2.05).

Insert Table 5 here

This result shows that capitalization is associated with more informative stock prices than expensing. This is the first empirical evidence that an accounting method choice is associated with the amount of information about future fundamentals reflected in current stock returns.

5.3 Robustness Tests – Excluding Mandatory Expensers

As a robustness test, we delete mandatory expensers from our sample, and we re-estimate our two-equation system on capitalizers and optional expensers. Based on our evidence that RD_VALUE is a measure of success, we define mandatory expensers as those with either a negative RD_VALUE (from MV < BV) or an RD_VALUE lower than the lowest capitalizer for each industry-year. This ensures that all remaining expensers were at least as successful in their R&D endeavors as the least successful capitalizer, and so these remaining expensers likely have met the five capitalization conditions. Table 1, Panel B shows the industry breakdown of the optional expensers. In total, this filter deleted 245 of the original 834 expensers (29%).

Since all firms in the reduced sample are able to capitalize, this test is more of an “apples to apples” comparison than our previous test. In other words, by eliminating mandatory expensers, we can test whether actually capitalizing provides more information about future earnings (higher FERC) than just meeting the five conditions or footnote disclosure.

Panel B of Table 4 reports the results of our Probit models on our reduced sample. Note that the coefficient of RD_VALUE is now negative in all three industries and significant in two (marginally significant in the third), whereas in the full sample, the coefficient of RD_VALUE was only significantly negative in one industry and was positive in another. Note also that the percentage of observations correctly classified has increased in all three industries. These two results are likely related.

Recall that a negative coefficient on RD_VALUE means that the most successful firms choose to expense. In the full sample, mandatory expensers (those with the lowest RD_VALUEs) are included, reducing the average RD_VALUE of expensers, and making it comparable to (or even lower than) capitalizers' average RD_VALUE. Thus, in this sample, RD_VALUE does not discriminate between capitalizers and expensers. In the reduced sample, only expensers with high RD_VALUEs remain, and expensers have significantly higher RD_VALUEs than capitalizers, as shown by the Probit results; i.e., in this sample, RD_VALUE does discriminate between capitalizers and expensers. Thus, expensers are a mix of the most unsuccessful R&D firms (mandatory expensers) and the most successful R&D firms (voluntary expensers). The improvement of the Probit models in Panel B is due to the discriminatory power of RD_VALUE as a measure of success when mandatory expensers are removed, because the most successful firms choose to expense. In the full sample, the discriminatory power of RD_VALUE was diminished by the inclusion of the mandatory expensers.

Column 2 of Table 5 shows the results of estimating equation (5) on the reduced sample.[24] Note that the average ERC (Φ_2) and FERC (Φ_3) are higher than in the full sample (1.84 vs 1.10 and 0.39 vs 0.35, respectively), consistent with our deletion of less successful firms, and thus providing additional support for RD_VALUE as a measure of R&D success. Likewise, the mean incremental FERC is lower than in the full sample (0.18 vs 0.25), since this incremental effect now only captures the information benefit of capitalization, not the difference between successful vs unsuccessful firms (i.e., the reduction in FERC in the reduced sample shows that some of the incremental benefit in the full sample was due to the inclusion of unsuccessful expensers), but the incremental FERC is still marginally significantly positive at the

.05 level, supporting the inference that capitalization is associated with more informative stock prices relative to expensing.

6. Conclusion

We have examined whether capitalization of R&D expenditures is associated with more informative stock prices, relative to expensing R&D, where stock price informativeness is defined as the amount of information about future earnings that is reflected in current period stock returns. We measure informativeness as the coefficient on future earnings in a regression of current stock return against current and future earnings, which we refer to as the future earnings response coefficient, FERC. Ceteris paribus, firms whose stock returns reflect more information about future earnings have higher stock price informativeness, and higher FERC.

An important feature of our tests is control for self-selection, because the decision to capitalize vs expense R&D is endogenous and is associated with factors that affect the relation between current returns and future earnings. In particular, capitalizers are “early life cycle” firms, while expensers are more “mature” firms, and more mature firms have a stronger returns-earnings relation.

We find that capitalization is associated with greater stock price informativeness (higher FERC). Thus, our results provide the first empirical evidence consistent with the proposition that capitalization of R&D provides more information (about future earnings) to the market, as capitalization’s proponents have suggested.

Our results are subject to a number of important caveats. First, our tests are based on three industries over one decade. Also, due to the length of our sample, we are limited to a three year horizon, which does not capture all of the benefits of R&D that require a longer gestation period. Moreover, in our reduced sample, the incremental FERC due to capitalization is only marginally significant at conventional levels. Finally, since our capitalization prediction model is imperfect, we may not have captured all existing predictability. In this case, our evidence of a higher FERC for capitalizers might be due to an unmodeled group difference, rather than to greater informativeness. For these reasons, we remain cautious in drawing strong inferences or policy implications from our evidence.

Perhaps more important than our results, however, we contribute both a new approach to studying the effects of accounting choice and a unique sample to test the effects of accounting choice in the R&D context. Application of our approach to other accounting choices and examination of the effects of R&D capitalization using both R&D expensers and capitalizers represent promising avenues for future research.

Table 1
Sample Observations

Panel A: Full Sample[a]

Industry Name	Expensers	Capitalizers
Electronic and Electrical Equipment	265	56
Engineering and Machinery	350	57
Software and Computer Services	219	55
Total Observations	834	168

Panel B: Excluded Sample[b]

Industry Name	Expensers	Capitalizers
Electronic and Electrical Equipment	191	56
Engineering and Machinery	219	57
Software and Computer Services	179	55
Total Observations	589	168

[a]The sample consists of U.K. firms who disclosed either a R&D asset or R&D expense in any year t=1991-1999, with the following data available on Datastream: industry membership, earnings, number of shares outstanding and corporate tax rate (lagged, contemporaneous and the subsequent three years), stock price and stock return (contemporaneous annual return and the subsequent three-year buy-and-hold return). We also require firms to be in one of the top three R&D industries (defined by number of firm-year observations). A firm-year observation is defined as a Capitalizer if in that year the firm reported either a non-zero value for the R&D asset or a non-zero amount for R&D amortization; otherwise the firm-year observation is classified as an Expenser. Industry classifications are based on Datastream Level 4 classifications.

[b]The Excluded Sample removes expensers that we believe may not meet the five conditions for capitalization. Specifically, we exclude expensers with either a negative RD_VALUE or RD_VALUE smaller than the smallest positive RD_VALUE for the capitalizers within the same industry-year. RD_VALUE equals the difference between market value of equity and book value of equity (converted to 'as-if-expense' for the capitalizers) at fiscal year end, divided by the sum of the firm's current and lagged annual R&D expenditures.

Table 2
Descriptive Statistics

Panel A: Descriptive Statistics[a]

	Expensers		Capitalizers		Difference	
	Mean	Median	Mean	Median	Mean	Median
Share Price	1.86	1.25	1.76	1.04	0.64	0.05
Market Value	261.09	56.06	330.02	23.57	0.37	0.01
Sales	263.28	56.98	305.97	39.03	0.52	0.25
Assets	216.85	40.86	327.20	29.35	0.08	0.30
Book Value of Equity	81.86	19.88	123.59	10.43	0.03	0.05
Earnings	14.49	2.78	11.91	0.75	0.59	0.01
Reported EPS_{t-1}	0.08	0.08	0.09	0.05	0.85	0.01
Reported EPS_t	0.10	0.08	0.01	0.04	0.01	0.01
Reported $EPS_{t+\tau}$	0.27	0.24	0.00	0.07	0.01	0.01
R&D Expense	4.52	1.47	8.55	0.39	0.01	0.01
R&D Asset	-	-	7.22	0.60	-	-
Age	38.88	26.60	32.06	18.94	0.01	0.01
Market-to-Book	3.71	2.25	8.76	2.23	0.01	0.93
R&D Intensity	0.05	0.03	0.08	0.04	0.01	0.55
Leverage	1.57	1.03	1.35	1.55	0.71	0.01
EP Variability	0.03	0.00	0.06	0.03	0.01	0.01
Beta	0.76	0.77	0.76	0.71	0.97	0.83
RD_VALUE	22.54	9.21	22.13	6.88	0.95	0.17

Panel B: Variables Used in the Stock Price Informativeness Test[b]

	Expensers		Capitalizers		Difference	
	Mean	Median	Mean	Median	Mean	Median
$Return_t$	33.51%	15.82%	25.36%	6.74%	0.39	0.07
E_{t-1}	0.08	0.08	0.08	0.04	0.94	0.01
E_t	0.10	0.08	0.00	0.03	0.01	0.01
$E_{t+\tau}$	0.27	0.24	0.00	0.07	0.01	0.01
$Return_{t+\tau}$	65.35%	12.05%	40.05%	11.62%	0.20	0.08

Table 2 - Continued
Descriptive Statistics

[a]Share price per share and market value are measured at the end of the fiscal year. Share price is reported in pounds sterling; market value, sales, assets, book value of equity, earnings, R&D expense and R&D asset are measured in millions of pounds sterling. Reported EPS_{t-1}, Reported EPS_t and Reported $EPS_{t+\tau}$ are equal to reported earnings divided by number of shares outstanding for the lagged year, current year and the sum of the future three years' EPS, respectively. Age is the number of years since incorporation. Market-to-Book is market value divided by book value (converted to 'as-if-expense' for the capitalizers) measured at fiscal year end. R&D intensity is R&D expenditures divided by total assets (converted to ‘as-if-expense’ for the capitalizers) measured at fiscal year end. Leverage is measured as total debt divided by book value (converted to 'as-if-expense' for the capitalizers) measured at fiscal year end. EP Variability is earnings variability and is calculated as $\sigma^2(E_t/P_{t-1})$ using all available data from 1990-2002 (we require a minimum of three observations per firm to estimate variability), where E_t is earnings per share in year t and P_{t-1} is share price at the start of the fiscal year t. Beta is the market model beta calculated using monthly returns ending in the month of the firm's fiscal year end (requiring a minimum of 12 months and maximum of 60 months of returns) and the FTSE All Share Index. RD_VALUE equals the difference between market value of equity and book value of equity (converted to 'as-if-expense' for the capitalizers) at fiscal year end, divided by the sum of the firm's current and lagged annual R&D expenditures.

[b]R_t is the annual return measured over the period beginning nine months before the end of the fiscal year and ending three months after the fiscal year end in year t. $R_{t+\tau}$ is the buy-and-hold return measured over the following three years (measured over months (+3, +39) relative to fiscal year end). E_t is earnings divided by shares outstanding for fiscal year t; E_{t-1} and E_{t+t} are earnings divided by shares outstanding for fiscal year t-1 and the sum of the future three years' EPS, respectively. Earnings per share is as reported for expensers, and adjusted to 'as-if-expense' for capitalizers. All earnings per share numbers are reported in pounds sterling.

[c]The Difference column reports the significance levels for F-tests (Wilcoxon tests) comparing the pooled sample mean (median) for the difference between expensers and capitalizers.

Table 3
RD_VALUE Correlation[a]

Industry Name	ROE (Raw)	ROE (Adj)	Rev Gwth
Electronic and Electrical Equipment	0.421	0.415	0.300
	(0.01)	(0.01)	(0.01)
Engineering and Machinery	0.521	0.517	0.169
	(0.01)	(0.01)	(0.01)
Software and Computer Services	0.308	0.295	0.218
	(0.01)	(0.01)	(0.01)
Full Sample	0.418	0.411	0.190
	(0.01)	(0.01)	(0.01)

[a]This table reports the spearman correlation between RD_VALUE and three standard measures of success for each industry. RD_VALUE equals the difference between market value of equity and book value of equity (converted to 'as-if-expense' for the capitalizers) at fiscal year end, divided by the sum of the firm's current and lagged annual R&D expenditures. ROE (Raw) equals earnings divided by book value measured at fiscal year end; ROE (Adj) equals earnings divided by book value (both converted to 'as-if-expense' for capitalizers) measured at fiscal year end. Rev Gwth equals average revenue growth over the following three years from fiscal year end. Probability values are reported in parentheses.

Table 4
Determinants of the Decision to Capitalize Development Expenditures[a]

Panel A: Full Sample[b]

	ELECTRICAL		ENGINEERING		SOFTWARE	
	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance
Intercept	-2.69	0.01	-0.63	0.18	-2.18	0.01
EARN_VAR	2.47	0.01	-0.20	0.59	2.41	0.01
EARN_SIGN	0.32	0.20	-0.52	0.02	-0.29	0.20
SIZE	-0.25	0.56	-1.29	0.01	1.43	0.01
M/B	3.16	0.01	0.46	0.35	0.12	0.79
RD_VALUE	-2.03	0.01	0.30	0.53	-0.23	0.64
RDINT	-1.50	0.01	-0.41	0.23	0.27	0.51
BETA	0.63	0.08	0.97	0.01	-1.28	0.01
% Correctly Classified	72.27%		67.57%		71.90%	

Panel B: Excluded Sample[c]

	ELECTRICAL		ENGINEERING		SOFTWARE	
	Coefficient	Significance	Coefficient	Significance	Coefficient	Significance
Intercept	-1.06	0.11	1.58	0.01	-1.59	0.01
EARN_VAR	2.23	0.01	-0.54	0.21	2.55	0.01
EARN_SIGN	0.20	0.47	-0.57	0.05	-0.23	0.33
SIZE	-0.40	0.38	-1.65	0.01	1.16	0.01
M/B	2.30	0.01	0.56	0.28	0.18	0.68
RD_VALUE	-2.78	0.01	-1.95	0.01	-0.83	0.11
RDINT	-2.31	0.01	-1.44	0.01	0.08	0.87
BETA	0.63	0.11	0.88	0.04	-1.48	0.01
% Correctly Classified	77.64%		72.83%		76.50%	

Table 4 - Continued
Determinants of the Decision to Capitalize Development Expenditures[a]

[a]This table reports the coefficient estimates and significance levels from estimating the following Probit model:

$$CAP_{it} = \beta_0 + \beta_1 EARN\_VAR_{it} + \beta_2 EARN\_SIGN_{it} + \beta_3 SIZE_{it} + \beta_4 M/B_{it} + \beta_5 RDINT_{it} + \beta_6 BETA_{it} + \beta_7 RD\_VALUE_{it} + \varepsilon_{it}$$

CAP_{it} = indicator variable equal to one if firm i capitalizes development expenditures in year t, zero otherwise. $EARN\_VAR_{it}$ = percentile ranking of firm i's earnings variance within each firm's industry. Earnings variance is calculated as the variance of the firm's earnings per share deflated by share price at the start of the fiscal year, over 1990-2002 (earnings per share is adjusted to be 'as-if-expense' for the capitalizers). $EARN\_SIGN_{it}$ = indicator variable equal to one if E_{it} is positive, zero otherwise. $SIZE_{it}$ = percentile ranking of firm i's market value (measured at fiscal year end) within each firm's industry-year. M/B_{it} = percentile ranking of firm i's market-to-book within each firm's industry-year. Market-to-Book is market value divided by book value (converted to 'as-if-expense' for the capitalizers) measured at fiscal year end. $RDINT_{it}$ = percentile ranking of firm i's R&D intensity within each firm's industry-year. R&D intensity is R&D expenditures divided by total assets (converted to 'as-if-expense' for the capitalizers) measured at fiscal year end. $BETA_{it}$ = percentile ranking of firm i's beta within each firm's industry-year. Beta is the market model beta calculated using monthly returns ending in the month of the firm's fiscal year end (requiring a minimum of 12 months and maximum of 60 months of returns) and the FTSE All Share Index. RD_VALUE_{it} = percentile ranking of firm i's RD_VALUE within each firm's industry-year; RD_VALUE equals the difference between market value of equity and book value of equity (converted to 'as-if-expense' for the capitalizers) at fiscal year end, divided by the sum of the firm's current and lagged annual R&D expenditures. ε_{it} = residual term for firm i in year t. % Correctly Classified reports the percentage of observations we define as correctly classified; an expenser (capitalizer) firm-year observation is correctly classified when the fitted probability is less than (greater than) the ratio of capitalizers to expensers in each industry.

[b]The Full Sample column uses all firm-year observations.

[c]The Excluded Sample removes expensers that we believe may not meet the five conditions for capitalization. Specifically, we exclude expensers with either a negative RD_VALUE or RD_VALUE smaller than the smallest positive RD_VALUE for the capitalizers within the same industry-year. RD_VALUE equals the difference between market value of equity and book value of equity (converted to 'as-if-expense' for the capitalizers) at fiscal year end, divided by the sum of the firm's current and lagged annual R&D expenditures.

Table 5
Informativeness of Stock Prices[a]

Explanatory Variable \ Sample	Full Sample[b]	Excluded Sample[c]
E_{t-1}	-0.29	-0.37
	(-2.82)	(-2.32)
E_t	1.10	1.84
	(6.61)	(7.96)
$E_{t+\tau}$	0.35	0.39
	(8.29)	(5.49)
$R_{t+\tau}$	-0.07	-0.07
	(-5.20)	(-4.12)
CAP_t	-0.27	-0.09
	(-1.94)	(-0.59)
CAP_t*E_{t-1}	-0.72	-0.67
	(-2.40)	(-2.14)
CAP_t*E_t	0.27	-0.52
	(0.55)	(-1.74)
$CAP_t*E_{t+\tau}$	0.25	0.18
	(2.05)	(1.76)
$CAP_t*R_{t+\tau}$	-0.10	-0.09
	(-2.46)	(-2.19)
$MILLS_t$	-0.04	0.01
	(-1.37)	(0.12)
$MILLS_t*CAP_t$	0.17	0.07
	(1.86)	(0.64)

[a]This table reports the average coefficient and z-statistic (in parentheses) from estimating the informativeness of accounting information for expensers and capitalizers:

$$R_t = \alpha_0 + \Phi_1 E_{t-1} + \Phi_2 E_t + \Phi_3 E_{t+\tau} + \Phi_4 R_{t+\tau} + \Phi_5 CAP_t + \Phi_6 CAP_t*E_{t-1} + \Phi_7 CAP_t*E_t + \Phi_8 CAP_t*E_{t+\tau} + \Phi_9 CAP_t*R_{t+\tau} + \Phi_{10} MILLS_t + \Phi_{11} MILLS_t*CAP_t + \mu_t$$

See Table 2 for variable definitions. The Z-statistic tests whether the mean t-statistic equals zero and equals $1/\sqrt{N}\sum_{j=1}^{N} t_j / \sqrt{k_j/(k_j-2)}$ where t_j is the t-statistic for industry j, k_j is the degrees of freedom for industry j, and N is the number of industries. The 5% (1%) significance levels for Z is 1.645 (1.96).

Table 5 - Continued
Informativeness of Stock Prices[a]

[b]The Full Sample column uses all firm-year observations.

[c]The Excluded Sample removes expensers that we believe may not meet the five conditions for capitalization. Specifically, we exclude expensers with either a negative RD_VALUE or RD_VALUE smaller than the smallest positive RD_VALUE for the capitalizers within the same industry-year. RD_VALUE equals the difference between market value of equity and book value of equity (converted to 'as-if-expense' for the capitalizers) at fiscal year end, divided by the sum of the firm's current and lagged annual R&D expenditures.

Notes

[1] SSAP #13 allows for the capitalization of development expenditures provided that they meet five conditions (which generally requires that management is satisfied that the expenditures go towards creating a commercially viable product / service). Research expenditures must be expensed in the period incurred. See section 4 for more detail on SSAP # 13.

[2] Ball, Kothari, and Robin (2000) group the U.K., U.S., Australia, and Canada as major common-law countries.

[3] Tobin (1982) refers to improvement in efficiency of resource allocation as functional efficiency. Durnev, et al. (2003) discuss the link between informational efficiency and functional efficiency.

[4] As Aboody and Lev explain, the relation between the book value of capitalized software R&D and future earnings is somewhat mechanical, because capitalization can take place only after feasibility is determined. Thus, since only successful projects get capitalized, greater capitalized costs mean higher future earnings.

[5] We do not mean to imply that increasing the amount of information is necessarily the reason that firms capitalize. However, increased information may still be a consequence of the choice.

[6] We show only one future year for ease of exposition. Liu and Thomas (2000) estimate a model similar to (1) using analysts forecasts as proxies for market expectations. We use actual future earnings as the regressors and not analysts' forecasts, because we want to know how much information about future earnings is reflected in current returns (i.e., how close future earnings realizations are to the unobservable expectations implicit in stock prices).

[7] Contemporaneous ERC is often estimated as the sum of the coefficients on current and lagged earnings, $b_0 + b_1$.

[8] Other recent papers using the informativeness measure are Durnev, Morck, Yeung, and Zarowin (2003), Ayres and Freeman (2001), Jiambalvo, Rajgopal, and Venkatachalam (2002), and Piotroski and Roulstone (2004).

[9] There are a number of reasons why management may chose not to capitalize development expenditures which meet the five criteria outlined in SSAP #13. First, it may be costly to deviate from analyst preferences (AIMR, 1994). Second, managers may be concerned about the quality of current and future earnings (Freeburn, 1998). Finally, there are measurement and record keeping costs associated with capitalizing development expenditures (Nixon and Lonnie, 1990).

[10] For example, for firms in the mining industry, Datastream often reports a positive amount for the firm's R&D asset; however, upon examination it is apparent that the amount reported relates to an exploration asset, not R&D. Similarly, for many firms in the Oil and Gas industry, the R&D asset relates to exploration and development.

[11] We measure leverage as total debt divided by book value of equity (converted to 'as-if-expense' for capitalizers) R&D intensity is measured as the total amount expended on R&D (equal to R&D expense for the expensers and R&D expense plus the amount added to the R&D asset for the capitalizers) divided by total assets (converted to an 'as-if-expense' basis for the capitalizers). We measure the market-to-book ratio as the market value of equity divided by book value of equity, converted to 'as-if-expense' for the capitalizers. We measure beta as the market model beta calculated using monthly returns ending in the month of the firm's fiscal year end (requiring a minimum of 12 months and maximum of 60 months of returns) and the FTSE All Share Index.

[12] Pro-forma (or 'as-if-expense') earnings are the earnings that would have been reported had the firm followed a policy of fully expensing R&D expenditures. We construct capitalizers' pro-forma earnings by subtracting the excess (or adding the deficit) after-tax amount of development costs capitalized minus amortization expense, from reported net income. Even if capitalizers do not report the amount of development costs capitalized, we can compute the pro-forma operating profit, because the difference between the amount capitalized and the amortization expense equals the change in the reported R&D asset balance.

[13] For example, Lang (1991) and Freeman (1987) find that young firms and small firms, respectively, have earnings that are more variable and have a lower association with stock returns.

[14] Another way to deal with selection bias is to examine the change in FERC for firms that switch methods, so that each firm acts as its own control. We did not do this, because there are only 25 switchers (an average of 8 per industry), so the sample size is small. Moreover, with only a nine year sample period, either the pre or post switch period (or both) is too short to reliably estimate FERC. We re-estimated our regressions after eliminating switchers. The results, not shown in the interest of brevity, are very similar to our main results.

[15] Skinner uses the term "investment opportunity set" (IOS) to capture firm type. Similar to us, he uses R&D intensity and q (which is related to the M/B ratio) as proxies for IOS.

[16] We also calculated the earnings variance as $\sigma^2(\Delta EPS_t/P_{t-1})$, with very similar results.

[17] As a robustness test we also included firm age (defined as the number of years since incorporation) and sales growth (defined as current sales minus lagged sales all divided by lagged sales) in our Probit model. Neither variable was significant in explaining the capitalization choice in any of our three industries. For brevity, we do not report these results.

[18] We use two years of R&D expenditures in the denominator to avoid undue influence from the current year. We do not use more than two years since prior to 1990 the disclosure of R&D expense was voluntary, and to use more years eliminates too many observations.

[19] Since successful firms can choose to expense, we have no expectation about firms with high RD_VALUEs. As we discuss in Section 5.3, the most successful firms do in fact choose to expense.

[20] Our model is similar to Aboody and Lev's (1998), who use size, profitability, R&D intensity, beta, and leverage as explanatory variables. As a robustness test, we re-estimated the model adding leverage, and our results were virtually unchanged. In addition, although we suggest in Section I that earnings-based bonus plans may provide an incentive for managers to manipulate earnings for their own benefit, we are unable to control for this factor in our analysis. Information pertaining to the composition of bonus plans is unavailable for our entire time-series. Finally, in footnote 9 we suggest that there are costs associated with capitalization; however, we are unable to accurately measure these costs and therefore, we cannot include them in our model.

[21] Based on the distribution of expensers and capitalizers, we define an expenser (capitalizer) firm-year observation as correctly classified when the fitted probability is less than (greater than) the ratio of capitalizers to expensers in each industry.

[22] We also used returns measured over months (-12, 0) relative to the fiscal year end. Very similar results are found. To remove extreme observations, we windsorize R_t, E_t, E_{t-1}, $E_{t+\tau}$, and $R_{t+\tau}$ at the top / bottom 1%, and we remove observations with studentized residuals greater than two.

[23] The Z statistics assume that the industry regressions are independent. However, since the regressions are all estimated over the same time period, they might not be independent. To check our independence assumption, we estimate the regressions with fixed time effects, and the results are very similar. The Z statistic also assumes that the coefficients' standard errors are unbiased. This is a reasonable assumption, since the regressions are run by industry. In effect, all observations are relative to their industry mean, as in an industry index model, so that common industry effects are removed (Bernard, 1987). Results for the individual industries are available from the authors on request.

[24] Although the coefficients of the Mills ratios are insignificant, we include them to make the results of the two samples comparable.

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