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Abstract

This study examines whether firms manage earnings to meet analyst forecasts to signal superior future performance. Prior research finds that firms use earnings management to just meet analyst forecasts and that these firms have a positive association with future performance (Bartov et al., 2002). There are two potential explanations for the positive association—signaling and attaining benefits that allow for better future performance (i.e., the real benefits explanation). Prior studies cannot provide evidence of signaling because they do not control for the real benefits explanation. Our research design enables us to control for the real benefits explanation because we can identify potential signaling firms within the sample of firms that just meet analyst forecasts. We use a unique database from the National Bureau of Economic Research to construct a proxy for the manager's belief about future firm value due to patents. We find that firms with more patent citations are more likely to just meet the analyst forecast and manage earnings to achieve this goal. We also find firms that just meet analyst forecasts with more patent citations have significantly better performance than firms with fewer patent citations, which is consistent with signaling and not the real benefits explanation.

Keywords: Signaling, Analyst Forecasts, Earnings Management, Patents, Research and Development

JEL Classifications: D82, M40, M41, M49

1. Introduction

We examine the signaling hypothesis as an explanation for the discontinuity around zero analyst forecast errors. Several studies find that a disproportionate number of firms meet or slightly beat analyst forecasts (Degeorge et al., 1999; Payne and Robb, 2000; Burgstahler and Eames, 2003) and that firms manage earnings to meet this benchmark (Ayers et al., 2006; Matsumoto, 2002; Roychowdhury, 2006; Graham et al., 2005). Prior literature also consistently finds a market premium and superior future performance for firms meeting analyst forecasts of earnings (Bartov et al., 2002; Kasznik and McNichols, 2002).

The positive association between just meeting earnings benchmarks and future performance is consistent with two explanations—signaling and attaining benefits that allow for better performance in the future (i.e., the real benefits explanation). The signaling explanation asserts that firms manage earnings to meet analyst forecasts to signal superior future performance. If meeting the forecast (via earnings management) is a credible signal about a firm's favorable outlook, we would expect future performance to be better for firms that meet the target than for those that miss.

The real benefits explanation, in contrast, suggests that the act of meeting an earnings benchmark may provide benefits, such as enhancing the firm's credibility and reputation with stakeholders (Burgstahler and Dichev, 1997). These benefits could lead to stronger relationships with such stakeholders as customers, suppliers, and creditors, which could enhance future performance.[1]

[1]Another explanation for the discontinuity around zero analyst forecasts is managerial opportunism in which executives engage in earnings management to just meet analyst forecasts in an effort to exploit stakeholders, maximize personal gain, or mislead investors (Barua et al., 2006; Christensen et al., 2008; Matsunaga and Park, 2001). However, managerial opportunism is inconsistent with a positive association between just meeting forecasts and future performance.

Our research objective is to investigate signaling after controlling for the confounding effect of the real benefits explanation. We examine a sample of patent-intensive firms that may have difficulty credibly communicating their future value. Management can communicate the level of research and development (R&D) expenditure and the number of patents created in a particular year but the underlying value of the patents is difficult to credibly communicate. Graham et al. (2005) report 74.1% of the 401 executives surveyed acknowledge they try to meet earnings benchmarks because it helps to convey growth prospects to investors, and prior literature documents that patent citations are indicators of future firm value (Deng et al., 1999; Hall et al., 2005). Signaling by meeting the analyst forecast thus may be a way to communicate private information about future firm performance.

Examining a sample of patent-intensive firms also allows us to identify potential signaling firms within the dichotomy of just meeting analyst forecasts. To test for signaling, we need a proxy for the manager's unobservable information about future firm value. Prior literature provides evidence that the number of citations received by a patent is an indicator of its economic impact on future firm value (Hall et al., 2005; Lanjouw and Schankerman, 2004; Deng et al., 1999; Trajtenberg, 1990). We use patent citations (i.e., citations received by a patent from future patents) to proxy for managers' beliefs about firm growth prospects. By using this measure, we assume that ex post citation counts capture managers' ex ante information about the quality of their firms' patents and thus future firm performance. Consistent with this assumption, Ahuja et al. (2005) examine insider trading and find managers possess foresight about the value of their firms' patents. We can obtain information on patent counts and citations from the NBER U.S. Patent Citations Data File. Every patent

document contains information about the invention, the inventor, the assignee, and the technological antecedents of the invention (cited patents).

To test the signaling hypothesis, we use a sample of 5,491 firm-years (653 firms) from 1983–1998. First, we hypothesize that managers of firms with more valuable patents will signal future firm value by meeting analyst forecasts and find evidence consistent with this hypothesis. In the case of signaling, managers with more favorable private information about their firm's growth prospects would be more likely to meet the analyst forecast relative to firms that just miss. The results hold after controlling for factors found in prior literature to influence the ability and cost of meeting/missing the analyst forecast such as book-to-market ratio, return on assets, size, industry and year (McVay et al., 2006; Jia, 2013). We employ several robustness checks to rule out any systematic bias in our patent citation measure.

Second, we hypothesize that firms with more patent citations are more likely to manage earnings to meet the analyst forecast. For meeting the analyst forecast to be a signaling equilibrium, the signal must be costly, thus preventing firms with less favorable prospects from signaling. Firms with more patent citations can afford to manage earnings in costly ways because they expect that future earnings growth will outweigh the adverse impact of reversals of earnings management. We find that managers whose firms' patent citations suggest positive information about future firm value are more likely to use income increasing earnings management to just meet the analyst forecast relative to firms with less positive information about future firm value.

While the first two hypotheses explore whether just meeting the analyst forecast creates a separating equilibrium that is costly and undertaken by firms with better prospects (i.e., the necessary conditions for signaling), the third hypothesis is designed to test for signaling after controlling for the real benefits explanation. Specifically, we hypothesize that

firms with more patent citations have superior future performance even within the subsample of firms just meeting analyst forecasts. If the positive association between just meeting analysts' forecasts of earnings and future performance depends on the manager's belief about the firm's growth prospects, this would be consistent with signaling.

We find firms with more favorable information that just meet the earnings benchmark have significantly better future performance than firms with less favorable information that just meet the benchmark, even after controlling for factors previously found to influence future performance, such as current ROA, book-to-market ratio, size and R&D intensity (Gunny, 2010; Roychowdhury, 2006). Overall, our results are consistent with signaling explaining the discontinuity around just meeting analyst forecasts for our sample of patent-intensive industries.

We contribute to the literature by providing evidence of signaling by meeting earnings benchmarks. Prior literature finds firms meeting benchmarks have superior future performance relative to firms not meeting earnings benchmarks (e.g., Bartov et al., 2002). Prior results also rule out managerial opportunism as a likely explanation for meeting earnings benchmarks but these results do not provide evidence of signaling. There are two explanations for the positive association between meeting earnings benchmarks and future performance: (1) managers signal future firm value by meeting earnings benchmarks, or (2) firms meeting these benchmarks attain benefits that enable better future performance. Our research design allows us to disentangle these explanations by partitioning potential signaling firms *within* the group that meets benchmarks. For firms meeting benchmarks, we identify managers' ex ante information about the underlying value of the firm (i.e., firms with more patent citations). We find firms meeting benchmarks with more favorable patent-related information perform better than firms meeting benchmarks with less favorable information, consistent with signaling. We

also contribute to the literature by introducing a unique dataset to the accounting literature that proxies for managers' private information about the underlying value of firm patents. Data on patents under application offer opportunities for researchers to study how various stakeholders communicate and use private information (Plumlee et al., 2013).

2. Motivation and hypotheses development

Our research is motivated by the lack of explanations for why firms manage earnings to meet analyst forecasts. Given the positive association between just meeting analyst forecasts and future performance, the evidence suggests signaling (or real benefits) rather than opportunism. However, the research design in prior literature limits the ability to draw inferences regarding signaling because prior studies do not control for the confounding influence of the real benefits explanation.

Several studies indicate that firms face pressure to meet or beat analyst consensus forecasts (Brown and Caylor, 2005; Graham et al., 2005) and find a disproportionate number of firms that meet or slightly beat analysts' forecasts (Degeorge et al., 1999; Payne and Robb, 2000; Burgstahler and Eames, 2003). Several papers also find evidence of earnings management to meet the analyst forecast. For example, Payne and Robb (2000) show firms use income-increasing abnormal accruals to just meet the analyst forecast. Barua et al. (2006) also find accruals management to achieve earnings benchmarks. Similarly, firms in the UK appear to use accrual management and classification shifting to just meet earnings benchmarks (Athansakou et al., 2009; Athansakou et al., 2011), and firms in Canada seem to manage earnings to meet voluntary earnings forecasts in the initial public offering setting (Cormier et al. 2014).

Earnings management around benchmarks can be opportunistic, or it can be consistent with shareholder value maximization. The managerial opportunism explanation asserts that

earnings management to meet analyst forecasts allows executives to exploit other stakeholders, to maximize personal gain, or to mislead investors. For example, managers' incentives to trade in their own firm's stock (McVay et al. 2006) or meet goals in executive compensation contracts (Matsunaga and Park, 2001) could influence whether they manage earnings to meet benchmarks. If opportunism explains why managers use earnings management to meet earnings benchmarks, future performance should be lower for these firms because earnings management decisions reverse in subsequent periods. However, prior literature finds evidence that firms are rewarded with higher than expected returns for meeting analyst forecasts (Kasznik and McNichols, 2002). Prior literature likewise finds a positive association between just meeting analyst forecasts and future performance even when firms use earnings management to achieve analysts' expectations of earnings (Athansakou et al., 2011; Bartov et al., 2002).

Although the evidence is not consistent with opportunism, it is difficult to attribute the results of prior literature exclusively to signaling because the act of meeting the analyst forecast could allow firms to perform better in the future (which is distinct from signaling). On the one hand, prior literature has proposed signaling future earnings growth as an explanation for the positive association between just meeting analysts' forecasts and future performance. Xue (2003), for example, finds that firms with higher information asymmetry exhibit a more pronounced discontinuity around earnings thresholds and firms that just meet thresholds have better operating performance than those that just miss. Her findings suggest that firms with information-constrained environments may use meeting a threshold to signal favorable prospects.

On the other hand, the real benefits explanation is also plausible. The act of meeting an analyst forecast may provide benefits such as enhancing the firm's credibility and

reputation with stakeholders (Burgstahler and Dichev 1997). These benefits could lead to stronger relationships with customers, suppliers, creditors, or all three, which would allow firms to thrive in the future.

2.1 Hypotheses

Our main objective is to test for signaling as the explanation for the positive association between meeting earnings benchmarks and future performance. Therefore hypotheses one and two focus on whether the results of prior literature are similar for our sample. More specifically, we examine whether firms with more patent citations are more likely to meet the analyst forecast relative to firms with fewer patent citations (hypothesis one) and whether firms with more patent citations are more likely to use earnings management to achieve this goal (hypothesis two). Taken together, these two hypotheses are designed to explore whether just meeting the analyst forecast creates a separating equilibrium (consistent with signaling) that is costly and undertaken only by firms with better prospects. Hypothesis three, for its part, focuses on testing for signaling after controlling for the real benefits explanation. More specifically, we examine whether firms with more patent citations have superior performance even within the subsample of firms just meeting analyst forecasts. We develop each hypothesis in more detail below.

In the case of signaling, managers with more favorable private information about their firm's underlying growth prospects would be more likely to meet the analyst forecast relative to firms that just miss (or just beat) the analyst forecast. Managers with favorable information about the underlying value of their patents can either directly or indirectly communicate (i.e., signal) their effect on future firm value. Direct disclosure about the underlying value of firms' patents by managers involves proprietary costs that could give rise to the need for signaling. To minimize proprietary costs, management may choose to delay direct communication of

their innovations from the application year to the grant year, at which point details of the patents will be announced by U.S. Patent and Trademark Office.[2] During the application year, management with high-quality patents under application may have incentives to indirectly communicate their favorable information via signaling to separate themselves from firms with less favorable future firm growth prospects. This leads to our first hypothesis:

> **H1:** Firms with more patent citations are more likely to just meet the analyst forecast relative to firms with fewer patent citations

When used as a signal, meeting analyst forecasts should result in a separating equilibrium between firms with favorable future growth prospects and firms with less favorable prospects because the net costs of managing earnings to meet analyst forecasts differs for these two groups. Prior studies document that firms manage earnings to meet analysts' forecasts of earnings (Ayers et al., 2006; Matsumoto, 2002; Roychowdhury, 2006; Graham et al., 2005). Firms managing accruals will face an adverse effect on future earnings as the past manipulations reverse.

Firms with favorable future growth prospects can afford to undertake costly earnings management because future earnings growth will outweigh the cost of reversals of earnings management. This argument is consistent with Graham et al. (2005), who report executives consider increased uncertainty about firm prospects to be the number one consequence of missing earnings benchmarks. In order for meeting analysts' forecasts to be a separating equilibrium consistent with signaling, we expect firms with more patent citations to engage in more costly earnings management activities relative to firms with fewer citations. Firms with

[2]The American Inventors Protection Act of 1999 requires information about patent applications to be published approximately 18 months after the application has been filed (for patents filed on or after November 29, 2000). However, publication can be avoided by filing a certificate stating the patent has not been applied for in another country that requires disclosure.

more patent citations expect that future earnings growth will outweigh the cost of earnings management reversals. This leads to our second hypothesis:

> **H2:** Firms with more patent citations are more likely to use earnings management to just meet the analyst's forecast of earnings relative to firms with fewer patent citations.

Lastly, for signaling to be the explanation for the positive association between just meeting analysts' forecasts and future firm performance versus the alternative explanation of attaining real benefits that allow better future performance, we must control for the benefits of meeting analysts' forecasts. Specifically, we partition potential signaling firms within the dichotomy of meeting the analyst forecast. Within the sample of firms just meeting analysts' forecasts of earnings, we examine the *interaction* of just meeting analyst forecasts and patent citations on future firm performance. If signaling is the explanation, we would expect a positive association between the interaction and future firm performance. This would suggest that the positive association between just meeting analysts' forecasts of earnings and future performance depends on the manager's belief about the firm's growth prospects, consistent with signaling. On the other hand, if just meeting analysts' forecasts of earnings enables firms to attain better performance, the interaction should not be positive. In this case, the benefits should not depend on the manager's belief about future firm growth prospects. This leads to our third hypothesis.

> **H3:** Firms with more patent citations that just meet the analyst's forecast of earnings have superior future performance relative to firms with fewer patent citations

3. Why patent value could be difficult to credibly communicate

Prior research suggests that managers know more about the underlying value of their firms' patents than investors (Ahuja et al., 2005), even when investors have the aid of financial intermediaries (Deng et al., 1999). Managers with favorable patent information can either directly disclose or indirectly communicate through signaling the underlying future firm

value due to patents. Direct disclosure about the underlying value of firms' patents could involve costs related to competition (i.e. proprietary costs), litigation, and disclosure. The substantial costs of direct disclosure (discussed in the next few paragraphs) could give rise to the need for signaling in our setting.

Proprietary costs may affect a firm's decision to disclose patent details. To minimize proprietary costs, a manager may choose to delay direct communication of an innovation until the patent grant date, at which point the U.S. Patent and Trademark Office announces the details. During the patent-pending period (i.e., the time between the application and grant), direct disclosure of patent details could entail proprietary costs because competitors could reverse engineer the patent or develop substitute innovations (Wagenhofer 1990). Therefore, during the application year, managers with high-quality pending patents may have incentives to indirectly communicate their favorable information via signaling to separate themselves from firms with low-quality patents.

Litigation costs could also affect a firm's decision to directly disclose patent details. Even if the manager directly disclosed specific details of a patent, investors could have difficulty estimating the precise financial impact (i.e., future cash flows) of an innovation due to the specialization and uncertain nature of technological innovations. And managers may be reluctant to reveal their estimates of the financial impact of a technological innovation given litigation costs associated with inaccurate earnings estimates.

Credibility is another potential obstacle to direct disclosure. As with any disclosure of positive information, management faces a potential credibility problem when disclosing information about an innovation and its impact on future performance. A firm with a low quality patent could mimic a firm with a high quality patent by disclosing information about its patents under consideration. There is a very low cost to file a patent application, and not

every patent application results in a patent (72% in 2000). In addition, deciding whether an innovation warrants a patent requires considerable expertise and time.[3] Managers with favorable information about future firm value due to high quality pending patents may have an incentive to signal to separate themselves from low quality firms. These firms can afford to manage earnings in costly ways to meet the analyst's forecast of earnings because they expect future earnings growth to outweigh the cost of the reversals of their earnings management.[4] For our sample of patent-intensive firms, all of these costs could contribute to the need for signaling.

4. Sample selection

We obtain information on patents from the NBER U.S. Patent Citations Data File,[5] which has information on all the utility patents granted from January 1, 1963, through December 30, 1999.[6] The files contain information about the patent on the grant date (when the patent office granted the patent) and the application date (when the inventor filed for the patent). Since the inventor has an incentive to apply for a patent soon after the innovation, Hall et al. (2001) recommend the use of the application date as the relevant time for the patent. The grant date depends on the review process at the Patent Office, which takes on average two years. Therefore we classify patents by the application year and use the period from 1983 to 1998.[7]

For every CUSIP and year, we obtain the number of patents and the number of citations received on those patents. After matching the NBER data to Compustat by CUSIP,

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[3]See http://judiciary.house.gov/media/pdfs/Dudas080227.pdf

[4]Since managers have incentives to signal closer to the application date, we conduct sensitivity analysis using the grant date to measure *Patent Importance* and do not find evidence of signaling.

[5]We thank Hall, Jaffe, and Trajtenberg for sharing the data.

[6]There are three types of patents: utility, design, and plant. The majority of patents are utility patents.

[7]We start in 1983 because that is when analyst forecasts are first available. We exclude 1999 data to allow time for application dates to be revealed at the grant date.

we have 18,515 observations with grant dates from 1963-1999. We restrict the sample by deleting observations (1) without analyst forecast data on I/B/E/S (which starts in 1983) and (2) without sufficient data to calculate the control variables (including research and development expense). Next, we exclude firms in the financial and utility industries (standard industrial classification: 6000-7000 and 4400-5000) because they operate in highly regulated industries with accounting rules that differ from those in other industries. As such, our proxy for earnings management (discretionary accruals) might not be suitable as a proxy for earnings management behavior in these industries. These restrictions reduce our sample to 5,491 firm-years (653 firms).

5. Variable measurement

5.1 Patent citations

A patent for an invention grants property rights to the inventor and is issued by the U.S. Patent and Trademark Office. The term of a patent is 20 years from the date on which the application for the patent is filed. The patent grants "the right to exclude others from making, using, offering for sale, or selling" the invention in the U.S. Every patent document contains information about the invention, the inventor, the assignee, and the technological antecedents of the invention (cited patents). The patent approval process involves a number of formal steps, including the application for a patent (i.e., application date) and the issuance of the patent (i.e., grant date).

We use the number of patent citations received as a proxy for the value of the firms underlying patents. Prior literature finds that patent citations received convey information about two aspects of innovation: (1) spillovers along geographical and institutional dimensions (Jaffe et al., 1993) and (2) individual economic importance or value (Hall et al., 2005; Trajteberg, 1990). Other measures, such as R&D intensity (measuring input, the ratio of

R&D expense to total assets) and patent yield (measuring output, the ratio of the number of patents to R&D expense), typically do not capture value generated from innovations for various reasons. First, input based measures, such as R&D, are noisy because innovation, by its nature, is risky. Moreover, patents tend to vary enormously in their technological or economic importance. Patent yields or patent counts cannot capture this heterogeneity and are thus limited as proxies for underlying patent value (Griliches et al., 1991).

The evidence in prior literature suggests patent citations received are a reasonable proxy for future firm value due to patents. In general, these studies find that various patent importance proxies constructed from patent citation data explain cross-sectional differences in firm market valuations (Deng et al., 1999; Hall et al., 2005).[8] Hall et al., (2005) find that an extra citation increases market value of the patent by 3%, while Lanjouw and Schankerman (2004) show that citations predict which patents will be renewed and which will be litigated (both of which are measures of value). Trajtenberg (1990) focuses on the relationship between a patent's social value (including positive externalities) and patent characteristics. He finds that patents associated with a major innovation in medical technology—computed tomography (CT) scanners—were cited more frequently but had no correlation with patent counts. Harhoff et al. (1999) focus on the private value of patents and ask German holders of U.S. patents for how much they would be willing to sell the patent right three years after filing. They find that the estimated value is correlated with the number of citations received in the subsequent three years. In addition, there is evidence to suggest that managers possess foresight about the underlying value of their patents based on citations (Ahuja et al., 2005)

[8]We replicate these findings for our sample of firms and find patent importance is significantly and positively associated with abnormal returns in all of the subsequent three years.

and that investors do not fully understand the quality of patents even with the aid of financial intermediaries (Deng et al., 1999)

Given this evidence, we use patent citations received as a proxy for managers ex ante information about the underlying value of firm patents. However, citations are only meaningful when used comparatively. Thus we need to choose the best benchmark for comparison. Our variable of interest, *Patent importance*, is the mean number of patent citations received on firm j's patents applied for in year t divided the mean number of patent citations received on all patents applied for in year t by all firms.[9] We measure the variable as follows: $Adj\_CITE_{j,t} = CITE_{j,t} / [\sum_{i=1}^{N} CITE_{i,t} / N]$, where $CITE_{j,t}$ is the total citations received through year 2000 for patent j that was applied for in year t. N is the total number of patents applied for in year t. $\sum_{i=1}^{N} CITE_{i,t}$ is the sum of total citations received through 2000 for all patents applied for in year t. Next, *Patent Importance* for firm x at year t is calculated as follows:

$Patent\ Importance_{x,t} = [\sum_{j=1}^{K} Adj\_CITE_{j,t} / K]$, where K is the total number of patents from firm x that were applied for in year t.

Following Hall et al. (2001), we choose overall patent citations for the same year as the comparative benchmark to control for any systematic variations in patent citations over time. This approach controls for effects due to (1) truncation,[10] (2) any systematic changes

[9]We use the application date since the inventor has an incentive to apply for a patent soon after the innovation (Hall et al., 2001). More importantly, we are investigating signaling by just meeting analyst forecasts, and managers have no incentive to signal the underlying value of firm patents once the details of the patent are publicly disclosed.

[10]Patents applied for in 1983 will have 16 subsequent years to receive citations. Patents applied for in 1995 only have four subsequent years to receive citations. Weighting by year treats a patent that received six citations for which the average patent received five citations in that year as equivalent to a patent that received 12 citations but belongs to a year in which the average was 10 citations.

over time in the propensity to cite, and (3) changes in the number of patents making citations.[11] In the sensitivity analysis, we perform several robustness checks to ensure neither benchmark choice nor truncation drives our results. We use two other variables to capture the innovative process: patent yield and R&D intensity. *Patent yield* is the ratio of the number of patents to R&D expense (in millions). *R&D intensity* is the ratio of R&D expense to total assets.

5.2 Earnings threshold

We use the analyst unadjusted mean consensus forecast as the earnings threshold managers want to meet if they have optimistic inside information. Specifically, we use the annual consensus analyst forecast, which is the mean earnings per share (EPS) forecast computed over the set of the analysts' most recent forecasts. We only use forecasts within two months of the annual earnings release date to reduce the influence of stale forecasts (McVay et al., 2006). We use the I/B/E/S forecasts that are unadjusted for stock splits (Diether et al. 2002). Following McVay et al. (2006) and Jia (2013), we classify the firms in the following way. Firms "just meeting" are those with realized EPS that meets consensus analyst forecast by zero or one cent. Firms "just missing" are those with realized EPS that misses consensus analyst forecast by one or two cents. Firms "just beating" are those with realized EPS that meets consensus analyst forecast by two or three cents.

6. Descriptive statistics

Table 1 presents descriptive statistics for our sample of 5,491 firm-years (653 firms) for which we have data on analyst forecast and patents. The average number of patents for each firm-year is 41.2 and median is 7, consistent with the notion these are patent-intensive

[11]The limitation of this approach is that it does not separate any "real" effects over time. However, attempting to control for these "real" effects requires more assumptions and could induce even more measurement error.

firms. The mean (median) number of patent citations is 5.5 (4.0), and mean (median) R&D expense is $141.6 million ($21.5 million). For the three innovation measures used in prior literature: patent yield has mean (median) of 0.749 (0.380); patent importance has mean (median) of 1.003 (0.761); R&D intensity has mean (median) of 0.058 (0.04).[12] Hall et al. (2005) report higher patent yield and R&D intensity for their sample of 12,118 firm-years during 1979-1988. The difference is primarily due to the fact we have fewer small firms because we require data on analyst forecasts.

Table 2 reports the industry composition (defined by two-digit SIC code) and industry R&D intensity. The five most highly represented industries for our sample are industrial machinery and equipment, chemicals and allied products, electrical and electronic equipment, instruments and related products, and transportation equipment. These industries all have significant industry investments in R&D. The chemical and allied products industry, for example, spends on average 7.3% of assets on R&D investment, while the industrial machinery and equipment industry likewise spends on average 6.6% of assets. Consistent with prior evidence (Degeorge et al., 1999; Payne and Robb, 2000; Burgstahler and Eames, 2003), we find disproportionate numbers of firms just meeting analyst forecasts compared to firms just missing or just beating the forecasts. Out of 5,491 firm-years, 767 firm-years just meet the forecast by 0 or 1 cent; 522 firm-years just miss by 1 or 2 cents; and 576 firm-years beat the forecast by 2 and 3 cents. The discontinuity around the threshold does not appear to be driven by any particular industry.

7. Results

7.1 Testing Hypothesis 1: Meeting Analyst Forecasts to Signal

[12]Chan et al. (2001) report R&D intensity for all Compustat firms engaged in R&D as 3.75% in 1995.

Our regression specification is the following logit regression to examine the characteristics of firms that just meet the analyst forecast versus firms that just miss the forecast (including year and industry fixed effects):

$$\text{Just Meeting}_t = \gamma_0 + \gamma_1\text{Patent Yield}_t + \gamma_2\text{Patent Importance}_t + \gamma_3\text{R\&D Intensity}_t + \gamma_4\text{ROA}_t + \gamma_5\text{BTM}_t + \gamma_6\text{SIZE}_t + \varepsilon_t \quad (1)$$

Just Meeting	=	An indicator variable equal to one if the firm's realized EPS beats the analyst forecast by zero or one cent, and zero if the firm misses the analyst forecast by one or two cents
Patent Yield	=	the number of patents divided by research and development expense
Patent Importance	=	the mean number of patent citations received on current year patents divided by the mean number of patent citations received in the current year for all firms
R&D Intensity	=	research and development expense divided by total assets
ROA	=	operating income divided by assets
BTM	=	the book value of equity divided by the market value of equity
SIZE	=	the natural logarithm of market value of equity at the beginning of the year

Hypothesis one predicts that γ_2 will be positive, indicating firms that are more likely to meet the analyst forecast to signal optimistic future firm value have more important patents than firms just missing. We include *Patent Yield* in the regression to control for the total number of patents. Although Hall et al. (2005) find that *Patent Yield* is not an indicator of underlying patent value, we include it to control for the overall patent generation profile of the firm; however, we do not expect γ_1 to be significant. We include R&D Intensity in the regression to control for the accounting effects of R&D. Under current accounting rules, R&D expenditures must be expensed as incurred because of the uncertainty of future benefits (SFAS No. 2, October 1974).[13] Thus R&D may influence the ability of the firm to meet the earnings expectation.

[13]FASB permits R&D to be capitalized only for certain kinds of software (SFAS 86).

We include three control variables that may influence whether a firm just misses versus just meets the earnings expectation: book-to-market, return on assets, and size. Skinner and Sloan (2002) show high-growth firms are associated with a more negative stock price reaction from missing the analyst forecast than nongrowth firms. Therefore we include *BTM* to control for growth firms. *ROA* controls for performance; *SIZE* controls for size in terms of the market value of equity.

Table 3 presents univariate statistics for firms that just meet the analyst forecast versus just miss it. The univariate statistics in table 3 show that firms just meeting forecasts have significantly higher mean patent importance compared to firms just missing (1.195 vs. 0.977), with no significant difference on patent yield. The univariate statistics also reveal that firms just missing the forecast have lower ROA than firms just meeting. This suggests that, on average, firms that meet analyst forecasts perform better. Firms that just miss the analyst forecast have higher BTM. This suggests that value firms (i.e., higher BTM) are more likely to miss the analyst forecast, consistent with Skinner and Sloan (2002), who show that the costs of missing are higher for growth firms (i.e., lower BTM). The univariate statistics highlight the importance of controlling for these differences in the regression analysis.

Next, we estimate the likelihood of just meeting versus just missing analyst forecasts controlling for *BTM*, *ROA*, *Size*, industry, and year. The results are presented in table 4. We find patent importance significantly increases the likelihood of just meeting analyst forecasts (coefficient=0.149 and p value=0.01) after controlling for the characteristic differences between the two groups. In contrast, the likelihood of just meeting forecasts is not explained by patent yield. These different results (γ_1 versus γ_2) increase our confidence that our hypothesis 1 testing does not capture an omitted variable that could be correlated with the overall patent generation profile of the firm. Overall, it appears that firms are more likely to

meet the analyst forecast if they have more favorable private information about their underlying growth prospects (i.e., more patent citations). This result suggests signaling.

7.2 More Considerations for Testing Hypothesis 1

7.2.1 Data Truncation and Measurement

As discussed in section 5.1, the data truncation problem is one unavoidable limitation of using the NBER patent citations database. Our variable of interest, *Patent Importance*, is constructed using a comparative benchmark of overall patent citations for the same year (i.e., the fixed-effects approach to mitigate concerns about data truncation). To show our results are not driven by the truncation correction method or truncation, we perform two robustness tests (untabulated). First, we use an alternative measure of patent importance that does not adjust for truncation. We use the average number of patent citations divided by the number of patents in the current year, and our coefficient on this alternative proxy is similar in magnitude and significance. Second, since truncation should affect the earlier years less than it affects more recent ones, we estimate the likelihood of meeting analyst forecast for two earlier sample periods. The coefficient on patent importance is significantly positive using the sample period from 1983-1993 and the sample period from 1983-1987. In addition, the coefficients on *Patent Importance* for these two regressions are not significantly different. The consistency of results across each subsample leads us to believe that our inferences are not affected by truncation.

7.2.2 Hypothesis 1: Three Alternative Explanations

In this section we describe three alternative explanations for the findings presented in 7.1 and describe the sensitivity tests we implement to mitigate concerns about alternative explanations. We hypothesize that managers of firms with more valuable patents will signal future firm value by meeting analyst forecasts and find evidence consistent with this

hypothesis. We use a measure calculated from ex post data to proxy for management's private information of patent value and assume there is no systematic bias. One violation of this assumption could be that patents at financially more successful firms enjoy higher visibility and are more likely to influence work in the same field, which would lead to more citations. If firms just meeting the analyst forecast are more successful than firms just missing forecasts and hence enjoy greater visibility and more citations, our results could be mechanical.

We design a test to explicitly rule out this possibility. If such a mechanical relationship exists, we would expect firms just beating the analyst forecasts (by two or three cents) to invite more citations than firms just meeting forecasts by the same logic (beating firms are more successful and enjoy higher visibility than just meeting firms). On the other hand, if our results reflect signaling, we would not expect beating firms to have more citations than just meeting firms because signaling firms would not engage in more costly earnings management than necessary (i.e., signaling firms would just meet but not beat analysts' expectations due to higher signaling costs).

Table 5 presents the results from a logistic regression comparing patent importance between the just meeting and beating samples. We find firms that just meet the forecast have even higher patent importance than firms beating the forecast (coefficient=0.121 and p value=0.02). The results presented in tables 4 and 5 suggest firms just meeting forecasts have favorable information about the underlying value of patents.

Another alternative explanation for our results is that firms with more valuable patents have earnings that are easier to predict, making them more likely to meet the analyst forecast. A biotechnology firm with no products, for example, would require the analyst to predict only expense (e.g., R&D and SG&A), which is easier to predict than a firm with both revenue and expense. To rule out this explanation, we control for revenue variability over the past five

years (i.e., standard deviation of revenue) in tables 4 and 5. The results—that just meeting firms have favorable information about the underlying value of patents compared to just beating or missing firms—are robust at a 1% level.

The third alternative explanation is that an omitted correlated variable, such as managerial talent, explains the positive association between meeting analysts' forecasts and patent importance. If patent importance proxies for managerial ability, we would expect managers of high patent-importance firms to meet the analyst forecast not only in t but also in t-1 since managerial ability should not change systematically from year t-1 and year t.[14] From table 1, it appears the variable *Just Meeting* is serially correlated—the correlation between *Just Meeting*$_t$ and *Just Meeting*$_{t-1}$ is 0.09 (table 1B). *Just Meeting*$_{t-1}$ is also correlated with various independent variables that we employ (table 1B). This highlights the necessity of formal testing through regression analysis. Table 6 presents the results of a regression of *Just Meeting* in period t-1 on the patent innovation variables (*Patent Yield*, *Patent Importance*, *R&D Intensity*) in period t-1 and control variables (*ROA*, *BTM*, *SIZE*) in period t-1. We do not find that higher patent importance firms just meet the forecast in t-1 (coefficient=0.003 and p value=0.96), suggesting that the result in table 4 is not driven by managerial ability.

7.3 Testing Hypothesis 2: Managing Earnings to Signal

After finding firms with more patents are more likely to meet analyst forecasts in 7.1 and 7.2, we next investigate whether they achieve this outcome by engaging in costly earnings management. There is evidence that firms just meeting the forecast engage in accruals management (Ayers et al., 2006; Matsumoto, 2002). We examine whether firms with more patent citations are more likely to manage earnings to meet the analyst forecast. Our

[14]Management ability does not change every year (Bushman et al., (1996) report the median of CEO tenure is 5 years). Furthermore, there is no reason to believe management ability changes contemporaneously with patent importance given the long duration and uncertainty of R&D activities.

regression specification is the following logit regression to examine the earnings management characteristics of firms that just meet the analyst forecast versus firms that just miss (including year and industry fixed effects):

$$\text{Just Meeting}_t = \beta_0 + \beta_1\text{Patent Yield}_t + \beta_2\text{Patent Importance}_t + \beta_3\text{R\&D Intensity}_t + \beta_4\text{Accruals}_t + \beta_5\text{Accruals*Patent Importance}_t + \beta_6\text{ROA}_t + \beta_7\text{BTM}_t + \beta_8\text{SIZE}_t + \varepsilon_t \quad (2)$$

All variables as previously defined in model (1) except *Accruals*. If firms with favorable private information are more likely to use earnings management to just meet the analyst forecast relative to firms with less favorable private information, we would expect the interaction coefficient (β_5) to be positive. We use the modified-Jones model to calculate our measure of earnings management (Dechow et al., 1995). To estimate abnormal accruals (*Accruals*), we perform the following cross-sectional regressions for each two-digit SIC code containing at least 15 companies in each year for the entire population of Compustat companies (Dechow et al., 1995):

$$TA_{j,t}/A_{j,t-1} = \alpha_{1,t}/A_{j,t-1} + \alpha_{2,t}(\Delta REV_{j,t} - \Delta AR_{j,t})/A_{j,t-1} \quad (3)$$

$$ETA_{j,t}/A_{j,t-1} = \alpha_{1,t}/A_{j,t-1} + \alpha_{2,t}(\Delta REV_{j,t} - \Delta AR_{j,t})/A_{j,t-1} \quad (4)$$

TA	=	total accruals
A	=	total assets
Δ*REV*	=	net sales in year t less net sales in year t-1
Δ*AR*	=	accounts receivable in year t less accounts receivable in year t-1
ROA	=	operating income divided by total assets

Total accruals (*TA*) are estimated from the balance sheet as change in current assets minus change in current liabilities minus change in cash plus change in short-term debt minus depreciation and amortization expense.[15] *A* is total assets; Δ*REV* equals net sales in year t less net sales in year t-1; Δ*AR* equals accounts receivable in year t less accounts receivable in year

[15]Although Collins and Hribar (2002) suggest calculating accruals from the statement of cash flows mitigates concerns about the effects of acquisitions and foreign currency translation adjustments, operating cash flows from the statement of cash flows is only available after 1988.

t-1. We use the industry-year specific parameter estimates from (3) to estimate expected accruals (*ETA*) using model (4). Our measure of discretionary accruals (*Accruals*) equals $TA_{j,t}$ $/A_{j,t-1}$ minus $ETA_{j,t}/A_{j,t-1}$.

The results from estimating equation (2) are presented in table 7. First, we find patent importance significantly increases the likelihood of just meeting the analyst forecast (i.e., the coefficient on patent importance is similar in magnitude and significance to the coefficient reported in table 4). We also find that firms with favorable patent information are more likely to engage in income increasing accruals management to meet the analyst forecast (i.e., β_5 is significantly positive). This supports our hypothesis that firms with favorable information about their underlying patents undertake costly earning management activities to signal future firm value. These firms can afford the costly signal because they expect that future earnings growth will outweigh the adverse impact of reversals of earnings management.[16]

7.4 Testing Hypothesis 3: Superior Future Performance of Signaling Firms

This section provides evidence on an important necessary condition regarding the signaling explanation, that signaling firms experience superior future performance even after controlling the confounding effect of real benefits. We examine whether firms with more patent citations have superior future performance even within the subsample of firms just meeting analyst forecasts. Similar to Core et al. (1999), we specify the following OLS regression (including industry and year fixed effects):

$$\begin{aligned} ROA_{t+i} = {} & \mu_0 + \mu_1 \text{Patent Yield}_t + \mu_2 \text{Patent Importance}_t + \mu_3 \text{R\&D Intensity}_t + \mu_4 \text{Just Meeting}_t \\ & + \mu_5 \text{Just Meeting*Patent Importance}_t + \mu_6 \text{stdROA}_t + \mu_7 \log(\text{Sales})_t + \mu_7 BTM_t \\ & + \mu_8 \log MV_t + \mu_9 ROA_t + \varepsilon_t \end{aligned} \quad (5)$$

[16] Prior research indicates that abnormal accrual proxies (e.g., the modified Jones model) may increase in earnings (Kasznik, 1999; Dechow et al., 1995, 2003), which biases towards our finding. However, Ayers et al. (2006) find that this issue is less problematic for the analysts forecast benchmark.

where i = 1,2,3.

All variables are as previously defined in model (1). Future performance is measured using return on assets (operating income plus research and development expense divided by total assets) in year t+1, t+2, and t+3. Following Bharat and Kini (2008), Dorrough and Rangan (2005) and Raman and Shahrur (2008), we add back R&D expense to operating income. This adjustment controls for any potential spurious correlation between current R&D intensity and subsequent profitability.[17] In addition, we use an accounting-based measure of performance instead of a market-based measure (e.g., stock returns, Tobin's Q) because market based measures are susceptible to investor expectations. If favorable future prospects are credibly communicated to investors via signaling, long-term stock returns will not necessarily be superior for the signaling firms because investors will have already impounded this information into price. ROA is widely used in accounting and finance to measure future firm performance (e.g., Core et. al., 1999; Larcker et. al., 2007).

For meeting the analyst forecast to be a credible signal, we would expect firms with favorable information about the underlying value of their patents to undertake costly earnings management because they expect that future earnings growth will outweigh the cost of reversals of earnings management. The specification of equation (5) allows us to test for signaling while controlling for the real benefits explanation. Under the real benefits explanation, just meeting analysts' forecasts allow firms to attain real benefits that result in better future performance; therefore, researchers would observe a positive association between future firm performance and just meeting analysts' forecasts, even in the absence of signaling. When estimating equation (5), μ_4 captures the benefits of meeting the benchmark. If signaling is the explanation, firms with favorable information about the value of their

[17] Our results are similar without this adjustment.

underlying patents will signal by meeting the analyst forecast, thus the coefficient for the interaction term μ_5 should be positive after controlling for just meeting the analyst forecast (*Just Meeting*). In contrast, if real benefits is the explanation, μ_4 should be positive and μ_5 should *not* be significant, because meeting the analyst forecast is the benefit and should not depend on the manager's belief about future firm value.

Table 8 reports our findings: μ_4 is not significant in any specification, and μ_5 is significantly positive for two specifications. Thus firms with favorable patent information that meet analyst forecasts have statistically and economically higher *ROA* in t+1 (coefficient=0.005 and p=0.06) and t+2 (coefficient=0.006 and p=0.06).[18] Taken together with the results reported earlier, our evidence is consistent with the signaling explanation because (1) firms with favorable patent information signal by undertaking costly earnings management to meet analyst forecasts; (2) signaling firms' prospects are favorable enough that they can afford costly signaling because their future performance is superior compared to other firms.

7.5 Industry Effects

We conduct sensitivity analyses for all three hypotheses to ensure our results are not driven by the industry effects. Our approach to measuring *Patent Importance* (i.e., comparing patents to all patents in the same year) controls for systematic changes over time in the propensity to cite and changes over time in the number of patents making citations. However, it does not control for potential differences across industries. We implement several tests to mitigate concerns that our results are driven by industry differences. First, all our regressions include industry dummies, which control for industry effects. Second, in table 2, we explore differences in patent citations for the four most represented industries in the "Just Meeting

[18] Although, we do not find that these firms perform better in year t+3, the overall evidence on future performance is consistent with hypothesis three.

Analyst Forecast" sample and find no statistical difference between these four industries. Third, we construct an alternative *Patent Importance* variable that takes into consideration variation in industry patent citations. *Patent_Importance_Industry* is the mean number of patent citations received on current year patents divided the mean number of patent citations received in the current year for firms in the same two-digit SIC code. Our results are qualitatively similar using this alternative measure for patent importance. Overall, we believe that the results are not driven by industry differences.

8. Conclusion

This study explores whether the discontinuity around zero analyst forecast errors can be explained by the signaling explanation for a sample of patent-intensive firms. Prior research finds that there are a disproportionate number of firms that just meet analyst forecasts and find evidence of earnings management to achieve this objective (Ayers et al., 2006; Matsumoto, 2002; Roychowdhury, 2006; Graham et al., 2005). In addition, Bartov et al. (2002) find a positive association between just meeting analyst forecasts and future performance. The positive association is consistent with two explanations—signaling and attaining benefits that allow better performance in the future. Our research objective is to test for signaling while controlling for the confounding effect of the real benefits explanation.

We focus on a sample of patent-intensive firms included in a unique database on patents and patent citations from NBER. This database allows us to construct a proxy for the manager's belief about future firm value due to patents, which helps us test for signaling after controlling for the confounding effect of the real benefits explanation. Specifically, we can identify potential signaling firms within the sample of firms that just meet the analyst forecast, which holds constant the real benefits of just meeting the analyst forecast.

We find that firms with more patent citations are more likely to meet the analyst forecast relative to firms with fewer citations and firms with more citations are more likely to manage earnings to achieve this goal. These results are consistent with the literature and suggest that just meeting the analyst forecast creates a separating equilibrium (consistent with signaling) that is costly and undertaken by firms with better prospects. Lastly, we find that firms with more patent citations have superior performance even within the subsample of firms just meeting analyst forecasts. This result suggests that the dominant explanation for the discontinuity around the analyst forecast is signaling. We contribute to the literature by providing evidence of signaling.

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Table 1

Panel A: Descriptive statistics for the 5,491 firm-years (653 firms) with analyst forecast and patent information

	Mean	Median	Std.dev.	1st quartile	3rd quartile
Number of Patents	41.2	7.0	122.3	2.0	29.0
Patent Citations	5.5	4.0	6.8	1.0	7.4
Research & Development Expense (millions)	141.6	21.5	364.4	7.0	86.4
Patent Yield	0.749	0.380	1.718	0.170	0.821
Patent Importance	1.003	0.761	1.133	0.410	1.286
R&D Intensity	0.058	0.040	0.054	0.019	0.082
Just Miss	0.140	0	0.347	0	0
Just Meet	0.095	0	0.293	0	0
Just Beat	0.105	0	0.306	0	0
ROA	0.163	0.153	0.092	0.104	0.216
BTM	0.557	0.487	0.345	0.314	0.715
Total Assets (millions)	3,181	642	7,350	177	2,503

Table 1 (continued)

Panel B: Pearson correlation

	Patent Yield$_t$	Patent Importance$_t$	R&D Intensity$_t$	Just Meet$_t$	Just Miss$_t$	Just Beat$_t$	ROA$_t$	BTM$_t$	SIZE$_t$
Patent Importance$_t$	0.01								
R&D Intensity$_t$	-0.13***	0.21***							
Just Meet$_t$	-0.01	0.07***	0.03**						
Just Miss$_t$	-0.01	-0.01	0.02	-0.13***					
Just Beat$_t$	-0.01	0.01	0.02	-0.14***	-0.11***				
ROA$_t$	-0.10***	0.14***	0.33***	0.17***	0.08***	0.10***			
BTM$_t$	0.07***	-0.08***	-0.13***	-0.15***	-0.07***	-0.12***	-0.46***		
SIZE$_t$	-0.25***	-0.05***	-0.26***	-0.05***	-0.02	0.01	-0.03*	-0.08***	
Just Met$_{t-1}$	0.00	0.04***	0.06***	0.09***	0.05***	0.08***	0.16***	-0.14***	-0.06***

Patent Yield	= the number of patents divided by research and development expense (in millions)
Patent Importance	= the mean number of patent citations received on current year patents divided by the mean number of patent citations received in the current year for all firms (this controls for the citation truncation problem described in Hall et al. 2005)
R&D Intensity	= research and development expense divided by total assets
Just Meeting	= an indicator variable equal to one if the firm's realized EPS meets the analyst forecast by zero or one cent, zero otherwise
Just Missing	= an indicator variable equal to one if the firm's realized EPS misses the analyst forecast by one or two cents, zero otherwise
Just Beating	= an indicator variable equal to one if the firm's realized EPS beats the analyst forecast by two or three cents, zero otherwise
ROA	= operating income divided by total assets
BTM	= the book value of equity divided by the market value of equity
SIZE	= the natural logarithm of market value of equity

Table 2

Descriptive statistics for the 5,491 firm-years (653 firms) with analyst forecast and patent information

Industry	Mean Industry R&D to Assets	Frequency			
		Total # of Firms	Just Missing Analyst Forecast (-1,-2 cents)	Just Meeting Analyst Forecast (0,1 cent)	Just Beating Analyst Forecast (2,3 cents)
Industrial machinery and equipment	6.6%	1032	98	113	98
Chemicals and allied products	7.3%	949	118	164	121
Electrical and electronic equipment	7.8%	830	77	136	99
Instruments and related products	7.9%	810	84	153	94
Transportation equipment	3.4%	495	30	55	43
Fabricated metal products	1.8%	190	15	19	13
Primary metal industries	1.6%	172	11	15	8
Paper and allied products	1.8%	153	15	14	16
Food and kindred products	1.1%	130	10	18	22
Rubber and misc. plastics products	3.2%	118	21	24	11
Business services	8.1%	98	9	7	10
Furniture and fixtures	2.0%	96	8	10	11
Oil and gas extraction	1.9%	75	1	4	4
Petroleum and coal products	2.7%	69	2	2	3
Other		274	23	33	23
		5,491	522	767	576

The mean industry R&D to assets average is calculated using all firms with patent data and analyst forecast data. Industry is defined by the two-digit SIC code. A firm is included in the Just Meeting sample if the firm's realized EPS beats the consensus analyst forecast by zero or one cent; a firm is included in the Just Missing sample if the firm misses the consensus analyst forecast by one or two cents; a firm is included in the Just Beating sample if the firm beats the consensus analyst forecast by two or three cents.

Table 3

Univariate statistics between firms just meeting versus just missing the analyst forecast

	Just Missing (n=522)		Just Meeting (n=767)	
	Mean	Median	Mean	Median
Patent Yield	0.672	0.336	0.699	0.365
Patent Importance	0.977	0.764	1.195***	0.801*
R&D Intensity	0.061	0.042	0.062	0.045
ROA	0.185	0.171	0.201***	0.190***
BTM	0.477	0.414	0.428***	0.362***
SIZE	6.428	6.239	6.304	6.213

***/**/* represent statistical significance at 1%/5%/10% levels two-tailed between the Just Missing sample and the Just Meeting sample. A firm is included in the Just Meeting sample if the firm's realized EPS beats the consensus analyst forecast by zero or one cent; a firm is included in the Just Missing sample if the firm misses the consensus analyst forecast by one or two cents.

Patent Yield = the number of patents divided by research and development expense (in millions)

Patent Importance = the mean number of patent citations received on current year patents divided by the mean number of patent citations received in the current year for all firms (this controls for the citation truncation problem described in Hall et al. 2005)

R&D Intensity = research and development expense divided by total assets

BTM = the book value of equity divided by the market value of equity

ROA = operating income divided by total assets

SIZE = the natural logarithm of market value of equity

Table 4

Logit regression of probability of just meeting versus just missing the anayst forecasts

$$\text{Just Meeting}_t = \gamma_0 + \gamma_1\text{Patent Yield}_t + \gamma_2\text{Patent Importance}_t + \gamma_3\text{R\&D Intensity}_t + \gamma_4\text{ROA}_t + \gamma_5\text{BTM}_t + \gamma_6\text{SIZE}_t + \varepsilon_t \quad (1)$$

	Dependent variable=Just Meeting	
	coefficient	p value
Intercept	1.712	(0.00)
Patent Yield	0.002	(0.97)
Patent Importance	**0.149**	**(0.01)**
R&D Intensity	-0.474	(0.73)
ROA	1.982	(0.02)
BTM	-0.357	(0.19)
SIZE	-0.108	(0.01)
Year Dummies	Yes	
Industry Dummies	Yes	
# that Just Miss	522	
# that Just Meet	767	
Psuedo R^2	0.04	

Just Meeting = an indicator variable equal to one if the firm's realized EPS beats the analyst forecast by zero or one cent, and zero if the firm misses the analyst forecast by one or two cents

Patent Yield = the number of patents divided by research and development expense (in millions)

Patent Importance = the mean number of patent citations received on current year patents divided by the mean number of patent citations received in the current year for all firms (this controls for the citation truncation problem described in Hall et al. 2005)

R&D Intensity = research and development expense divided by total assets

ROA = operating income divided by total assets

BTM = the book value of equity divided by the market value of equity

SIZE = the natural logarithm of market value of equity

Table 5: Sensitivity Analysis
Logit regression of probability of just meeting versus just beating the analyst forecasts

	Dependent variable=Just Meeting (vs. Just Beating)	
	coefficient	p value
Intercept	1.562	(0.00)
Patent Yield	-0.065	(0.23)
Patent Importance	**0.121**	**(0.02)**
R&D Intensity	-0.927	(0.47)
ROA	1.235	(0.15)
BTM	-0.161	(0.57)
SIZE	-0.141	(0.00)
Year Dummies	Yes	
Industry Dummies	Yes	
# that Just Beat	576	
# that Just Meet	767	
Psuedo R^2	0.03	

Just Meeting (vs. Just Beating)	= an indicator variable equal to one if the firm's realized EPS beats the analyst forecast by zero or one cent, and zero if the firm beats the analyst forecast by two or three cents
Patent Yield	= the number of patents divided by research and development expense (in millions)
Patent Importance	= the mean number of patent citations received on current year patents divided by the mean number of patent citations received in the current year for all firms (this controls for the citation truncation problem described in Hall et al. 2005)
R&D Intensity	= research and development expense divided by total assets
ROA	= operating income divided by total assets
BTM	= the book value of equity divided by the market value of equity
SIZE	= the natural logarithm of market value of equity

Table 6: Sensitivity Analysis

Logit regression of probability of just meeting versus just missing the analyst forecasts in year t-1

	Dependent variable=**Just Meeting$_{t-1}$**	
	coeffcient	p value
Intercept	0.575	(0.34)
Patent Yield$_{t-1}$	0.093	(0.24)
Patent Importance$_t$	**0.003**	**(0.96)**
R&D Intensity$_{t-1}$	0.797	(0.57)
ROA$_{t-1}$	2.145	(0.03)
BTM$_{t-1}$	-0.411	(0.20)
SIZE$_{t-1}$	-0.067	(0.16)
Year Dummies	Yes	
Industry Dummies	Yes	
# that Just Beat	486	
# that Just Meet	666	
Psuedo R^2	0.04	

Just Meeting = an indicator variable equal to one if the firm's realized EPS beats the analyst forecast by zero or one cent, and zero if the firm misses the analyst forecast by one or two cents

Patent Yield = the number of patents divided by research and development expense (in millions)

Patent Importance = the mean number of patent citations received on current year patents divided by the mean number of patent citations received in the current year for all firms (this controls for the citation truncation problem described in Hall et al. 2005)

R&D Intensity = research and development expense divided by total assets

ROA = operating income divided by total assets

BTM = the book value of equity divided by the market value of equity

SIZE = the natural logarithm of market value of equity

Table 7

Logit regression of probability of just meeting versus just beating the analyst forecasts and abnormal accruals

$$\text{Just Meeting}_t = \beta_0 + \beta_1\text{Patent Yield}_t + \beta_2\text{Patent Importance}_t + \beta_3\text{R\&D Intensity}_t + \beta_4\text{Accruals}_t + \beta_5\text{Accruals*Patent Importance}_t + \beta_6\text{ROA}_t + \beta_7\text{BTM}_t + \beta_8\text{SIZE}_t + \varepsilon_t \quad (2)$$

	Dependent variable=Just Meeting	
	coefficient	p value
Intercept	1.637	(0.00)
Patent Yield	0.010	(0.86)
Patent Importance	0.172	(0.00)
R&D Intensity	-0.346	(0.78)
Accruals	-1.381	(0.23)
Accruals*Patent Importance	**0.956**	**(0.09)**
ROA	2.136	(0.01)
BTM	-0.255	(0.35)
SIZE	-0.113	(0.01)
Year Dummies	Yes	
Industry Dummies	Yes	
# that Just Beat	506	
# that Just Met	739	
Psuedo R^2	0.04	

Just Meeting	= an indicator variable equal to one if the firm's realized EPS beats the analyst forecast by zero or one cent, and zero if the firm beats the analyst forecast by two or three cents
Patent Yield	= the number of patents divided by research and development expense (in millions)
Patent Importance	= the mean number of patent citations received on current year patents divided by the mean number of patent citations received in the current year for all firms (this controls for the citation truncation problem described in Hall et al. 2005)
R&D Intensity	= research and development expense divided by total assets
Accruals	= abnormal accruals from the modified Jones model controlling for performance
ROA	= operating income divided by total assets
BTM	= the book value of equity divided by the market value of equity
SIZE	= the natural logarithm of market value of equity

Table 8

OLS regression of future return on assets on patent importance and just meeting meeting the analyst forecast (1983-1998)

$$ROA_{t+i} = \mu_0 + \mu_1 \text{Patent Yield}_t + \mu_2 \text{Patent Importance}_t + \mu_3 \text{R\&D Intensity}_t + \mu_4 \text{Just Meeting}_t + \mu_5 \text{Just Meeting*Patent Importance}_t + \mu_6 \text{stdROA}_t + \mu_7 \log(\text{Sales})_t + \mu_7 BTM_t + \mu_8 \log MV_t + \mu_9 ROA_t + \varepsilon_t \quad (5)$$

	ROA_{t+1}	ROA_{t+2}	ROA_{t+3}
Intercept	0.004	-0.018	-0.075
	(0.78)	(0.34)	(0.00)
Patent Yield	-0.003	-0.003	-0.005
	(0.03)	(0.21)	(0.00)
Patent Importance	-0.003	-0.004	0.004
	(0.15)	(0.19)	(0.29)
R&D Intensity	-0.013	0.027	-0.049
	(0.68)	(0.53)	(0.34)
Just Meet	0.002	-0.002	0.009
	(0.64)	(0.76)	(0.18)
Just Meet*Patent Importance	**0.005**	**0.006**	**-0.005**
	(0.06)	**(0.06)**	**(0.30)**
stdROA	0.021	0.017	0.002
	(0.09)	(0.33)	(0.92)
log(Sales)	-0.007	-0.010	-0.014
	(0.00)	(0.00)	(0.00)
BTM	-0.018	0.010	0.039
	(0.03)	(0.39)	(0.00)
logMV	0.009	0.015	0.021
	(0.00)	(<.0001)	(<.0001)
ROA	0.769	0.703	0.651
	(<.0001)	(<.0001)	(<.0001)
Year Dummies	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes
No. of Observations	1,241	1,195	1,150
Adj. R^2	0.733	0.558	0.452

Two-tailed. p-values in parentheses.

Just Meeting	= an indicator variable equal to one if the firm's realized EPS beats the analyst forecast by zero or one cent, and zero if the firm misses the analyst forecast by one or two cents
Patent Yield	= the number of patents divided by research and development expense (in millions)
Patent Importance	= the mean number of patent citations received on current year patents divided by the mean number of patent citations received in the current year for all firms
R&D Intensity	= research and development expense divided by total assets
stdROA	= the standard deviation of ROA during the period from fiscal year t-4 to t
log(Sales)	= the natural log of net sales
BTM	= the ratio of book value to market value of common equity
logMV	= the natural logarithm of market value of common equity
ROA	= operating income plus R&D expense divided by total assets