Accounting Horizons
Vol. 18, No. 1
March 2004
pp. 1–12

The Information Content of Royalty Income

Feng Gu and Baruch Lev

SYNOPSIS: The rise of intangible assets in size and contribution to corporate growth over the past quarter century was accompanied by a steep increase in the rate and scope of patenting. Consequently, many patent-rich companies, particularly in the science-based and high-tech industries, are extensively engaged in the licensing and sale of patents. We examine various valuation and disclosure aspects of the outcome of patent licensing—royalty income. Our findings indicate the following: (1) royalty income is highly relevant to securities valuation, (2) the intensity of royalty income provides investors with an important signal about the quality and prospects of firms' R&D expenditures, and (3) a substantial number of companies engaged in patent licensing do not disclose royalty income in financial reports.

Keywords: Patent licensing; royalty income; intangibles; disclosure.

Data Availability: Data are available from sources identified in the text.

INTRODUCTION

Corporate investment in intangible assets—research and development (R&D), software, brand enhancement, employee training, and the development of unique organizational designs and processes (organization capital)—was estimated at $1 trillion in 2000, rivaling the corporate sector's investment in physical (tangible) assets (Nakamura 2003). The S&P 500's average market-to-book ratio surpassed 4.5 in September 2003, indicating that the value of intangible assets, proxied by the difference between market and book values, substantially exceeds the value of physical and financial assets.[1] Various studies indicate that the returns on intangible investments, particularly R&D, are substantially higher than returns on physical assets and firms' cost of capital, implying that intangibles are the major contributor to corporate earnings and growth (Nadiri 1993; Hall 1996; Cameron 1998). The prominence of intangibles among corporate assets naturally creates incentives to trade in these assets in order to provide firms with liquidity and risk-sharing opportunities.

Trade in intangibles is, however, hindered by the relatively high information asymmetry between potential sellers and buyers of intangibles. For example, developers of drugs or software products enjoy a large informational advantage over prospective buyers of such in-process R&D,

Feng Gu is an Assistant Professor at Boston University and Baruch Lev is a Professor at New York University.

We thank Robert Freeman (associate editor), Robert Lipe (editor), two anonymous reviewers, and participants of the 2001 American Accounting Association Annual Meeting for their helpful comments and suggestions. Professor Gu thanks the financial support provided by Boston University School of Management.

[1] The balance sheet values of some physical assets (not impaired) are reflected at cost, rather than current values. The difference between the market and book values of these assets will also contribute to the market-to-book gap.

Submitted: January 2003
Accepted: November 2003
Corresponding author: Baruch Lev
Email: blev@stern.nyu.edu

compared with the relatively low information asymmetries in the markets for commercial real estate or commodities. Markets in certain intangibles, such as human capital or organizational designs, are further retarded because of the hazy property rights over such assets; who owns the value of employee training—the employer or employee? Active markets require low information asymmetries and clearly defined and transferable property rights, which are absent for many intangibles.

With such inherent limitations on the marketability of intangibles, it is interesting to note that trade prospers for patents—an important segment of intangibles and the focus of our study.[2] The rise of intangible assets over the past 20 years was accompanied by a fast increase in patenting, particularly in the U.S., Europe, and Japan. For example, U.S. patent applications (grants) in the 1960s and 1970s ranged between 80,000 and 100,000 (50,000 and 75,000) annually. The activity increased to 100,000 and 150,000 (60,000 and 90,000) in the 1980s and exploded to 326,502 (166,039) in 2001 (U.S. Patent and Trademark Office [USPTO] 2003). With deep patent portfolios, business enterprises increasingly engage in trade via patent licensing or sales. Indeed, aggregate royalty income from patent licensing has increased in the U.S. from $15 billion in 1990 to more than $110 billion in 1999 (Rivette and Kline 2000b, 59).[3] IBM, Texas Instruments, and Dow Chemical, along with others, have independent functions dedicated to the licensing of patents, and an increasing number of consultants provide specialized services for the valuation of patents and identification of potential licensees. Some investment companies attempt to "securitize" patents by selling securities backed by the royalties earned from patent portfolios, akin to mortgage-backed securities. The patent licensing market is expected to grow rapidly. A 1998 survey by the technology licensing firm BTG International found that 67 percent of U.S. companies own identified technology assets that they do not exploit in either internal development or licensing, creating a large potential for trade (Rivette and Kline 2000b, 58–59).[4]

Most patent licensing transactions are concentrated in the chemicals, software, electrical and nonelectrical machinery, engineering and professional services, semiconductor, and particularly in the pharmaceutics and biotech sectors. The semiconductors industry has recently seen a significant growth in "fabless" or "chipless" companies, which specialize in the design of chip modules and then sell or license the patented designs to manufacturing companies (Linden and Somaya 1999).

In this study, we examine various valuation and disclosure aspects of royalty income from patent licensing. Based on a sample of 198 companies that disclosed royalty income, we draw the following conclusions:

- The information conveyed to investors by royalty income is highly relevant. Regressions of stock returns on royalty income and control variables indicate that the multiple assigned by investors to royalty income is approximately three times larger than the earnings multiple, apparently indicating the higher persistence (quality) of the former.
- Royalty income conveys to investors an important signal about the quality and prospects of the generally uncertain R&D expenditures. The ability of royalty-intensive companies to market

[2] The nontradability or exchangeability of many intangibles led several commentators to argue that intangibles should not be recognized as assets in financial reports. Thus, for example, Walter Schuetze, a former FASB member and SEC Chief Accountant wrote, "It is the same line of reasoning, that a cost can be an asset, that leads some people to suggest that the FASB should reconsider FASB Statement No. 2 and allow for recognition of research and development costs as an asset. Note that in none of the cases is the asset [proposed to be] represented on the balance sheet exchangeable [traded in a market]" (Schuetze 1993, 68). Strictly speaking, though, tradability is not a necessary condition for asset recognition (FASB 1985, para. 26).

[3] An August 2003 study by AdvanceTech Monitor (http://www.advancetechmonitor.com) reports that "In 2001, 16.4 percent of sales from the top 20 pharmaceutical companies were derived from in-licensed drugs, equating to over $38 billion."

[4] IBM is a case in point. It is the world largest patent holder (approximately 3,500 granted in 2001). However, until 1993, royalty income at IBM only amounted to about $300 million a year. This changed drastically when, under the newly appointed (1993) CEO Lou Gerstner, IBM embarked on an aggressive licensing program. In 2002, IBM reported intellectual property income of $1.1 billion. This income accounted for about 15 percent of IBM's pretax net income.

their patents—the outcome of R&D efforts—enhances investors' confidence in the technological capabilities of these companies, and in the prospects of their R&D.

- Despite the evident valuation relevance of royalty income, a substantial number of companies engaged in patent licensing choose not to report this item.

The next section discusses our sample and provides summary statistics, followed by the presentation of the valuation implications of royalty income, the evidence on the signaling role of royalty income regarding R&D, and comments on disclosure issues.

SAMPLE AND SUMMARY STATISTICS

We obtained our sample by conducting an automated keyword search of "royalties," "licensing income," and similar terms in corporate annual reports and 10-K filings available on Nexis for the period 1990–1998.[5] A total of 198 companies were identified as reporting annual royalty income from the licensing of patents.[6] The number of firms that disclosed royalty income varies by year, with the highest in 1996 (188 firms) and the lowest in 1990 (94 firms). Financial statement data for our tests were retrieved from Compustat, and stock prices and returns were obtained from the CRSP monthly files.

Table 1 presents the industry composition of the sample. Typical R&D-intensive industries dominate the sample, with pharmaceutics (including biotech) companies accounting for the largest concentration of the sample—23.2 percent. The preponderance of patent licensing among pharmaceutics and biotech companies is attributed to the ability of owners of intellectual property in these industries to clearly define property rights and defend ownership against infringement. Specifically, the exact molecular construct of pharmaceutics and biotech patents establishes unambiguous property rights and facilitates the substantiation of claims concerning patent infringement. In other economic sectors, such as food products or durable goods, it is relatively easy to infringe on intellectual property rights by "inventing around the patent," thereby hindering the licensing of patents. This is particularly relevant for the recently popular "business method" patents of financial and Internet companies, and it could explain the paucity of patent licensing in these sectors.

Summary statistics of the sample are reported in Table 2. The mean earnings is negative (–0.5 percent of stock price), whereas median earnings is positive (2.9 percent), indicating that a few sample firms have relatively large losses. Royalty income represents 7.2 percent, on average, of net earnings (13.7 percent for profitable companies). The mean and median values of market capitalization are $2,971 million and $147.2 million, respectively, where the large difference indicates the existence of a few sizeable companies in the sample.[7] The mean and median annual stock returns of the sample firms were 12.4 percent and 7.1 percent, respectively.

---

[5] Starting in 1999, Nexis academic services no longer provides the keyword search required for our sample selection.

[6] Examples of disclosures of royalty income (in millions of dollars):

1. Dupont	**1998**	**1977**	**1996**	
	$132	$64	$72	
2. Genome Therapeutics	**1998**	**1997**	**1996**	
	$21	$647	$127	

Royalty income in 1996 and 1997 was primarily derived from a rennin patent licensing that was assigned (sold) to Pfizer in 1998.

3. Texas Instruments	**1993**	**1992**	**1991**	**1990**
	$521	$391	$256	$172

Texas Instruments did not report royalty income after 1993, although it continues to stress that it "expects a significant ongoing stream of royalty revenue into the next [21st] century." In 1995, Texas Instruments reported that royalty income was at a record high without disclosing the amount of royalties.

[7] However, our analysis (not reported in a table) indicates that firm size does not significantly affect the valuation estimates reported in the "Valuation Implications of Royalties" and "The Signaling Role of Royalty Income" sections.

TABLE 1
Industry Composition of Sample Firms[a]

SIC Code	Industry	Number	Percent
280	Chemical (other than pharmaceuticals)	17	8.6
283	Pharmaceuticals	46	23.2
350	Computer hardware and machinery	23	11.6
360	Electronics and electrical	28	14.2
370	Transportation equipment	5	2.5
380	Medical and scientific instruments	21	10.6
679	Patent owners and lessors	11	5.6
737	Computer software	20	10.1
	Other industries	27	13.6
Total		**198**	**100.0**

[a] Sample firms were identified by using an automated keyword search of "royalty" and similar terms in annual reports and 10-K filings available on Nexis during the period 1990–1998.

TABLE 2
Descriptive Statistics of Sample Firms

Variable	n	Mean	Standard Deviation	25%	Median	75%
NI	1,273	–0.005	0.195	–0.065	0.029	0.069
RTY	1,273	0.023	0.048	0.002	0.007	0.025
RD	1,273	0.092	0.071	0.020	0.051	0.088
RTY/NI (all firms)	1,273	0.072	2.047	–0.036	0.022	0.169
RTY/NI (profitable firms only)	766	0.137	0.490	0.034	0.074	0.343
RET	1,273	0.124	0.657	–0.224	0.071	0.367
MV (market capitalization, $million)	1,273	2,971	14,787	35.15	147.2	658.3
SIZE (average total assets, $million)	1,273	1,578	6,339	21.08	57.04	411.0

All level variables except *MV* and *SIZE* are deflated by market value as of nine months before the end of fiscal year *t*. *NI* is earnings before extraordinary items of year *t*. *RTY* is patent royalty and licensing income of year *t*. *RD* is R&D expenditure of year *t*. *RTY/NI* is the ratio of patent royalty and licensing income to earnings before extraordinary items of year *t*. *RET* is the stock return for fiscal year *t*, calculated for the period from nine months before to three months after the end of year *t*. *MV* is market capitalization at the end of year *t*. *SIZE* is average total assets of year *t*.

How representative is our sample of all companies engaged in R&D (potential licensors of patents)? The mean (median) ratio of R&D expenditures-to-market value of all Compustat firms engaged in R&D during 1990–1998 was 8.4 percent (4.2 percent) versus 9.2 percent (5.1 percent) for our sample.[8] Thus, not surprisingly, firms engaged in patent licensing are more R&D-intensive than the average R&D firm. The degree to which our sample represents the population of patent licensors is more difficult, if not impossible, to ascertain. Research (e.g., Arora et al. 2000) and anecdotal evidence (Rivette and Kline 2000a) indicate the existence of several large licensors (e.g., IBM, Apple, Sun Microsystems, Eli Lilly) that are absent from our sample due to nonreporting of

[8] The t-test and Wilcoxon test reject the null hypothesis that R&D intensity is the same for the two groups of firms at the $p = 0.01$ level.

patent royalties.[9] In a specific examination of 25 leading biotech, pharmaceutical, and chemical companies over 1999–2001 (details reported in the Appendix), we find that about half the companies did not report royalty income, although they provided a general discussion of patent licensing in their financial reports.

VALUATION IMPLICATIONS OF ROYALTIES

We use the following cross-sectional regression to examine the valuation implications of royalty income:

$$RET_{it} = a_0 + a_1 NI_{it} + a_2 NI_{i,t-1} + a_3 RTY_{it} + a_4 RTY_{i,t-1} + e_{it} \quad (1)$$

where:

RET_{it} = company i's annual stock return for fiscal year t, calculated for the period from nine months before to three months after the end of fiscal year t (to reflect the information provided in year t's annual report);

NI_{it} and $NI_{i,t-1}$ = company i's earnings before extraordinary items for fiscal years t and t–1, respectively; and

RYT_{it} and $RTY_{i,t-1}$ = company i's royalty income for fiscal years t and t–1, respectively.

All independent (right-side) variables in Model (1) are scaled by market value as of nine months before fiscal year t end (namely at the beginning of the return cumulation period).

The dependent (left-side) variable in Model (1)—annual stock return—reflects new information that becomes available to investors during the year. Earnings and presumably royalty income are part of this information set, and Model (1) quantifies the roles of earnings and royalties in investors' decisions. Researchers have shown that current-period earnings are partially predictable by earnings from prior periods. The predictable part of earnings is reflected in previous year's stock return, and it acts like noise when trying to explain this year's return, thereby biasing a_1 toward zero. To reduce this bias, we include prior-year income, $NI_{i,t-1}$, in the regression, so that a_1 captures the association between RET_{it} and that part of NI_{it} that is unpredictable from the prior year's earnings. (See Biddle et al. [1995] for details.) The same argument holds for including both current- and prior-year royalty income in Model (1).

Model (1) is estimated separately for each sample year, 1990–1998, and we report in Tables 3 and 4 the mean value of yearly coefficient estimates from the nine annual regressions. To allay concerns that observations are not independent across companies, we base our inferences on t-statistics regarding the means of the nine estimates. Results from a pooled time-series and cross-sectional regression of Model (1) are similar to those reported in Table 3.[10]

Table 3 presents summary statistics of the annual regressions of Model (1). It is evident from the estimates in the right column of the table that both net income (NI_t) and royalty income (RTY_t) are highly statistically significant in relation to stock returns. The coefficient of royalty income, 3.973, relative to the coefficient of earnings, 1.282, indicates that investors place an extra value of 3.973/

[9] In wake of the Enron-related disclosure concerns, and under shareholder pressure, IBM disclosed in February 2002 some information concerning royalty income. "Mr. Joyce [IBM's CFO] also for the first time provided a breakdown of IBM's income from two categories of intellectual property, which were used to reduce its SG&A [selling, general, and administrative expense] totals ... In the second category, income from licensing IBM's patents on semiconductors and other products, Big Blue's income totaled about $500 million in 2001, down from about $600 million in the prior year" (*Wall Street Journal* 2002). Note that IBM's policy had been to offset intellectual property income against SG&A in its income statement, allegedly to make the company "appear to be more efficient and cost-conscious than it is" (*Wall Street Journal* 2002).

[10] We computed, but do not report, the correlations between the variables (scaled by market value) examined in the study. Royalties and earnings are virtually uncorrelated (Pearson coefficient of 0.018); lagged values of both earnings and royalties are significantly correlated with current values. Royalties and R&D are correlated (Pearson coefficient of 0.20), indicating that investment in R&D generally leads to high royalty income. Royalties are more highly correlated with last year's R&D (0.27), indicating a lag in patent licensing.

TABLE 3
Average Coefficients from Annual Regressions of Returns on Earnings Information and Royalty (t-statistics in parentheses)

$$RET_{it} = a_0 + a_1NI_{it} + a_2NI_{i,t-1} + a_3RTY_{it} + a_4RTY_{i,t-1} + e_{it}$$

Independent Variable	Regression without Royalty	Regression with Royalty
Intercept	0.186	0.140
	(7.11)***	(4.85)***
NI_t	1.354	1.282
	(5.29)***	(5.07)***
NI_{t-1}	−0.583	−0.448
	(−2.48)*	(−1.91)*
RTY_t		3.973
		(4.73)***
RTY_{t-1}		−1.986
		(−2.71)**
t-statistic[a]		3.28**
Adj. R^2	3.35%	6.06%

***, **, * indicate statistical significance at the p = 0.001, 0.01, and 0.05 levels, respectively (two-tailed test).
[a] The t-test is for the null hypothesis: $^a3 = {}^a1$.
RET_t is the stock return for fiscal year *t*, calculated for the period from nine months before to three months after the end of year *t*. NI_t (NI_{t-1}) is earnings before extraordinary items of year *t* (*t*−1). RTY_t (RTY_{t-1}) is patent royalty and licensing income of year *t* (*t*−1). All independent variables are deflated by market value as of nine months before the end of year *t*.

1.282 on $1 of royalty income relative to $1 of other income. This, apparently reflects the relative permanence of royalty income—patent licensing contracts typically range over four to five years. The large coefficient of royalty income may also reflect the positive implications (signaling) of such income with respect to the technological and innovation capabilities of licensing companies, an issue examined in "The Signaling Role of Royalty Income" section. Comparison of the two columns in Table 3 indicates that when royalty income is included in the regression separately from earnings, the value of R^2 (i.e., explanatory power) increases from 3.4 percent to 6.1 percent, another indication of the value-relevance to investors of the information inherent in royalty income.[11]

To examine the impact of extreme observations ("outliers") on our estimates, we reran Model (1) after eliminating from the sample those firms in the top and bottom percentile (1 percent) of the examined variables. Alternatively, we winsorized the sample, namely set the values of the top and bottom 1 percent observations equal to the closest, unwinsorisized observation. Estimates from these regressions (not reported) are very close to those in Table 3, except that the coefficients of earnings (1.421) and royalties (4.149) in the winsorized regressions are somewhat larger than those in Table 3. Thus, extreme observations do not affect our estimates and inferences.

In light of the evidence in Table 3, we conclude that royalty income is highly valued by investors. We conjecture that royalty income has a higher persistence than earnings, and corroborate it by estimating a cross-sectional regression of the current value of the variable (earnings or royalties) on its lagged value. We find that the mean (median) slope coefficient of lagged royalty income is 1.202 (1.115), whereas the mean (median) coefficient for lagged earnings are 0.579 (0.532),

[11] When Regression (1) is run with earnings (*NI*) *before* royalty income (*RTY*), the estimated coefficients on earnings and royalty income are 1.282 and 5.255, respectively. When 1/(Market Value)$_{t-1}$ replaces the regular intercept in Regression (1), the estimated coefficients on earnings and royalty income are 1.293 and 3.658, respectively.

respectively. A t-test (Wilcoxon test) rejects the null hypothesis that the mean (median) coefficient for royalty income is the same as that for earnings at the $p = 0.01$ level. Thus, the large coefficient of royalty income reflects the high persistence (quality) of this source of value. A natural question is whether royalty income provides additional (indirect) information to investors about the all-important technological and innovation capabilities of companies, and in particular the prospects of their R&D expenditures. We consider this issue next.

THE SIGNALING ROLE OF ROYALTY INCOME

Consider the following case of technology licensing by IBM from LSI Logic (*Wall Street Journal* 2001):

> IBM Corp. said it will license a design for a communications chip from LSI Logic Corp., giving a major boost to LSI's efforts to create an industry standard in the fast-growing field of digital-signal processors. LSI has pushed its "open standard" chip as an alternative to the industry-leading designs of Texas Instruments, Inc. The chips are used to convert radio waves and other natural signals into digital forms, and are used in communications devices from cellular phones to sophisticated switching systems. IBM and LSI declined to discuss terms of their licensing deal. "This will certainly help IBM and it gives more credibility to LSI's chip," said Tony Massimini, chief of technology for Semico Research Corp. "The fact that IBM is our principal competitor is a benchmark for how open we are," Mr. Corrigan [LSI chairman] added.

This statement by the chief technology officer of Semico Research demonstrates how patent licensing enhanced the credibility of LSI's product. Thus, royalties from patent licensing may bolster investors' perceptions of the licensor's technological capabilities and alleviate some uncertainty about the outcome of its R&D activities.[12]

Technological and innovation capabilities—key to the success of many business enterprises—are acquired primarily through investment in intangibles, such as R&D, information technology, and human resources. Firms' technological capabilities, however, are difficult to observe. New products or services—the outcome of these capabilities—are observable, but their impact on revenues and earnings is seldom separated from that of established products.[13] R&D is the major publicly available proxy for technological and innovation capabilities, but it is a noisy proxy. Some R&D expenditures are successful, leading to new products, services, and processes, while many others come to naught. For example, AT&T did not benefit from its development of the cellular phone technology in the 1970s, since it decided to abandon this technology.[14] More recently, the $5 billion investment of Motorola and partners in the development of the Iridium (communications satellites) project vanished, as Iridium declared bankruptcy. Indeed, empirical research (e.g., Kothari et al. 2002) confirms that the variability of earnings associated with R&D is substantially higher than the variability of earnings associated with physical assets.[15]

Given the substantial uncertainty associated with R&D outcomes, investors in R&D-intensive companies can be expected to search for information concerning the prospects of firms' R&D activities. The existence and intensity of royalty income from patent licensing may provide such

[12] The information (signaling) effect of licensing is also demonstrated by the *Wall Street Journal* (2000) report on Palm's licensing agreements with Nokia and Sony, which quotes the CEO of Indigo as saying, "Those licensing deals made it clear to us that Palm was a company with legs."

[13] A few firms do provide voluntary information about the share of total revenues generated by recently introduced products. For example, the 2000 annual report of 3M included the following information: "In 2000, the company experienced one of the highest levels of innovation in our history, generating $5.6 billion—nearly 35 percent of total sales—from products introduced during the past four years, with over $1.5 billion of sales coming from products introduced in 2000."

[14] This decision was made by AT&T after a major consulting firm concluded that cellular (wireless) communication would not be commercially viable.

[15] This variability, of course, gives rise to accountants' concern with the *reliability* of capitalized R&D.

information. If licensing technology increases a firm's credibility (see LSI quote above), then investors will place a higher value on technology firms with large levels of licensing income. Royalty income may thus serve as a "Good Housekeeping seal" for the firm's R&D expenditures and its technological capabilities.[16]

Table 4 presents tests of the signaling hypothesis of royalty income. We expand Model (1) to include the current- and prior-year R&D expenditures, and add an interaction term between royalty income and R&D, and between royalty income and net income. R&D is coded as a positive number, even though it is a GAAP expense. The estimates reported on the left-hand column of Table 4 indicate that R&D is positively and significantly valued by investors (relative to other expenses), a result consistent with earlier studies (Lev and Sougiannis 1996). Our conjecture about the signaling (confirmatory) role of royalty income regarding the prospects of R&D is corroborated by the positive and significant coefficient of the interaction term of royalties and R&D ($RTY \times RD$). The coefficient on the interaction term, 1.441, implies that a 10 percent increase in the intensity of royalties (relative to market value) will add 0.144 to the coefficient of R&D (1.336), amounting to an addition of 12 percent to the multiple investors assign, on average, to R&D expenditures. This is on top of the valuation assigned to royalty income itself, as reflected by the coefficient of *RTY* (2.582).

Further insight into the signaling effect of royalty income is obtained by estimating the expanded Model (1) for biotechnology and pharmaceutical companies vs. the remaining sample firms. The focus on biotech and drugs derives from the fact that the R&D of these companies is mostly in the form of "basic research," aimed at the discovery of *new* science and technology, whereas most of the R&D in other sectors (e.g., electronics, software, cars, oil and gas) is "applied research," primarily aimed at modifying and improving existing products and technologies. Some R&D, particularly prevalent in chemical and oil companies, is in the form of "process R&D" that is aimed at improving the efficiency of production and delivery processes, rather than generating new products. It is generally believed that the uncertainty associated with basic (next-generation) research is substantially higher than that of applied or process R&D. Basic research is subject to both technological uncertainty (will the product work?) and commercial (market) uncertainty (will it be first to market?). Applied R&D is generally subject to commercial uncertainty only, given that the existing product proved to be technologically feasible. Process R&D has no commercial uncertainty since improvements in production processes are implemented internally, rather than sold to customers. Given that basic research faces both high technological and commercial uncertainty, we expect the signaling impact of royalty income to be more pronounced for the R&D of biotech and drug companies than for R&D in other industrial sectors.

The two regressions reported in the right-hand columns of Table 4 confirm this expectation. The coefficient of the interaction term between royalty income and R&D for biotech and drug companies (2.307) is double the interaction term coefficient of the remaining companies (1.115). The difference between coefficients is statistically significant, based on estimates from a regression using all companies in which biotech and drug companies are allowed to have different coefficients from other companies. Thus, investors appear to place more emphasis on the intensity of patent licensing in companies where quality information is needed most—those intensive in basic research.[17]

Our valuation analysis in this and the preceding section thus indicates: (1) that royalty income is a potent source of shareholder value, and (2) that the intensity of royalty income serves as a quality

[16] Texas Instruments' 1992 10-K includes the following related comment: "Research and development success in the form of new products, services and intellectual property contributes importantly to TI shareholder value. Royalty revenues have helped us make the R&D and other investments necessary for our strategic transitions and to support future growth."

[17] The general caveat that statistical association studies, such as ours, cannot prove causality should be noted here. Thus, while we intuitively feel that investors "use" royalty income as a signal for R&D prospects, we did not prove it. We only established the interaction between the two variables.

TABLE 4
Average Coefficients from Annual Regressions of Returns on Earnings, Royalty, and R&D Expenditure (t-statistics in parentheses)

$$RET_{it} = \gamma_0 + \gamma_1 NI_{it} + \gamma_2 NI_{i,t-1} + \gamma_3 RTY_{it} + \gamma_4 RTY_{i,t-1} + \gamma_5 RD_{it} + \gamma_6 RD_{i,t-1} + \gamma_7 (RTY \times NI)_{it} + \gamma_8 (RTY \times RD)_{it} + \eta_{it}$$

Independent Variable	Full Sample	Biotechnology and Pharmaceutics[a]	Other Firms
Intercept	0.024	–0.037	0.064
	(0.62)	(–0.59)	(1.19)
NI_t	1.306	1.429	1.280
	(5.23)***	(4.21)***	(4.81)***
NI_{t-1}	–0.361	–0.306	–0.513
	(–1.40)	(–0.42)	(–1.17)
RTY_t	2.582	2.591	2.405
	(3.76)***	(4.61)***	(2.60)**
RTY_{t-1}	–1.272	–0.464	–1.709
	(–2.35)*	(–0.72)	(–1.23)
RD_t	1.336	2.564	1.282
	(3.62)***	(3.41)***	(2.15)*
RD_{t-1}	0.232	–0.281	0.317
	(0.20)	(–0.44)	(0.14)
$RTY \times NI_t$	–0.003	–0.004	0.002
	(–0.06)	(–0.24)	(0.04)
$RTY \times RD_t$	1.441	2.307	1.115
	(2.82)**	(3.24)**	(2.37)*
Adj. R^2	11.08%	12.26%	9.67%

***, **, * indicates statistical significance at the p = 0.001, 0.01, and 0.05 levels, respectively (two-tailed test).
[a] Results are for firms from the biotechnology and pharmaceutical industries (three-digit SIC code of 283).
RD_t (RD_{t-1}) is R&D expenditure of year t (t–1). $RTY \times RD_t$ ($RTY \times NI_t$) equals RTY times RD (NI) of year t. See Table 3 notes for definitions of other variables. All independent variables are deflated by market value as of nine months before the end of year t.

signal for the firm's R&D activities. Such considerable valuation-relevance of an information item naturally leads to an examination of disclosure issues.

DISCLOSURE ISSUES

Despite the demonstrated value-relevance of royalty income and the steep increase in the volume of patent licensing, our sample exhibits a temporal decrease in the number of companies disclosing royalty income.[18] Some early disclosers in our sample (e.g., Texas Instruments) stopped reporting royalty income in later years. To gain further insight into recent disclosure patterns of royalty income, we examine the 1999–2001 financial reports of 25 leading companies in three industries mostly likely to engage in patent licensing: biotech (15 companies), pharmaceuticals (five companies), and chemicals (five companies). (Details of this examination are provided in the Appendix.) Overall, we find that roughly half the selected companies provide quantitative information about royalty income, while most of the remaining companies discuss patent licensing in the

[18] The number of sample firms disclosing royalty income in 1996, 1997, and 1998 was 188, 174, and 152, respectively.

financial report without providing royalty income numbers. We cannot rule out that royalty income for some nondisclosers was immaterial, although for the biotech companies immateriality seems unlikely since their earnings are often negligible.

We consider the disclosure of royalty income to be part of a larger issue concerning the adequacy of financial information about intangible assets. This issue has gained considerable momentum in recent years due to increasing evidence on the substantial economic value created by intangible assets and the distortions in financial reports resulting from the current accounting for them.[19] Indeed, various regulatory bodies have recently conducted extensive examinations of the information available to investors, concluding that information on intangible assets is particularly deficient. For example, the main recommendation of the SEC Task Force, *Strengthening Financial Markets: Do Investors Have the Information They Need*, is as follows:

> Create a new framework for supplemental reporting of intangible assets and operating performance measures. We recommend that the SEC ... move forward with a framework for voluntary supplemental reporting for intangible assets, operating performance measures and other information that would help investors assess a company's future performance ... [We] anticipate that a dedicated group of experts ... would be asked to develop a best practice report for companies interested in adopting enhanced disclosure. (SEC 2001, 2)

Similarly, the FASB's extensive examination of the voluntary disclosures of six to nine large companies in each of eight industries concluded the following:

> Although some disclosures were found about unrecognized intangible assets, additional data about those assets would be beneficial because of the importance of intangibles to a company's value. Intangibles include not only those resulting from research and development but also human resources, customer relationships, innovations and others ... *Companies are encouraged to continue improving their business reporting and to experiment with the types of information disclosed and the manner by which it is disclosed.* (FASB 2001, VI) (emphasis added)

This study was followed in January 2002 by an FASB announcement of the addition of "Disclosures about Intangible Assets" to its agenda, aiming "to establish standards that will improve disclosure of information about intangible assets that are not recognized in financial statements" (FASB 2002). In 2003, however, this project has been deactivated by the FASB (http://www.fasb.org/project/intangibles.shtml). Based on the evidence presented in this study, we believe that information about patent licensing and royalty income falls within the FASB's category of "information about intangible assets that are not recognized in financial statements" (i.e., internally generated patents). A comprehensive analysis of the disclosure of royalty income should, of course, consider the cost of disclosing proprietary information.

SUMMARY

Intangible assets have become over the last 20 years the prime generators of corporate earnings and growth. Relatedly, the number of patents applied for and granted, as well as the pervasiveness of patenting across industries, has increased considerably over that period. Patent licensing and the resulting royalty income have been increasing as well. This study examines various valuation and disclosure issues concerning royalty income. Our analyses indicate the following: (1) royalties from the licensing of patents are a potent source of shareholder value, (2) the intensity of royalty income serves as a signal for the quality and potential of firms' R&D expenditures, and (3) a considerable number of companies engaged in patent licensing do not disclose royalty income to investors. The importance of royalty income in explaining stock returns should be of interest to accounting regulators concerned with the disclosure of information about intangible assets.

---

[19] For a review of this evidence, see Lev (2001, Chapter 4), and Hand and Lev (2003).

APPENDIX
DISCLOSURE PATTERNS OF ROYALTY INCOME, 1999–2001

We selected a sample of the largest companies (based on 12/31/2001 market value) from the biotech (15 companies), pharmaceutical (five companies), and chemical (five companies) sectors for a specific examination of disclosure patterns of royalty income during 1999–2001. The selection criteria (large companies in R&D-intensive industries) were aimed at increasing the probability of encountering companies with royalty income, as patent licensing is strongly associated with the size of R&D expenditures, which, in turn, is positively related to firm size.

Eight of the 15 biotech companies (Amgen, Immunex, Genzyme, IDEC Pharmaceuticals, Medimmune, Biogen, Gilead Sciences, and ImClone Systems) disclosed royalty income in each of the three years examined and provided certain information on licensing agreements and identities of licensees. Amgen, the largest biotech company with a market value of $60 billion on 12/31/2001, reports royalty income of $181 million (11 percent of earnings) and $253 million (15 percent of earnings) in 2000 and 2001, respectively. Amgen is followed by Biogen, which reports $165.4 million and $71.8 million of royalty income in the two years, respectively, and by Medimmune, which reports $44.7 million and $39.2 million of royalties in 2000 and 2001, respectively. In a few cases (Immunex, Genzyme, Biogen), the disclosure of royalty income was made despite the fact that this income decreased over the three-year period, dispelling the widespread belief that voluntary disclosure happens only when the news is good. The nondisclosing biotech companies (Amersham, Millenium, Human Genome Science, Invitrogen, Abgenix, Protein Design Labs, and Enzon) discussed patent licensing agreements in their financial reports and thus appear to have royalty income that they choose not to disclose. One nondiscloser (Protein Design Labs) even emphasizes the importance of licensing in the company's strategy and discusses factors affecting future royalty income. We do not know whether the nondisclosure is due to the immateriality of royalty income or to a deliberate decision not to disclose this item. Given the meager earnings of most biotech firms, immateriality appears unlikely.

Of the five largest pharmaceutical companies we examined (Pfizer, Johnson & Johnson, Merck, Bristol Myers, and Eli Lilly), only Merck disclosed royalty income ($134 million, $153 million, and $126 million—roughly 1.5 percent of earnings—in 1999, 2000, and 2001, respectively). Johnson & Johnson and Eli Lilly note that royalty income is included in "other income," without giving numbers. Pfizer and Bristol Myers do not mention licensing of patents in financial reports.

Three of the five largest chemical companies we examined (DuPont, Dow Chemical, and Rohm & Haas) disclose royalty income and provide detailed discussions of licensing agreements. Dow Chemical, for example, discusses the formation of a licensing business group in 2000. Leading in size of royalty income are the two "heavies": DuPont ($289 million, $349 million, and $380 million—roughly 10 to 15 percent of earnings—in 1999, 2000, and 2001, respectively), and Dow Chemical ($226 million, $278 million, and $185 million in the three years). The remaining two chemical companies, Monsanto and Eastman Chemical, discuss various aspects of their patent licensing programs without providing specific royalty income numbers.

It appears from this examination of recent disclosure patterns that roughly half the firms that engage in patent licensing do not disclose royalty income.

REFERENCES

Arora, A., A. Fosfuri, and A. Gambardella. 2000. Markets for technology and corporate strategy. Working paper, Carnegie Mellon University, Pittsburgh, PA.

Biddle, G., G. Seow, and A. Siegel. 1995. Relative versus incremental information content. *Contemporary Accounting Research* 12: 1–23.

Cameron, G. 1998. Innovation and growth: A survey of the empirical evidence. Working paper, Nuffield College, Oxford, U.K.

Financial Accounting Standards Board (FASB). 1985. *Characteristics of Assets*. Statement of Financial Accounting Concepts No. 6. Stamford, CT: FASB.

———. 2001. *Improving Business Reporting: Insights into Enhancing Voluntary Disclosures*. Steering Committee Report, Business Reporting Research Project. Stamford, CT: FASB.

———. 2002. *News Release: Disclosure about Intangibles*. Stamford, CT: FASB.

Hall, B. 1996. The private and social returns to research and development. In *Technology, R&D, and the Economy*, edited by B. Smith, and C. Barfield, 140–183. Brookings Institution and the American Enterprise Institute. Washington, D.C.: Brookings Institution Press.

Hand, J., and B. Lev. 2003. *Intangible Assets: Values, Measures, and Risks*. Oxford, U.K.: Oxford University Press.

Kothari, S., T. Laguerre, and A. Leone. 2002. Capitalization versus expensing: Evidence on the uncertainty of future earnings from capital expenditures versus R&D outlays. *Review of Accounting Studies* 7: 355–382.

Lev, B., and T. Sougiannis. 1996. The capitalization, amortization, and value-relevance of R&D. *Journal of Accounting and Economics* 21: 107–138.

———. 2001. *Intangibles: Management, Measurement, and Reporting*. Washington, D.C.: Brookings Institution Press.

Linden, G., and D. Somaya. 1999. System-on-a-chip integration in the semiconductor industry: Industry structure and firm strategies. Working paper, University of California, Berkeley.

Nadiri, I. 1993. Innovations and technology spillovers. Working paper No. 4423. Cambridge, MA: National Bureau of Economic Research.

Nakamura, L. 2003. A trillion dollars a year in intangible investment and the new economy. In *Intangible Assets: Values, Measures, and Risks*, edited by J. Hand, and B. Lev. Oxford, U.K.: Oxford University Press.

Rivette, K., and D. Kline. 2000a. *Rembrandts in the Attic: Unlocking the Hidden Value of Patents*. Boston, MA: Harvard Business School Press.

———, and ———. 2000b. Discovering new value in intellectual property. *Harvard Business Review* 78: 55–66.

Schuetze, W. 1993. What is an asset? *Accounting Horizons* 7: 66–70.

Securities and Exchange Commission (SEC). 2001. *Strengthening Financial Markets: Do Investors Have the Information They Need*? A Report by the SEC Special Task Force. May. Washington, D.C.: Government Printing Office.

U.S. Patent and Trademark Office (USPTO). 2002. *U.S. Patent Statistics Report*. March. Washington, D.C.: Government Printing Office.

Wall Street Journal. 2000. Competitive drive: Palm puts up its fists as Microsoft attacks hand-held PC market. (August 8): A1.

———. 2001. IBM will license LSI chip design to help boost industry standard. Interactive Edition (January 22).

———. 2002. IBM plans to expand earnings reports to include more details about its income. (February 19): A3.