Rev Account Stud (2017) 22:677–714
DOI 10.1007/s11142-017-9399-x

# The positive externalities of IFRS R&D capitalization: enhanced voluntary disclosure

**Ester Chen**[1] · **Ilanit Gavious**[2] · **Baruch Lev**[3]

Published online: 29 April 2017


**Abstract** Studies comparing IFRS with U.S. GAAP generally focus on differences in the attributes and consequences of the *recognized* financial items. We, in contrast, focus on *voluntary disclosure* resulting from arguably the most significant difference between IFRS and GAAP: the capitalization of development costs—the "D" of R&D—required by IFRS but prohibited by GAAP. Using a sample of Israeli high-technology and science-based firms, some using IFRS and others U.S. GAAP, we document a significant externality of IFRS development cost capitalization in the form of extensive voluntary disclosure of forward−looking information on product pipeline development and its expected consequences. We show that this disclosure is value-relevant over and above the mandated financial information, including the capitalized R&D asset. We also show that the capitalized development costs (an asset) is highly significant in relation to stock prices, and enhances the relevance of the voluntary disclosures.

**Keywords** R&D capitalization · Voluntary disclosure · IFRS · GAAP

**JEL classification** M41

## 1 Introduction

There is scant experimentation in setting accounting standards and therefore no trial-and-error lessons are available to instruct standard setting. The limited international differentiation in accounting standards is restricted to the two leading systems: U.S. GAAP and the international standard (IFRS). Many accounting studies have examined

✉ Baruch Lev
blev@stern.nyu.edu

[1] Rehovot, Israel

[2] Ben-Gurion University of the Negev, Beer-Sheva, Israel

[3] New York University Stern School of Business, New York, NY, USA

the differences between these two and their impact on investors' and firms' decisions (e.g., Kim et al. 2012; Hail et al. 2010). We also compare U.S. GAAP with IFRS but with a different and hitherto unexamined objective: to examine whether the R&D capitalization standard (IAS 38, 2004), which requires firms to gather substantive R&D information for the capitalization test, motivates managers to voluntarily disclose some of this information, thereby enriching the information environment beyond the direct disclosure impact of the standard. This could be termed a positive externality of accounting standard-setting, so to speak.

Specifically, we focus on the accounting for R&D, which constitutes one of the most pronounced differences between GAAP and IFRS: while GAAP mandates the immediate expensing of all internal R&D outlays, IFRS calls for the capitalization of development costs, under certain circumstances. Indeed, R&D capitalization is quite prevalent among IFRS-using firms: 40 % of our IFRS sample firms capitalize development costs. We hypothesize that IFRS capitalization requirements need a substantial amount of valuation-relevant information, some of which firms choose to disclose voluntarily to investors. Specifically, the capitalization of development costs under IFRS (the initial research costs have to be expensed as incurred) requires meeting stringent conditions, each calling for the collection and generation of new information. For example, to capitalize development costs, the firm must demonstrate the *technological feasibility* of the project, that is, a technical ability to complete it, such as passing a "beta test" for a software project under development or prototyping an electronic device. The various tests and experts' certifications involved in establishing technological feasibility generate considerable valuation-relevant information about the firm's pipeline of products, which allows investors to see inside the R&D black box and distinguish between successful and unsuccessful projects. Similarly, demonstrating an ability to sell the product gainfully, another IFRS condition, requires an extensive marketing and competitive pricing study, also of interest to investors. We don't rule out the possibility that, for internal valuation of R&D projects, GAAP managers collect similar R&D information to that possessed by IFRS capitalizers. But we hypothesize that, given the positive nature of this information for IFRS capitalizers (projects passed feasibility tests, funds for completion are assured) and the likely lower disclosure costs, they will share more of this information with investors.

We examine whether managers disclose some of the capitalization-related information to investors—thereby creating a positive externality of R&D capitalization—as well as the impact of this disclosure on investors. Models (e.g., Grossman 1981) predict, based on adverse selection, that, when investors *know* that managers possess certain information, it will be disclosed; otherwise investors "assume the worst." In our case, investors in capitalizing firms obviously know that mangers have the capitalization-related information, since it is required to be generated internally in the process of R&D capitalization. However, if the disclosure is costly (e.g., benefitting competitors), managers may exercise discretion in disclosing the information, particularly suppressing unfavorable news (Jovanovic 1982; Verrecchia 1983). In our case, most of the capitalization-related information is favorable (e.g., the product passed a feasibility test, and it's expected to generate net benefits). Otherwise, the firm does not meet the criteria for development costs capitalization. But competitor-related concerns may still deter full disclosure. So, ultimately, the *extent* of capitalization-related voluntary disclosure by IFRS companies and its *relevance* to investors are empirical questions. And thus this study identifies an important spillover effect of R&D capitalization, one that, to the best of our knowledge, was not examined before.

We focus on R&D-intensive firms not only because the accounting for R&D differs markedly between GAAP and IFRS but also because frequent technological changes and the considerable scientific complexity created by R&D lead to particularly large information asymmetries, impeding, and sometimes precluding, reliable investor assessment of the performance and financial condition of R&D-intensive firms without considerable disclosure of voluntary, value-relevant information. In fact, R&D intensity is often used by researchers as a proxy for financial information opaqueness (e.g., Aboody and Lev 2000; Vincente-Lorente 2001). Strong investor demand for R&D-related information is thus expected to induce voluntary disclosure. Our sample choice was also motivated by the fact that R&D-intensive firms populate large sectors of developed economies and the most important ones in terms of growth, innovation, and contribution to social welfare. There are thus compelling reasons to focus on R&D-intensive firms in our comparison of GAAP with IFRS regarding regulatory impact on voluntary disclosure.

Our sample consists of 180 (798) Israeli high-technology and science-based firms (firm-years), of which 116 (493) report in accordance with IFRS and 64 (305) follow GAAP. Of the firms (firm-years) reporting under IFRS, 51 (198) capitalized development costs and 65 (295) did not (hereafter, IFRS capitalizers and IFRS noncapitalizers). Twenty-four firms switched from noncapitalizing to capitalizing during the sample period, while no firm switched the other way. Although IFRS is mandated in Israel, the sample Israeli firms listed in the U.S. (either in U.S. exclusively or cross-listed with Israel) report under GAAP.[1] The sample period is 2007 through 2011.[2] We chose to focus on Israeli firms because Israel's unique setting, allowing the use of GAAP for Israeli firms listed in the U.S., provides a rare opportunity to explore our research question on firms using the two main reporting systems while operating in the *same country*. By focusing on a single country, we hold constant the institutional, legal, and economic factors affecting disclosure across all sample firms, thereby avoiding the onerous need to control for these factors in the typical cross-country GAAP-IFRS studies. Israel also befits an R&D study like our since, at 4.27% of GDP, it has the world's highest R&D intensity, over twice the OECD average of 2.01% and substantially higher than the U.S. average of 2.77%.[3]

For our empirical analyses, we construct a firm-specific disclosure index, which quantifies the extent of voluntary information conveyed by firms in their annual financial statements (including the MD&A). This hand-collected index summarizes the following information items that are relevant to investors in science-based and technology companies: general development information, the nature of the firm's R&D activities, feasibility of project completion, assessment of future project benefits and product market information, developed product specifications, product target uses, future R&D plans, and "innovation revenues" (share of total revenues from new

[1] Before 2008, firms listed on U.S. exchanges were required by the SEC to use GAAP. In 2008, the SEC allowed foreign firms to report under IFRS. However, all our sample U.S. listed firms joined U.S. exchanges before 2008 and therefore report under GAAP. These firms could have switched to IFRS after 2008, but none did so, apparently due to heavy switching costs for firms and their investors.

[2] Adoption of IFRS in Israel became mandatory for public companies in 2008. However, most companies had already adopted IFRS in 2007.

[3] OECD Internet Economy Outlook, 2013. http://www.oecd-ilibrary.org/sites/factbook-2013-en/08/02/01/index.html.

products). Note that all the information captured by our index is *voluntarily* disclosed by the sample firms. IFRS's capitalization rule requires disclosure of information directly related to the capitalized asset: its useful life or amortization rate; the amortization method; the gross carrying amount, accumulated amortization and impairment losses; income statement line-items, which include capitalized amortization; reconciliation of beginning and ending of period amounts; and capitalized assets whose title is restricted. None of this required information disclosure is included in our disclosure index.

The major findings of this study corroborate our expectations. Whereas before IFRS adoption in Israel (before 2007) the extent of voluntary R&D-related disclosure of IFRS (both capitalizers and noncapitalizers) and GAAP firms was practically identical, afterward the extent of disclosure was significantly higher for IFRS than for GAAP firms. Of the two IFRS subgroups, capitalizers provide significantly more information than noncapitalizers (which, in turn, provide more information than GAAP firms). Not only did IFRS reporters provide voluntarily more information than GAAP firms, they did so *increasingly* throughout the sample period (2007–2011). These findings are robust to controlling for firms' propensity to disclose voluntarily and for other confounding factors. As discussed above, the main reason why IFRS users disclose more R&D-related information than their GAAP counterparts is that IFRS requires the annual collection of capitalization-related information in the process of examining whether the firm meets the criteria for development cost capitalization, thereby endowing IFRS managers with considerable R&D-related information (e.g., on the prospects of successful completion and the marketing of products under development). Investors, therefore, know that IFRS managers possess such information, which GAAP managers may not have on a continuous basis, since GAAP prohibits capitalization. This knowledge induces IFRS managers to disclose certain information even if they don't capitalize R&D. The reason why IFRS capitalizers disclose more than noncapitalizers is that the information of the former is more favorable (projects passed feasibility tests) than that of the latter.

Our second research question concerns the relevance of the disclosed information to investors. We address this question three ways: (i) with price regressions relating the firm's market value to the disclosure index, plus controls; (ii) examining information relevance by the event-period returns around the information disclosure; and (iii) determining the effect of the disclosed information on the share price informativeness of the three subsamples. The results of all these tests indicate that indeed the voluntarily disclosed R&D-related information has a positive incremental value for investors over the mandated accounting information (earnings, book value, R&D expenditures, and the capitalized R&D) and that this disclosure enhances significantly share price informativeness. This incremental value-relevance of disclosures is significantly higher for IFRS capitalizers than for noncapitalizers and, in turn, higher than for GAAP firms. Our estimates are robust to controlling for self-selection characteristics associated with firms' stock exchange listing choice (local versus foreign exchange).

Finally, our findings raise an important question: If the voluntary disclosure of R&D-related information benefits investors, as we show, why don't all firms, GAAP as well as IFRS noncapitalizers, disclose as much as the capitalizers? Why the large cross-sectional variability of voluntary disclosure in our sample? The answer, we show, lies in the costs and incentives of disclosure. Obviously, if the R&D information is

highly proprietary, potentially benefitting competitors, or if the firm doesn't need external financing, managers will curtail disclosure. We accordingly incorporate in the analysis various competitive costs and financing needs proxies, which explain much of the cross-sectional disclosure differences.

Given the importance of R&D in developed economies and the continuing debate about the proper accounting for R&D, our results should be of interest to investors, researchers, and standard-setters. In particular, our findings illuminate the question of R&D capitalization which continues to intrigue researchers (e.g., Oswald et al. 2016, and Callen et al. 2010) as well as standard-setters.[4]

The next section briefly presents the differences between GAAP's and IFRS's treatment of R&D expenditures and outlines the conditions for capitalization set forth by IAS 38. Section 3 describes our sample, while Section 4 presents the disclosure index (elaborated in Appendix A). Section 5 documents the disclosure differences and patterns over time for the three subsamples, while Section 6 explores the costs and incentive reasons for the sample cross-sectional disclosure differences. Section 7 reports on the market impact of the voluntary disclosure, and Section 8 concludes.

## 2 R&D disclosure under IFRS and GAAP

GAAP mandates the full expensing of all internally generated R&D expenditures, whereas IFRS requires firms to capitalize development costs when certain criteria are met (IAS 38). Note that IFRS users do not self-select whether to capitalize or expense development costs; having met the criteria outlined by the standard, an IFRS firm is required to capitalize.

According to IAS 38, to capitalize development costs (the initial research costs must be expensed as incurred), a firm must meet several conditions related to the successful completion and marketing of the developed product or service. These conditions include that the technical feasibility of the product under development has been established; the firm has the intention and financial resources to complete development; it expects to use or sell the product, such use or sale will generate future economic benefits; and the firm can reliably measure the expenditures attributable to product development, separately from the earlier research phase.[5] These capitalization conditions are obviously quite stringent, but nevertheless, 40% of our IFRS firms capitalize all or some development costs.[6] Given the requirement to annually test for development capitalization, both IFRS capitalizers and noncapitalizers generate a substantial amount

[4] In 2016, the FASB placed the intangibles issue on its agenda.

[5] The standard does not require disclosure of this information to investors.

[6] A question was raised whether refraining from capitalization may be strategic: to avoid disclosure of certain R&D-related information, particularly bad news. We doubt that. For IFRS firms, noncapitalization of R&D is not a choice. It generally results from being in an early development stage or from products not progressing well—products that fail technological feasibility tests or from lack of sufficient funding. Given the requirement to capitalize successful development, the absence of capitalization, is in and of itself, bad news to investors. Furthermore, IAS 38 does not require disclosing the information gathered by the firm in its examination of whether it meets the criteria for capitalization (except for details of the capitalized asset). Thus a firm does not need to forego capitalization to avoid disclosure of R&D-related information. We thank the editor for highlighting this point.

of information in the process of exploring whether they comply with the capitalization conditions set forth by the standard, information they may choose to disclose.

It is clear that implementation of IAS 38 requires considerable amount and variety of important R&D information, available to be shared with investors.[7] Our tests are aimed at ascertaining the extent of this information sharing and its relevance to investors.

## 3 Sample selection

Our sample selection began with all the 186 Israeli high-technology and science-based firms that were listed on the Tel Aviv Stock Exchange (TASE), U.S. exchanges, or both between 2007 and 2011. Of these, 118 are listed on TASE only, 34 are listed on U.S. exchanges only, and the remaining 34 firms are cross-listed on TASE and the U.S. exchanges. Adoption of IFRS in Israel became mandatory in 2008. However, most companies had already adopted IFRS in 2007. Hence our sample period begins in 2007.[8] All the firms listed on TASE use IFRS, while all the U.S. listed or cross-listed firms use GAAP. Table 1 summarizes the sample selection procedure. To focus on R&D intensive firms, we eliminated from the sample three IFRS and two GAAP firms having no R&D expenditures, along with those with insufficient data, and obtained the final sample of 180 (798) firms (firm-years), of which 116 (493) use IFRS and 64 (305) use GAAP.

Note that the sample firms did not *self-select* to report under IFRS or GAAP. All TASE-listed firms (116) *must* use IFRS. As for our GAAP users, up to 2008, the U.S. SEC required foreign firms to conform with GAAP. In 2008, the SEC allowed foreign registrants to submit financial statements under IFRS, without a reconciliation to GAAP.[9] However, all our GAAP users were listed in the U.S. before 2008, when GAAP reporting was mandatory, and therefore did not self-select to use GAAP. True, from 2008 on, these firms could have switched to IFRS, but none did so, apparently due to high switching costs and low benefits. Switching from GAAP to IFRS requires considerable direct (administrative) costs and imposes a heavy burden on investors adjusting for the inconsistencies between the two systems. Moreover, given that most U.S. analysts and investors are familiar with GAAP, a switch to IFRS imposes a considerable informational burden on them. Although IFRS requires capitalization of development costs, a GAAP firm can obtain most of these benefits by voluntarily informing investors that certain projects passed feasibility tests, that sufficient funds are available for project completion, etc. Thus there was not much of a self-selection in the decision of our U.S. listed firms to continue using GAAP throughout the sample period. There is, of course, a fundamental self-selection in a firm's choice to *list* in Israel or the U.S., with which we address in Section 5.

[7] While GAAP doesn't *require* the collection of capitalization-related information, GAAP managers may nevertheless collect similar information but may choose not to disclose it.

[8] Before IFRS adoption, the Israeli Accounting Standards Board adopted the U.S. GAAP standard for R&D (SFAS 2).

[9] Securities and Exchange Commission, 17 CFR Parts 210, 230, 239 and 249 [Release Nos. 33–8879; 34–57,026; International Series Release No. 1306; File No. S7–13-07], RIN 3235-AJ90, Acceptance From Foreign Private Issuers of Financial Statements Prepared in Accordance With International Financial Reporting Standards Without Reconciliation to GAAP.

**Table 1** Sample-Selection Procedure

| | No. of firms | | | |
|---|---|---|---|---|
| | Pooled | IFRS capitalizers | IFRS non-capitalizers | US GAAP firms |
| Israeli high-technology firms listed in the Israel Venture Capital (IVC) Online database | 186 | 51 | 69 | 66 |
| Excluding firms with no R&D | 5 | 0 | 3 | 2 |
| Excluding firms with insufficient Bloomberg data | 1 | 0 | 1 | 0 |
| Final firm sample | 180 | 51 | 65 | 64 |

The list of Israeli high-technology firms was obtained from the Israel Venture Capital (IVC) Online database. IVC Online is a comprehensive database on Israel's high-tech and science-based industries, created by the Israel Venture Capital Research Center. Sample firms operate in the following industry segments: life sciences (pharmaceutics and biotechnology), computer hardware and electronic equipment (computers and electronics for parsimony), software, and telecommunications. Table 2, Panel A, presents the sample firms by industrial affiliation. Life sciences, computers, and electronics firms comprise roughly half of our sample.

We obtained the financial information from the Bloomberg Professional database, supplemented with information from the firms' disclosures derived from the PDF files of financial statements in the Bloomberg database. Firms with insufficient Bloomberg data are excluded from the analysis. Table 2, Panel B—Summary Statistics—shows that GAAP users are significantly larger (total assets) than IFRS firms, capitalizers as well as noncapitalizers. R&D intensity (annual R&D expense plus the change in capitalized R&D, relative to total assets) is similar for IFRS capitalizers and GAAP users but significantly higher for IFRS noncapitalizers. The reason for the higher R&D intensity of IFRS noncapitalizers is the prevalence of life science firms in this subgroup, compared to IFRS capitalizers and GAAP firms (44%, 27%, 22%, respectively; see Panel A of Table 2). The three subgroups also differ in revenue growth.

## 4 The disclosure index

Our disclosure index is constructed by hand collecting information from the firms' annual financial statements and MD&As, focusing on R&D-related items. The disclosure index focuses on voluntary information and does not include disclosures that are mandated by the IFRS capitalization standard. The index reflects the extent (length) of discussion of key development and marketing elements: distinguishing research from development costs, R&D human capital, legal protection of innovations, expected timing of development and marketing, alliances and collaborations with other firms, funds availability for project completion, expected benefits from development plans, product specifications and uses, and future plans for R&D activities. The detailed scoring of each information component of the disclosure index is presented in Appendix A.

**Table 2** Summary Statistics

**Panel A: Industry Affiliation**

| Industry: | No. of firms | | | | No. of firm-years | | | |
|---|---|---|---|---|---|---|---|---|
| | IFRS capitalizers | IFRS non-capitalizers | USGAAP | Pooled | IFRS capitalizers | IFRS non-capitalizers | US GAAP | Pooled |
| Life sciences | 14 | 29 | 14 | 57 | 53 | 123 | 65 | 241 |
| | (27%) | (44%) | (22%) | (32%) | (27%) | (42%) | (22%) | (30%) |
| Computers and electronics | 16 | 10 | 12 | 38 | 66 | 50 | 59 | 175 |
| | (31%) | (16%) | (19%) | (21%) | (33%) | (17%) | (19%) | (22%) |
| Software | 3 | 4 | 11 | 18 | 10 | 22 | 59 | 91 |
| | (6%) | (7%) | (19%) | (10%) | (5%) | (7%) | (19%) | (12%) |
| Telecommunications | 5 | 6 | 20 | 31 | 21 | 27 | 89 | 137 |
| | (10%) | (9%) | (29%) | (17%) | (11%) | (9%) | (29%) | (17%) |
| Other technologies | 13 | 16 | 7 | 36 | 48 | 73 | 33 | 154 |
| | (25%) | (24%) | (11%) | (20%) | (24%) | (25%) | (11%) | (19%) |
| Total | 51 | 65 | 64 | 180 | 198 | 295 | 305 | 798 |
| | (100%) | (100%) | (100%) | (100%) | (100%) | (100%) | (100%) | (100%) |

**Panel B: Descriptive Statistics**

| Variable | No. of Obs. | Mean | 25th Percentile | 50th Percentile | 75th Percentile | Std. Dev. |
|---|---|---|---|---|---|---|
| Pooled sample | 798 | | | | | |
| Total assets ($ millions) | | 128.888 | 9.472 | 35.145 | 109.260 | 243.119 |
| Revenue growth (%) | | 0.206 | −0.055 | 0.029 | 0.219 | 0.841 |
| R&D intensity | | 0.276 | 0.041 | 0.110 | 0.241 | 0.645 |

**Table 2** (continued)

| | | | | | | |
|---|---|---|---|---|---|---|
| IFRS capitalizers | 198 | | | | | |
| Total assets | | 83.616 | 9.706 | 23.475 | 81.049 | 164.703 |
| Revenue growth | | 0.231 | −0.087 | 0.026 | 0.186 | 0.988 |
| R&D intensity | | 0.168 | 0.029 | 0.071 | 0.156 | 0.283 |
| IFRS noncapitalizers | 295 | | | | | |
| Total assets | | 59.985 | 3.970 | 11.134 | 39.563 | 180.819 |
| Revenue growth | | 0.204 | −0.085 | 0.000 | 0.173 | 0.928 |
| R&D intensity | | 0.359 | 0.041 | 0.161 | 0.458 | 0.476 |
| US GAAP firms | 305 | | | | | |
| Total assets | | 224.295 | 34.522 | 95.064 | 244.221 | 300.702 |
| Revenue growth | | 0.192 | −0.043 | 0.058 | 0.255 | 0.625 |
| R&D intensity | | 0.164 | 0.066 | 0.112 | 0.178 | 0.221 |

The sample consists of 798 Israeli high-tech firm-years: 493 observations of firms reporting in accordance with IFRS, of which 198 are R&D capitalizers and 295 are noncapitalizers, and 305 observations of firms reporting in accordance with US GAAP during the years 2007–2011

## 5 Disclosure differences between IFRS capitalizers, IFRS noncapitalizers, and GAAP reporters

### 5.1 Between group differences

As shown in panel A of Table 3, the mean (median) of the total disclosure score of our pooled sample is 0.46 (0.43), indicating that the actual voluntary disclosure by sample firms was, on average, slightly below half of the maximum score. The interquartile range of disclosure (0.30–0.59) and the standard deviation (0.19) indicate considerable cross-sectional variation of R&D-related disclosures by the sample firms. The disclosure scores of life science firms (not tabulated) are higher than those of other firms (mean 0.464 vs. 0.435, difference significant at the 2% level). We accordingly control for this difference in our analyses by interacting the disclosure variable with a life science dummy. As for the individual score categories, the lowest level of disclosure, on average, is about future plans (24%), likely due to high uncertainty and competitive concerns, followed by information on feasibility of completion (36%), future benefits and market information (0.38), and R&D activities (42%).Target uses (88%) has the highest disclosure rate. We will discuss the remaining items displayed in Panel A (progress of product pipeline, etc.) below. Panel B of Table 3 presents the disclosure scores separately for IFRS capitalizers, IFRS noncapitalizers and GAAP users—a major focus of this study. Notably, the mean total disclosure of IFRS capitalizers (0.58) was significantly larger than the disclosure by other sample firms, IFRS noncapitalizers (0.45) and GAAP firms (0.38), with the mean/median differences highly significant. These intergroup disclosure differences support our conjecture that IFRS R&D capitalization rule leads firms to voluntarily disclose R&D-related information, particularly so by R&D capitalizers.

Intuition for these disclosure differences follows: IFRS capitalizers disclose more information than IFRS noncapitalizers because they have more positive news: their projects passed technological feasibility tests, financing for completing the projects is secured, etc. Moreover, capitalization of expenses is always suspect by investors since it increases reported earnings dollar-for-dollar. It is therefore in the interest of capitalizers to allay investors' concerns about earnings manipulation by providing extensive information attesting to the viability and integrity of the capitalized asset. More intriguing is the finding that IFRS noncapitalizers voluntarily disclose more information than GAAP firms, while both groups obviously didn't capitalize R&D. The reason, we believe, IFRS users disclose more than their GAAP counterparts is rooted in IFRS requirement to conduct an annual examination of development capitalization, namely, to find out whether projects under development passed feasibility tests. GAAP firms are not required to collect this extensive information.[10] Thus, even if GAAP managers collect internally capitalization-related information, investors do not know whether, or how much, information was collected. In contrast, IFRS investors *know* that managers possess the R&D-related information required by the capitalization

[10] An intriguing issue is whether IFRS capitalization requirement has real effects on firms' operations, such as expediting the development process to capitalize costs. We thank an anonymous referee for this observation. Addressing this question obviously requires access to firms' internal R&D decisions and operations, which we don't have.

**Table 3** Disclosure Index Attributes

**Panel A - Pooled Sample**

| Variable | # Obs. | Mean | 25th Percentile | 50th Percentile | 75th Percentile | Std. Dev. |
|---|---|---|---|---|---|---|
| Scaled Disclosure Score- Total | 798 | 0.46 | 0.30 | 0.43 | 0.59 | 0.19 |
| By subtotals of disclosure: | | | | | | |
| General Development Information | 798 | 0.54 | 0.41 | 0.57 | 0.71 | 0.21 |
| R&D Activities | 798 | 0.42 | 0.25 | 0.41 | 0.59 | 0.24 |
| Feasibility of Completion | 798 | 0.36 | 0.23 | 0.34 | 0.50 | 0.20 |
| Future Benefits and Market Information | 798 | 0.38 | 0.19 | 0.36 | 0.58 | 0.23 |
| Product Specifications | 798 | 0.57 | 0.38 | 0.63 | 0.80 | 0.26 |
| Target Uses | 798 | 0.88 | 1 | 1 | 1 | 0.26 |
| Future Plans | 798 | 0.24 | 0.00 | 0.12 | 0.37 | 0.26 |
| Innovation Revenues | 798 | 0.72 | 0 | 1 | 1 | 0.44 |
| Progress in Product Pipeline | 798 | 0.48 | 0 | 0 | 1 | 0.50 |
| Protection of R&D Innovation | 798 | 0.88 | 1 | 1 | 1 | 0.33 |
| Venture Backing | 798 | 0.52 | 0 | 1 | 1 | 0.50 |
| Ownership Concentration | 798 | 0.44 | 0.34 | 0.43 | 0.55 | 0.18 |
| Market-to-Book | 798 | 2.98 | 0.93 | 1.65 | 3.00 | 4.80 |
| External Financing | 798 | 0.22 | 0.00 | 0.00 | 0.18 | 0.57 |
| OCS | 798 | 0.39 | 0 | 0 | 1 | 0.49 |
| Cash Burn Rate | 798 | 7.44 | 0.00 | 1.27 | 4.52 | 28.91 |
| Firm Size | 798 | 72.135 | 6.60 | 18.65 | 55.73 | 175.56 |

**Panel B – Scaled Disclosure Score by IFRS Capitalizers, IFRS Noncapitalizers, and US GAAP Firms**

| Variable | No. of Obs. | Mean | 25th Percentile | 50th Percentile | 75th Percentile | Std. Dev. |
|---|---|---|---|---|---|---|
| IFRS capitalizers | 198 | 0.58 | 0.42 | 0.54 | 0.74 | 0.23 |
| IFRS noncapitalizers | 295 | 0.45 | 0.30 | 0.46 | 0.60 | 0.19 |
| US GAAP firms | 305 | 0.38 | 0.30 | 0.37 | 0.45 | 0.14 |

**Table 3** (continued)

| | | | |
|---|---|---|---|
| Differences: | | | |
| IFRS capitalizers – IFRS noncapitalizers | 0.13*** | | 0.08*** |
| IFRS capitalizers – US GAAP | 0.20*** | | 0.17*** |
| IFRS noncapitalizers – US GAAP | 0.07*** | | 0.09*** |
| **Panel C: Serial Correlation in Disclosure Indices** | | | |
| Total scaled score | | 0.926*** | |
| Subtotal scaled scores: | | | |
| General Development Information | | 0.943*** | |
| R&D Activities | | 0.906*** | |
| Feasibility of Completion | | 0.901*** | |
| Future Benefits and Market Information | | 0.894*** | |
| Product Specifications | | 0.905*** | |
| Target Uses | | 0.887*** | |
| Future Plans | | 0.894*** | |
| Innovation Revenues | | 0.535*** | |

Total (subtotal) Scaled Disclosure Score is calculated by dividing the disclosure index, obtained by the scoring procedure in Appendix B, by the overall (category's) available scores of 68 for life sciences firms and 65 otherwise (General Development Information – 14; R&D Activities – 15 for life sciences firms and 12 otherwise; Feasibility of Completion – 10; Future Benefits and Market Information – 9; Product Specifications – 8; Target Uses – 2; Future Plans – 9; Innovation Revenues – 1). For each firm, information on the progress made in the product pipeline, the protection on R&D innovation as well as venture capital backing is collected from the annual financial statements. *Progress in Product Pipeline* is a binary variable that equals to 1 if the firm has disclosed that progress was made in its products pipeline and 0 otherwise. *Protection on R&D Innovation* is a binary variable that equals to 1 if the firm has protected its R&D innovations (e.g., through patents, licenses, trademarks, intellectual property) and 0 otherwise. *Venture Backing* is a binary variable that equals 1 for firms backed by venture capitalists and 0 otherwise. *Ownership Concentration* is the percentage share ownership of managers, directors, and 5% or greater beneficial owners. *Market-to-Book* is the ratio of market value of equity to book value of equity. *External Financing* is the sum of net cash proceeds received from equity holders (equity issuances less dividends and repurchases) and net cash inflow received from debt holders (debt issuances less debt repayments) scaled by total assets. *OCS* is a binary variable that equals 1 for firms backed by the Office of the Chief Scientist in the Ministry of Economy in Israel and 0 otherwise. *Cash Burn Rate* is cash and cash equivalents divided by total R&D expenditure (expensed + capitalized). *Firm Size* is the firm's total market value (in $ millions). *** and * indicate that the difference between the two groups of firms is significant at the 1% and 10% levels, respectively

standard, even without R&D capitalization, and no disclosure will be suspect. Moreover, IFRS noncapitalizers are relatively small, having lower revenue growth (at the median) than other sample firms. The information asymmetry for noncapitalizers is therefore likely higher than that of the larger GAAP firms, and it's in the interest of noncapitalizers to enhance voluntary disclosure to increase transparency.[11]

Finally, Panel C of Table 3 portrays the serial correlations of the disclosure scores and their components. It's evident that the correlations are very high, indicating that the voluntary disclosure practice and the attributes captured by our index are stable and long term, reflecting the stability of firms' business models, which the scores mirror.

### 5.2 Disclosure trends

We have documented above that IFRS capitalizers disclose, on average, more than noncapitalizers, who, in turn, disclose more than GAAP reporters. We gain further insight from the pattern, or trend, of information disclosure. Table 4, Panel A.1, presents the disclosure scores, by year, for IFRS capitalizers, noncapitalizers, and GAAP firms. (The medians (untabulated) yield very similar inferences.) It is evident that in 2006, the year before IFRS adoption in Israel, the mean disclosure scores of the three subsamples were virtually identical (38%). This is notable. It shows that, before IFRS adoption, there was no stronger demand by Israeli investors for R&D information over U.S. investors' demand.

Things changed drastically in 2007, when most Israeli-listed firms adopted IFRS: The disclosure scores of IFRS capitalizers (noncapitalizers) increased significantly in 2007, from 0.381 to 0.462 (0.380 to 0.399), and kept increasing gradually up to 2011, whereas the scores of GAAP reporters remained constant throughout the sample period. The disclosure scores differences between 2007 and 2011 (and 2006–2007) are statistically significant ($p$-value < 0.01) for both IFRS capitalizers and noncapitalizers. The gradual increase in IFRS firms' disclosure was likely due to a learning curve: as firms learned IFRS's requirements and observed other firms' capitalization choices, they improved their own disclosure. Notably, we observe a significant difference between the total disclosure scores of the two groups in *each* of the years 2007–2011, with IFRS capitalizers being higher than noncapitalizers, and the latter being higher than GAAP firms. The patterns of the individual categories of the disclosure score behave similarly to the total scores (nontabulated). The difference-in-differences tests (bottom Panel A.1) between IFRS capitalizers, noncapitalizers, and GAAP reporters between 2007 and 2011 (and 2006–2007) are all statistically significant. Thus both the cross-sectional and over time differences in voluntary disclosure by our three subsamples are consistent with our conjecture: IFRS R&D capitalization requirement is associated with a significant increase in the voluntary disclosure of R&D-related information, particularly so by development cost capitalizers.

### 5.3 Robustness tests

The differences in the trend and extent of voluntary R&D-related disclosure between IFRS capitalizers, noncapitalizers, and GAAP reporters may, to some extent, reflect

[11] We are indebted to a reviewer for this insight.

**Table 4** Patterns of voluntary disclosure over time

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | Difference2006–2007 | Difference2007–2011 |
|---|---|---|---|---|---|---|---|---|
| **Panel A: Mean Scaled Disclosure Score by Year: a Difference-in-Differences Analysis** | | | | | | | | |
| **A.1 Pooled sample** | | | | | | | | |
| IFRS capitalizers | 0.381 | 0.462 | 0.521 | 0.583 | 0.579 | 0.689 | 0.081*** | 0.227*** |
| IFRS noncapitalizers | 0.380 | 0.399 | 0.396 | 0.491 | 0.476 | 0.546 | 0.019** | 0.147*** |
| US GAAP | 0.382 | 0.374 | 0.376 | 0.384 | 0.383 | 0.382 | −0.008 | 0.008 |
| Difference-in-differences | | | | | | | | |
| (IFRS capitalizers) – (IFRS noncapitalizers) | | | | | | | 0.063*** | 0.080*** |
| (IFRS capitalizers) – (US GAAP) | | | | | | | 0.089*** | 0.219*** |
| (IFRS noncapitalizers) – (US GAAP) | | | | | | | 0.027*** | 0.139*** |
| **A.2 Propensity-matched subsamples** | | | | | | | | |
| IFRS capitalizers | 0.405 | 0.492 | 0.508 | 0.539 | 0.524 | 0.556 | 0.087*** | 0.064*** |
| IFRS noncapitalizers | 0.418 | 0.440 | 0.453 | 0.492 | 0.499 | 0.462 | 0.022*** | 0.022*** |
| US GAAP | 0.419 | 0.410 | 0.414 | 0.423 | 0.421 | 0.420 | 0.009 | 0.010 |
| Difference-in-differences | | | | | | | | |
| (IFRS capitalizers) – (IFRS noncapitalizers) | | | | | | | 0.065*** | 0.042*** |
| (IFRS capitalizers) – (US GAAP) | | | | | | | 0.078*** | 0.054*** |
| (IFRS noncapitalizers) – (US GAAP) | | | | | | | 0.013** | 0.012** |
| **Panel B: Mean Proportion of Pages Containing R&D Disclosures out of Total Number of Pages of Footnote Disclosures, by Year: a Difference-in-Differences Analysis** | | | | | | | | |
| IFRS capitalizers | 0.027 | 0.034 | 0.038 | 0.057 | 0.046 | 0.053 | 0.007** | 0.019*** |
| IFRS noncapitalizers | 0.026 | 0.035 | 0.036 | 0.041 | 0.039 | 0.041 | 0.009** | 0.006** |
| US GAAP | 0.026 | 0.027 | 0.027 | 0.027 | 0.028 | 0.028 | 0.001 | 0.001 |

**Table 4** (continued)

| | | |
|---|---|---|
| Difference-in-differences: | | |
| (IFRS capitalizers) – (IFRS noncapitalizers) | −0.002 | 0.013*** |
| (IFRS capitalizers) – (US GAAP) | 0.006** | 0.018*** |
| (IFRS noncapitalizers) – (US GAAP) | 0.008** | 0.005** |

This table presents mean scaled disclosure scores by year over the sample period. Panel A shows the total scores for the subsamples of IFRS capitalizers, IFRS noncapitalizers, and US GAAP firms. In Panel A.1, the results are based on our entire sample, while in Panel A.2, we present the results for a propensity-matched subsample of 40 IFRS capitalizers, 40 IFRS noncapitalizers, and 40 US GAAP firms. In Panel B, we repeat the difference-in-differences analysis using the page proportion of R&D-related disclosures out of the firm's entire disclosure in the financial statements. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively

firms' self-selection into these groups.[12] We employ two methodologies to deal with self-selection: propensity-score matching (below) and the Inverse Mills ratio in section 6. Specifically, we repeat our difference-in-differences analysis using a propensity score-matched sample of firms, based on the following determinants of voluntary disclosure derived from the firms' financial statements for 2006—before IFRS adoption: the extent of R&D protection (patents, trademarks), the progress rate of the developed products, venture capital backing, Israeli Chief Scientist funding (OCS),[13] ownership concentration, firm size, sales growth, market-to-book ratio, external financing, and the cash burn rate.[14] Voluntary disclosure is expected to increase with project patent protection and advanced development stage (less concern with benefitting competitors); venture backing will also enhance disclosure since venture capitalists' early exits are facilitated by high share prices. Firms with concentrated ownership and those supported by the Israeli Chief Scientist have a lower need for external financing and hence will tend to disclose less. Large firms and otherwise dominant firms (high sales growth or market-to-book ratio) are less concerned with competitors and hence will disclose more, as will firms with a considerable need of external financing and a high R&D burn rate. (The exact measurement of each variable is outlined in Section 6.)

Our propensity-score matched sample consists of 40 IFRS capitalizers, 40 IFRS noncapitalizers, and 40 GAAP users.[15] Performing the difference-in-differences analysis on the propensity-score matched firms yields the results displayed in Panel A.2 of Table 4, which resemble those obtained for the full sample, as shown in Panel A.1. This solidifies our conclusion that it was the *exogenous* IFRS 2007 adoption in Israel, rather than other endogenous factors, which triggered the sharp increase in voluntary disclosure by IFRS firms, particularly by R&D capitalizers.

Finally, it can be argued that the documented intertemporal increase in the extent of R&D-related disclosures by IFRS firms, while GAAP disclosures were unchanged, is the consequence of a *general disclosure increase* by IFRS reporters, relative to GAAP users, unrelated to R&D capitalization—the focus of our study.[16] To address this concern, we use a measure of "general disclosure," which reflects all other information disclosed by the firm, over and above the R&D-related information. Specifically, for each firm-year, we *count* the number of footnote pages included in the sample firms' financial statements and the MD&As page count. We then count the number of pages

[12] We commented earlier that there isn't self-selection in R&D capitalization, since capitalization is required by IFRS if the conditions (e.g., project technological feasibility) are met. But there is a fundamental self-selection in the firms' listing decision: listing in Israel, dual listing, or U.S. listing.

[13] OCS is an indicator variable reflecting whether the firm's R&D was supported by the Office of the Chief Scientist in Israel's Ministry of the Economy.

[14] Descriptive statistics for these variables are displayed in Table 3, Panel A (bottom).

[15] Propensity-score matching is generally performed on two groups, whereas our setting requires three pairwise comparisons: (1) IFRS capitalizers vs. IFRS noncapitalizers, (2) IFRS capitalizers vs. GAAP reporters, and (3) IFRS noncapitalizers vs. GAAP reporters. From (1), we obtain 51 propensity-score matched pairs of IFRS capitalizers and noncapitalizers; from (2), we also obtain 51 matched pairs of IFRS capitalizers and GAAP reporters; and from (3), 64 pairs of IFRS non-capitalizers and GAAP reporters. (Recall that our sample comprises 51 IFRS capitalizers, 65 noncapitalizers, and 64 GAAP reporters; see Table 1.) Forty of the 64 pairs of noncapitalizers and GAAP reporters in group (3) had noncapitalizing firm in group (1) and a GAAP firm in group (2) with the same matching capitalizing firm. We selected those 40 pairs from group (3) to obtain a subsample of 40 capitalizers, 40 noncapitalizers, and 40 GAAP reporters which match on the propensity to disclose voluntarily.

[16] We thank an anonymous referee for this observation.

providing R&D-related information (parts of a page are counted too) and compute the *page proportion* of R&D disclosures to the total number of footnote and MD&A pages included in the financial statements, yielding a relative measure of R&D disclosure scaled by the general disclosure. We note that page count to proxy for the extent of disclosure was used in previous disclosure studies in accounting.[17]

Panel B of Table 4 presents the analysis of the page proportion measure of disclosure. It is evident that the proportion of R&D-related disclosure to the firms' overall disclosure, significantly increased over time for IFRS capitalizers (from 2.7% to 5.3%) as well as for IFRS noncapitalizers (from 2.6% to 4.1%) but did not change for GAAP users. As in Panel A, the page proportion was identical for the three subsamples in 2006 but differed markedly thereafter. The differences-in-differences tests (2007–2011) between the three groups of firms are statistically significant. Thus the intertemporal increase in R&D-related voluntary disclosures by IFRS firms, and particularly by capitalizers, is robust to controlling for a concomitant change in the overall disclosure of the sample firms.

## 6 What explains the inter-group disclosure differences?

We next evaluate why all firms do not voluntarily disclose as much information as they possess. This question is particularly intriguing given the evidence presented in the next section that the disclosure captured by our index is associated with higher and more informative stock prices. The answer, as usual with information issues, potentially boils down to incentives and costs of disclosure. Firms differ along the spectrum of the competitive threat of innovation imitation and infringement and in their need for external financing; hence the potential benefits of improved transparency and higher stock prices are weighed by managers against the costs of disclosure (see, e.g., Jovanovic 1982; Verrecchia 1983). We study below how firms' extent of voluntary disclosure, as captured by our index, is determined by various cost and financing needs proxies, explaining much of the cross-sectional disclosure differences we documented in the preceding section.

### 6.1 Disclosure costs and incentives

We consider two groups of disclosure determinants: *competitive costs* and *financing needs*, used in previous studies of voluntary disclosure (e.g., Guo et al. 2004). The competitive cost proxies are (1) the legal protection of the innovation, (2) the progress of the product pipeline, and (3) the extent of the firm's competitiveness. The financing needs proxies are (1) venture capital backing and (2) external financing. Following is a brief description of each disclosure determinant.

Legal protection of the innovation (*R&D Protection*) is a binary variable that equals 1 if the firm discloses that it has backed its R&D innovations by patents, licenses, or trademarks and 0 otherwise. Legal protection is expected to motivate more disclosure, since managers of protected innovations are less

[17] See, for example, Gray et al. (1995), Deegan and Gordon (1996), Milne and Adler (1999), Wilmshurst and Frost (2000). Note that number of pages is also a proxy for number of words.

concerned with imitation or infringement by competitors. Progress of the product pipeline (*Progress of Product*) is also a binary variable that equals 1 if the firm disclosed that its projects are in an advanced stage of development—for example, "the project progressed from Phase I to Phase II clinical test"— and 0 otherwise. For advanced products under development, there is less concern of imitation by competitors, generally leading to enhanced disclosure. Also, disclosing information about products in an advanced development stage often deters competitors from entering the market. Regarding these two cost proxies, our data indeed show (untabulated) that the mean disclosure score of firms with patent-protected projects (0.49) is significantly higher than that of those with unprotected projects (0.22) and that firms in an advanced development stage have a mean disclosure score of 0.57, significantly higher than that of firms with projects in early development (0.36).

We include in our analysis a measure of firm competitiveness, or ability to outperform competitors, derived from the entrepreneurial finance literature: sales growth rate (*Sales Growth*; e.g., Doyle and Hooley 1992; Moore 1999; Morgan and Strong 2003; Gavious and Schwartz 2009). Fast-growing firms are obviously successful competitors, who are less concerned with competitive disclosure costs.

Regarding the financial needs proxies, *Venture Backing* is a binary indicator that equals 1 for firms backed by venture capitalists and 0 otherwise. Venture capitalists generally strive for an early exit, enhanced by high stock prices, which is facilitated by voluntary disclosure of favorable information. *External Financing* is calculated as the sum of net cash proceeds from equity (equity issuances less dividends and repurchases) and debt (debt issuances less debt repayments), scaled by total assets. Firms with a greater need for external financing have stronger incentives to mitigate information asymmetry through enhanced disclosures. We use these disclosure costs and financing needs proxies to explain the cross-sectional variability of disclosure in our sample. But before this analysis, we first deal with self-selection concerns.[18]

### 6.2 Stock listing self-selection

We wish to control for self-selection of the stock listing place in our sample: U.S. exchanges vs. the Tel Aviv stock exchange. We do this by including in the regressions explaining the cross-sectional differences in disclosure (below) the Inverse Mills ratio (Heckman 1979), calculated from a probit model predicting firms' choice of listing place. We employ a Heckman-type two-stage treatment effect as follows. In the first stage, we estimate a probit U.S. listing model in which the likelihood of an Israeli firm listing on a U.S. exchange, denoted by *US_listed*, is regressed on a set of variables deemed to affect this decision (see, e.g., Kim and Shi 2012):

[18] Additional factors potentially affecting voluntary disclosure include ownership concentration, firm size, market-to-book ratio, OCS, and the cash burn rate, as elaborated in subsection 5.3. These variables are included in the first of the two-stage Heckman analysis we employ to estimate the costs/incentives factors affecting voluntary R&D disclosure. See the following 6.2 subsection.

**Table 5** First-stage analysis. Probit model for listing in foreign (US) exchanges

| | |
|---|---|
| *Intercept* | −21.291 |
| *Firm Size* | 0.414*** |
| *Market-to-Book* | 0.044** |
| *Cash Burn Rate* | −0.015** |
| *OCS* | 0.320* |
| *Ownership Concentration* | −1.840*** |
| *Dual List* | 39.462 |
| *Years* | included |
| *Industries* | included |
| **Pseudo $R^2$** | 0.497 |
| **No. of Obs.** | 711 |

$US\ listed = \alpha 0 + \alpha 1\ (Firm\ Size) + \alpha 2\ (Market{-}to{-}Book) + \alpha 3\ (Cash\ Burn\ Rate) + \alpha 4\ (OCS) + \alpha 5\ (Ownership\ Concentration) + \alpha 6\ (Dual\ List) + \alpha 7\ (Industry\ Fixed\ Effects) + \alpha 8\ (Year\ Fixed\ Effects) + \varepsilon.$

*US listed* is a binary variable that equals 1 if the firm is listed in the U.S. (either dually listed or listed solely in the U.S.) and 0 if the firm is listed only in Israel. *Firm Size* is the natural logarithm of the firm's total market value (in $ millions). *Market-to-Book* is the ratio of market value of equity to book value of equity. *Cash Burn Rate* is cash and cash equivalents divided by total R&D expenditure (expensed + capitalized). *OCS* is a binary variable that equals 1 for firms backed by the Office of the Chief Scientist in the Ministry of Economy in Israel and 0 otherwise. *Ownership Concentration* is the percentage share ownership of managers, directors, and 5% or greater beneficial owners. *Dual List* is a dual listing indicator variable. We control in the regressions for industry and year fixed effects. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively

$$\begin{aligned} US\_listed = {} & \alpha 0 + \alpha 1\ (Firm\ Size) + \alpha 2\ (Market{-}to{-}Book) + \alpha 3\ (Cash\ Burn\ Rate) \\ & + \alpha 4\ (OCS) + \alpha 5\ (Ownership\ Concentration) + \alpha 7\ (Dual\ List) \\ & + \alpha 8\ (Year\ Fixed\ Effects) + \alpha 9\ (Industry\ Fixed\ Effects) + \varepsilon. \end{aligned} \tag{1}$$

*US_listed* is a binary variable that equals 1 if the firm is listed in the U.S. (either dually or only in the US) and 0 if the firm is listed in Israel only. *Firm Size* is the natural logarithm of total market value (in $ millions). *Market-to-Book* is the ratio of market to book values at year-end. Higher values of these two variables make a company more attractive to U.S. investors. The higher the *Cash Burn Rate* measure (liquid assets over R&D), the lower the need for external financing and the lower the incentive to tap the deep U.S. capital markets. *OCS* reflects support from the Israeli Chief Scientist— a "Good Housekeeping seal" for the firm—making the firm more attractive to foreign investors. The larger the *Ownership Concentration*, the lower the need for external financing and the incentive to list outside Israel. *Dual List* is a dual listing indicator variable. Dual listing makes it easier to attract talent, offering the "best of all worlds"—working in both Israel and the U.S.

The estimates of the Probit model, displayed in Table 5, indicate that the probability of an Israeli firm listing on a U.S. exchange is indeed increasing in firm size, expected growth (market-to-book), and OCS and decreasing with the burn rate and ownership concentration, as expected. The Inverse Mills ratio is included in the following disclosure score regression.

**Table 6** Regressions of disclosure scores on IFRS capitalization dummies and cost determinants of disclosure

| | |
|---|---|
| Intercept | 0.093*** |
| | (0.015) |
| *IFRS Capitalizer* | 0.221*** |
| | (0.011) |
| *IFRS Noncapitalizer* | 0.054*** |
| | (0.010) |
| *Life Science Dummy* | −0.014* |
| | (0.007) |
| *R&D Protection* | 0.175*** |
| | (0.013) |
| *Progress of Product* | 0.144*** |
| | (0.010) |
| *Venture Backing* | 0.141*** |
| | (0.010) |
| *Sales Growth* | 0.002 |
| | (0.004) |
| *External Financing* | 0.015** |
| | (0.008) |
| *Inv. Mills Ratio (lambda)* | −0.002 |
| | (0.013) |
| **Adjusted $R^2$** | 0.813*** |
| **No. of Obs.** | 711 |

$$Disclosure\ Score = \alpha o + \alpha 1\ (IFRSCapitalizer) + \alpha 2\ (IFRSNoncapitalizer) + \alpha 3\ (LifeScienceDummy) + \alpha 4\ (R\&D\ Protection) + \alpha 5\ (ProgressofProduct) + \alpha 6\ (VentureBacking) + \alpha 7\ (SalesGrowth) + \alpha 8\ (ExternalFinancing) + \alpha 9\ (Inv.\text{Mills ratio}) + \alpha 10\ (YearFixedEffects) + \varepsilon.$$

*Disclosure Score* for each firm is calculated by dividing the disclosure index by overall available scores (68 for life sciences firms and 65 otherwise). *R&D Protection* is a binary variable that equals to 1 if the firm has protected its R&D innovations (e.g., through patents, licenses, trademarks, intellectual property) and 0 otherwise. *Progress of Product* is a binary variable that equals to 1 if the firm has disclosed that progress was made in its product pipeline and 0 otherwise. *Venture Backing* is a binary variable that equals 1 for firms backed by venture capitalists and 0 otherwise. *Sales Growth* is the percentage change in annual sales. *External Financing* is the sum of net cash proceeds received from equity holders (equity issuances less dividends and repurchases) and net cash inflow received from debt holders (debt issuances less debt repayments) scaled by total assets. We control in the regressions for year fixed effects. We account for the differences between IFRS capitalizers, IFRS non-capitalizers, and US GAAP firms by including *IFRS Capitalizer* and *IFRS Noncapitalizer* dummies. *IFRS (Non)Capitalizer* is a binary variable that equals 1 if the firm reports in accordance with IFRS and (did not) capitalized R&D expenditures during the sample period and 0 otherwise. *Life Science Dummy* is an indicator for the life science sub-industry. The Inverse Mills Ratio is computed from our first-stage probit regression. Entries are coefficients; standard errors clustered at the firm-level appear in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively

### 6.3 Explaining the cross-sectional disclosure differences

We now bring together the costs/incentives factors affecting voluntary R&D disclosure (Section 6.1) and the foreign listing determinants (Section 6.2), to examine their effect on the sample companies' disclosure, as reflected by our disclosure index:

$$\begin{aligned} \textit{Disclosure Score} = {} & \alpha o + \alpha 1\ (\textit{IFRS Capitalizer}) + \alpha 2\ (\textit{IFRS Noncapitalizer}) \\ & + \alpha 3\ (\textit{Life Science Dummy}) + \alpha 4\ (\textit{R\&D Protection}) \\ & + \alpha 5\ (\textit{Progress of Product}) + \alpha 6\ (\textit{Venture Backing}) \\ & + \alpha 7\ (\textit{Sales Growth}) + \alpha 8\ (\textit{External Financing}) \\ & + \alpha 9\ (\textit{Inv. Mills ratio}) + \alpha 10\ (\textit{Year Fixed Effects}) + \varepsilon \end{aligned} \tag{2}$$

*IFRS (Non)Capitalizer* is a binary variable that equals 1 if the firm reports in accordance with IFRS and capitalized (or did not) R&D expenditures during the sample period and 0 otherwise. *Life Science Dummy* is an indicator for the life science sub-industry. The Inverse Mills ratio is computed from our first-stage probit regression (Eq. 1). *R&D Protection*, *Progress of Product*, *Venture Backing*, *Sales Growth*, and *External Financing* were defined in section 6.1. Estimates of regression (2) are reported in Table 6. Notably, the coefficients of IFRS capitalizers and noncapitalizers are positive and highly significant, with that of capitalizers four times larger than the coefficient of noncapitalizers (the coefficient of GAAP reporters is embedded in the intercept). Thus our conjecture that R&D capitalizers disclose voluntarily more than noncapitalizers is supported by the multivariate analysis, consistent with the univariate analysis in Table 3.

Of the disclosure determinants examined, the coefficients on R&D patent protection, the progress of the product pipeline, and venture backing are positive and highly significant, as expected. The coefficient of external financing, reflecting financial needs, is also positive and significant. The insignificant coefficient of the inverse Mills ratio suggests that foreign listing self-selection doesn't affect our disclosure determinants findings.[19] Overall, our regression model explains well ($R^2 = 0.813$) the sample cross-sectional variance of voluntary R&D-related disclosure.

Finally, returning to the section's opening question: why aren't GAAP and IFRS noncapitalizers providing as much, or even more, information than IFRS capitalizers? The answer lies in information availability as well as disclosure costs and financing needs motives. First, R&D capitalizers have potentially more (due to the stringent capitalization requirements) and better (positive feasibility tests) information than noncapitalizers and GAAP reporters, while noncapitalizers have more R&D-related information than GAAP users, due to IFRS requirement to test periodically for R&D capitalization. Second, the competitive cost factors are higher for our GAAP reporters than for IFRS capitalizers: In particular, the development stage of IFRS capitalizers is, on average, significantly more advanced than that of GAAP reporters (63% of capitalizers reported pipeline progress vs. 45% of GAAP users), and the patent protection—another disclosure costs factor—of capitalizers is higher than that of GAAP users (56% vs 40%). Thus information availability and cost considerations indeed determine the extent of voluntary R&D disclosure.[20]

[19] The borderline negative coefficient of the life science dummy is counterintuitive and likely reflects the fewer life science companies among the capitalizers than noncapitalizers.

[20] Cost factors also help explain the disclosure differences between IFRS capitalizers and noncapitalizers: Progress of the product pipeline (63% vs. 55%), and patent protection (56% vs. 51%), are significantly higher for IFRS capitalizers than noncapitalizers.

## 7 Disclosure relevance: the market consequences of voluntary R&D disclosure

We now turn to our final question: is the voluntary disclosure captured by our index relevant to investors' decisions? Importantly, this investigation, if positive, also provides a validity check of our disclosure index, which is based, to a certain extent, on subjective judgment regarding the choice of information variables and the assigned scores. If the disclosure index is associated with market values, then our choices of information items and weights indeed reflect relevant information. We use three methodologies for this relevance examination: price associations, narrow window returns test, and price informativeness examination.

### 7.1 Price regressions

Based on a version of the Ohlson (1995) model, we relate firms' market value to book value, earnings (before R&D expense), the expensed R&D, the capitalized R&D asset, and the focus of our investigation—the firm's disclosure score:

$$MV = \beta_0 + \beta_1 BV + \beta_2 E + \beta_3 RD\ expensed + \beta_4 RDcapitalized + \beta_5\ Disclosure + \beta_6 RDcapitalized \times \text{Disclosure} + \beta_7 \%Disclosure\_Pages + v_{it}. \quad (3)$$

*MV* is market value five months after fiscal year-end. (Share prices for Israeli-listed firms are those on the Tel Aviv Stock Exchange and for U.S. listed firms are those on U.S. exchanges.)[21] *BV* is the most recent book value of equity. *E* is recent earnings before the (tax adjusted) R&D expense and extraordinary items.[22] *RDexpensed* is the annual amount of R&D expensed in the income statements, and *RDcaptialized* is the capitalized asset. *Disclosure* is the firm's disclosure score and *RDcaptialized***Disclosure* is the interaction between the capitalized asset and the extent of disclosure. A significantly positive coefficient on the interaction variable, over and above a significant impact of the capitalized asset on firms' market value would suggest that the value relevance of the voluntary disclosure is enhance by capitalizing R&D. *%Disclosure Pages* is the page proportion of R&D-related disclosures, calculated as the number of pages containing R&D-related information divided by the total number of footnote and MD&A pages included in the firm's financial statements. This variable controls for all the other information disclosed by the firm, over and above the R&D-related disclosures. We also include in the regression the firms' capital expenditures, since they too affect share prices.[23]

[21] Repeating our analyses using U.S. share prices for cross-listed firms does not affect our inferences.

[22] Accounting-based valuation models that use net earnings as an explanatory variable generally separate earnings into positive and negative to account for differences in the valuation of profits and losses (Hayn 1995; Basu 1997; Collins et al. 1997). This separation is particularly important in studies of R&D-intensive industries, as previous studies have shown that the earnings in such industries are depressed due to the immediate expensing of large R&D amounts, frequently resulting in firms reporting losses. Because our earnings measure is taken *before* the R&D expense, this variable is positive for most of our sample firm-years (around 70%). As such, Eq. (1) does not include a separate coefficient for negative *E*. However, when we allow for a separate coefficient for negative and positive *E*, we find no significant difference between the two.

[23] For our sample of R&D-intensive high-tech firms, we test and find that other proxies for growth in future earnings, such as sales growth or advertising expenditures, have no incremental contribution to the explanation of stock prices beyond the firm's expenditures on R&D and capital expenditures.

For R&D capitalizers (two right columns), we include in the regression the capitalized R&D asset, given the ongoing debate over the merits of R&D capitalization (e.g., the Skinner-Lev exchange: Lev (2008) and Skinner (2008)).[24] We further control for the life science sub-industry affiliation by including a *Life Science Dummy* and allow for differentiation between IFRS capitalizers and noncapitalizers, by interacting these variables in Eq. (3) with *Disclosure*. Finally, we include the Inverse Mills ratio from our first-stage regression (Eq. 1) to address potential self-selection bias. We repeat the regressions using share price three and four months after fiscal year-end and obtain similar results. All the market value regressions include year fixed effects. Finally, we include in the regression the number of shares outstanding, following Barth and Kallapur (1996).

The market value regression estimates are presented in Table 7. We first note that the coefficient on the disclosure index has the expected positive sign and is highly significant, indicating that the voluntary R&D disclosure captured by our index is indeed reflected in stock prices.[25] Moreover, the interactions of *Disclosure* with IFRS capitalizers and noncapitalizers are also positive and highly significant, with the former being larger than the latter, as expected.[26] The voluntary disclosure impact on investors is more pronounced for IFRS reporters. The inverse Mills Ratio is insignificant, implying no serious concerns with place of listing self-selection.

The right two columns of Table 7 apply to R&D capitalizers only. In the middle column, the capitalized asset *(RDcapitalized)* has a positive coefficient and is highly significant. In the right column, the capitalized asset interacted with *Disclosure* is highly significant, suggesting that the credibility of the voluntary R&D disclosure is enhanced by the capitalized development costs. In other words, the R&D capitalization—the actual recognition of an asset on the balance sheet—enhances the credibility of the voluntary R&D disclosure.[27] To the best of our knowledge, this evidence on the feedback effect between the capitalized R&D (recognition) and the voluntary disclosure is established here for the first time.

The market value regressions with the disclosure index decomposed into its eight categories (untabulated) support to some extent our judgment in constructing the disclosure index, since by running the eight components separately, we don't impose on them equal weight as in the overall index. The coefficient estimates indicate that most of the index components are value-relevant and significant, particularly the information on the various R&D activities of the firm, the feasibility of project completion, the expected benefits of the projects, and data on "innovation revenues" (percentage of revenues from recently introduced products), disclosure of which is not required by GAAP or IFRS.

[24] See additional evidence in, for example, Lev and Sougiannis (1996), Aboody and Lev (1998), and Kimbrough (2007).

[25] We also ran a version of Eq. (3) where the *Disclosure* variable is interacted with total assets, to account for possible size effect on the disclosure index. Estimates of this regression are very close to those reported in Table 7.

[26] The accounting variables are not interacted with IFRS capitalizers and noncapitalizers because, as expected, the associations between share price and book value, earnings, R&D and capital expenditures do not differ between the three subgroups.

[27] We thank an anonymous referee for suggesting this analysis. Note that the capitalized R&D coefficient is insignificant in the right column of Table 7. Apparently, the significant interaction of *Disclosure* with *RD Capitalized* subsumes the information in the capitalized assets.

**Table 7** Market value regressions on firm disclosure scores and control variables

| | Pooled sample | Capitalizers only | |
|---|---|---|---|
| *Intercept* | −131.336** | −9.872 | −65.969*** |
| | (59.110) | (8.914) | (13.241) |
| *IFRS Capitalizer* | −32.379 | | |
| | (76.246) | | |
| *IFRS Noncapitalizer* | −68.153 | | |
| | (72.212) | | |
| *Life Science Dummy* | 72.128*** | 15.441* | 16.870** |
| | (22.588) | (8.418) | (7.350) |
| *Disclosure* | 2.592*** | | 6.121*** |
| | (0.798) | | (2.072) |
| *Disclosure * IFRS Capitalizer* | 3.611*** | | |
| | (1.235) | | |
| *Disclosure * IFRS Noncapitalizer* | 2.903** | | |
| | (1.638) | | |
| *% Disclosure Pages* | 4.173 | | 6.466 |
| | (30.294) | | (8.111) |
| *BV* | 0.512*** | 0.801*** | 0.642*** |
| | (0.053) | (0.098) | (0.089) |
| *E* | 3.404*** | 2.787*** | 2.122*** |
| | (0.440) | (1.044) | (0.693) |
| *RD total* | 1.071*** | | |
| | (0.117) | | |
| *RD expensed* | | 0.418*** | 1.312*** |
| | | (0.140) | (0.326) |
| *RD capitalized* | | 1.218*** | 1.183 |
| | | (0.382) | (1.482) |
| *RD capitalized * Disclosure* | | | 4.638*** |
| | | | (1.371) |
| *CapEx* | 2.338*** | 2.589*** | 2.249*** |
| | (0.310) | (0.869) | (0.774) |
| *# Shares Outstanding* | 1.029*** | 0.199*** | 0.372*** |
| | (0.144) | (0.063) | (0.067) |
| *Inv. Mills Ratio (lambda)* | 30.170 | −19.429 | −16.438 |
| | (38.649) | (44.969) | (59.056) |
| **Adjusted $R^2$** | 0.926*** | 0.463*** | 0.644*** |
| **No. of Obs.** | 711 | 198 | 198 |

Shows the regressions results of market value of equity on accounting variables and the disclosure scores. The dependent variable is market value five months after fiscal year-end. *BV* is book value of equity. *E* is earnings before R&D expense and extraordinary items. *RD expensed* is annual R&D expense recorded in the income statement. *RD total* is *RD expensed* plus the annual capitalized development costs. *RD capitalized* is the R&D capital on the balance sheet. *CapEx* is capital expenditures. *Disclosure* is the firm's disclosure score, and *% Disclosure Pages* is the page proportion of R&D-related disclosures calculated as the number of pages containing R&D-related divided by the total number of footnote and MD&A pages included in the firm's financial statements. *IFRS (Non)Capitalizer* is a binary variable that equals 1 if the firm reports in accordance with IFRS and (did not) capitalized R&D expenditures during the sample period and 0 otherwise. *Life Science Dummy* is an indicator for the life science sub-industry. The Inverse Mills Ratio is computed from our first-stage probit regression. We control in the regressions for year fixed effects. Entries are coefficients; standard errors clustered at the firm-level appear in parentheses. *** and * indicate significance at the 1% and 10% levels, respectively

To examine the robustness of our regression results, we conducted the following sensitivity analyses (not tabulated for parsimony). First, we ran the regressions for IFRS firms and GAAP firms separately and find, as expected, that the coefficients on the disclosure index and on certain index components (feasibility of completion, future benefits, innovation revenues) are substantially higher for IFRS than for GAAP firms (and for IFRS capitalizers relative to noncapitalizers). Second, to avoid concerns with pooling our data over years, we ran year-by-year regressions of model (3) and find the results across all years similar to those reported in Table 7. Finally, we repeat the market value regressions on the propensity-score matched sample. The results obtained are qualitatively similar to those reported for the full sample. We thus conclude that IFRS's R&D capitalization rule motivates firms to disclose voluntarily extensive R&D-related information that is relevant to investors.

### 7.2 Return analyses: event study of R&D disclosure

The preceding analysis established an association between market value and our disclosure index, leaving open the question whether the voluntary R&D information we focus on indeed triggered investors' reaction.[28] A narrow window event study around the information disclosure provides insight into the direct impact of the voluntary R&D disclosure on investors. Specifically, we examine the cumulative abnormal stock return around the annual financial reports release day: from one day before to three days after the earnings release date. We allow three days post information release since the strategic R&D-related disclosures (e.g., on target market conditions) may take investors more time to digest. The univariate (untabulated) results show that the abnormal window returns are significant and positive for all three groups (around 2%–3% on average), and the mean (median) abnormal returns of IFRS capitalizers, 0.033 (0.036), are significantly larger than those on IFRS noncapitalizers and GAAP firms (at the 5% significance level), likely due to the greater extent and relevance of voluntary disclosure provided by the R&D capitalizers. To disentangle the effects of the R&D-related information voluntarily disclosed from other value-relevant information reported in the firms' financial statements, we regress the abnormal window returns on the price deflated earnings and the change in earnings, following Easton and Harris (1991), as well as on our disclosure index:

$$R = \alpha_0 + \alpha_1 E + \alpha_2 \Delta E + \alpha_3 Disclosure + \alpha_4 \Delta Disclosure + \alpha_5 \%Disclosure\_Pages + \varepsilon. \quad (4)$$

$R$ is the size-adjusted cumulative abnormal return from one day preceding financial statement release to three days following the release. $E$ is the annual earnings per share (before extraordinary items), deflated by the beginning of year share price. $\Delta E$ is the annual change in earnings per share (before extraordinary items), deflated by beginning of year share price. *Disclosure* is the firm's disclosure index, and $\Delta Disclosure$ is the change in the firm's disclosure index from the previous year. Here too we control for the impact of all the other information disclosed by the firm by including *%Disclosure*

[28] We thank the editor for this observation.

*Pages* in the regression. The disclosure variables are deflated by beginning of year price per share. We allow for differentiation between capitalizers and noncapitalizers by interacting these indicators in Eq. (4) with *Disclosure.* Finally, we control in the regressions for year fixed effects, life science firms, and for a listing potential self-selection bias by the Inverse Mills Ratio.

The results of the window return regression (4) are displayed in Table 8. Notably, the coefficient on the disclosure variable is highly significant (0.025, $p$-value < 1%), indicating that our voluntary disclosure index is value-relevant in explaining short-window abnormal returns around the publication of this information. Furthermore, the coefficient on the interaction between disclosure and the *IFRS Capitalizer* indicator variable is also significantly positive (0.022, $p$-value < 1%), indicating the greater impact on investors of disclosure by R&D capitalizers. Similarly, for the interaction of *Disclosure* with *IFRS Noncapitalizer*, albeit with a somewhat lower regression coefficient. The coefficient on the Inverse Mills ratio variable is once more insignificant. Our inferences remain the same when the returns analyses are conducted on the propensity-matched sample (not tabulated for parsimony). Overall, the findings from the return

**Table 8** Regressions of abnormal returns surrounding financial statement release

| | |
|---|---|
| Intercept | 0.009*(0.006) |
| *IFRS Capitalizer* | 0.012*(0.008) |
| *IFRS Noncapitalizer* | 0.003(0.009) |
| *Life Science Dummy* | 0.008*(0.006) |
| *Disclosure* | 0.025***(0.008) |
| *Disclosure * IFRS Capitalizer* | 0.022***(0.008) |
| *Disclosure * IFRS Noncapitalizer* | 0.021***(0.009) |
| $\Delta$*Disclosure* | 0.002(0.007) |
| $\Delta$*Disclosure** *IFRS Capitalizer* | −0.001(0.007) |
| $\Delta$*Disclosure** *IFRS Noncapitalizer* | 0.001(0.007) |
| *%Disclosure Pages* | 0.060**(0.028) |
| *E* | 0.007**(0.003) |
| $\Delta E$ | −0.004(0.004) |
| *Inv. Mills Ratio* | −0.001(0.001) |
| **Adjusted $R^2$** | 0.019 |
| **No. of Obs.** | 711 |

Shows the results of our returns regression. The dependent variable is the size-adjusted cumulative abnormal return from the day before the publication of financial statements to three days after. *E* is earnings per-share before extraordinary items, and $\Delta E$ is the change in *E*. *Disclosure* is the firm's scaled disclosure index, and $\Delta$*Disclosure* is the change in the firm's scaled disclosure index from previous year. *% Disclosure Pages* is the page proportion of R&D-related disclosures calculated as the number of pages containing R&D-related divided by the total number of footnote and MD&A pages included in the firm's financial statements. The independent variables are deflated by beginning of year price per share. *IFRS (Non)Capitalizer* is a binary variable that equals 1 if the firm reports in accordance with IFRS and (did not) capitalized R&D expenditures during the sample period and 0 otherwise. *Life Science Dummy* is an indicator for the life science sub-industry. The Inverse Mills Ratio is computed from our first-stage probit regression. Standard errors of the coefficients clustered at the firm-level are presented in parenthesis. We control in the regressions for year fixed effects. *** and * indicate significance at the 1% and 10% levels, respectively

analysis support the premise that the R&D-related voluntary disclosure affects investors' decisions.

### 7.3 Share price informativeness

A recent study examined the informativeness of financial markets over the past 50 years by regressing corporate earnings on lagged markets values and controls (Bai et al. 2015). We adopt this study's methodology to provide a different perspective on our research question: has the voluntary R&D-related disclosure elicited by IFRS R&D capitalization rule improved investors' information as reflected by share price informativeness?

We run the following regression:

$$\frac{EBIT_{i,t+k}}{TA_{i,t}} = a_t \log\left(\frac{MV_{i,t}}{TA_{i,t}}\right) + b_t\left(\frac{EBIT_{i,t}}{TA_{i,t}}\right) + \in_{i,t,} \tag{5}$$

where $EBIT_{i,t+k}$ are subsequent three-year operating earnings, $TA_{i,t}$ is total assets, $MV_{i,t}$ is current market value, and $EBIT_{i,t}$ is current operating earnings, for firm i and year t. We also run a version of (5) with the independent variables interacted with a year and industry dummies. We run these regressions separately for R&D capitalizers, noncapitalizers, and GAAP reporters. Regression estimates are reported in Table 9.

Panel A compares all IFRS reporters with GAAP firms. Notably, the coefficients on current earnings (*EBIT/TA*) in the three regressions of subsequent years' earnings are virtually identical for the two groups, indicating that the earnings of Israeli firms reporting under IFRS and U.S. GAAP are identically associated with future earnings. No indication of different earnings valuation by U.S and Israeli investors. In contrast, the estimates of market value (*MV/TA*)—indicating share informativeness—are markedly different between the two groups: for each of the three subsequent years, IFRS coefficients are orders of magnitude larger than the GAAP coefficients (e.g., for year t + 1, IFRS market value coefficient is 0.241 vs. GAAP coefficient of 0.008). IFRS $R_s^2$ are also substantially larger than GAAP $R_s^2$. Panel B of Table 9 shows a striking difference in price informativeness between IFRS capitalizers and noncapitalizers: the price (*MV/TA*) coefficients of R&D capitalizers in all three subsequent years are substantially larger than those of noncapitalizers, as are the regressions' $R_s^2$. When the independent variables are interacted with year and industry dummies (not tabulated), IFRS capitalizers' MV/TA (share informativeness) coefficients are still substantially larger than those of IFRS noncapitalizers, which, in turn, are larger than those of GAAP reporting firms for each year and industry.

We believe that a major reason for the subgroup differences in share price informativeness is the value-relevant voluntary R&D disclosure by IFRS firms, consistent with our preceding tests. However, given that IFRS and GAAP reporters are essentially different firms, we cannot rule out other factors affecting price informativeness. To alleviate some of these concerns, we note that IFRS and GAAP reporters are well matched on factors that affect share price informativeness: in particular, the mean market-to-book ratios—an expected growth measure—of IFRS and GAAP firms are very close (2.96 vs. 3.00). Also, recall that the earnings coefficients (*EBIT/TA*) of IFRS and GAAP firms—indicating earnings' predictive ability—are virtually identical (Panel

**Table 9** Price informativeness: Future earnings regressions on current earnings and market values

**Panel A: IFRS Versus US GAAP- Pooled Samples**

| | IFRS | | | US GAAP | | |
|---|---|---|---|---|---|---|
| | ***EBIT(t + 1)/TA(t)*** | ***EBIT(t + 2)/TA(t)*** | ***EBIT(t + 3)/TA(t)*** | ***EBIT(t + 1)/TA(t)*** | ***EBIT(t + 2)/TA(t)*** | ***EBIT(t + 3)/TA(t)*** |
| *Intercept* | 0.044*** | 0.023*** | 0.015*** | 0.041*** | 0.013*** | 0.009* |
| | (0.059) | (0.029) | (0.002) | (0.051) | (0.016) | (0.018) |
| *Log[MV(t)/TA(t)]* | 0.241*** | 0.472*** | 0.587*** | 0.008* | 0.015** | 0.020** |
| | (0.175) | (0.466) | (0.320) | (0.002) | (0.009) | (0.006) |
| *EBIT(t)/TA(t)* | 0.191*** | 0.115*** | 0.114*** | 0.199*** | 0.118*** | 0.117*** |
| | (0.068) | (0.029) | (0.012) | (0.022) | (0.018) | (0.026) |
| **Adjusted $R^2$** | 0.428 | 0.472 | 0.321 | 0.223 | 0.261 | 0.199 |
| **No. of Obs.** | 493 | 493 | 493 | 305 | 305 | 305 |

**Panel B: IFRS Capitalizers Versus Noncapitalizers**

| | IFRS Capitalizers | | | IFRS Noncapitalizers | | |
|---|---|---|---|---|---|---|
| | ***EBIT(t + 1)/TA(t)*** | ***EBIT(t + 2)/TA(t)*** | ***EBIT(t + 3)/TA(t)*** | ***EBIT(t + 1)/TA(t)*** | ***EBIT(t + 2)/TA(t)*** | ***EBIT(t + 3)/TA(t)*** |
| *Intercept* | 0.069*** | 0.039*** | 0.026*** | 0.040*** | 0.022*** | 0.015*** |
| | (0.061) | (0.029) | (0.008) | (0.058) | (0.041) | (0.002) |
| *Log[MV(t)/TA(t)]* | 0.333*** | 0.535*** | 0.651*** | 0.205*** | 0.309*** | 0.419*** |
| | (0.266) | (0.536) | (0.362) | (0.164) | (0.253) | (0.299) |
| *EBIT(t)/TA(t)* | 0.136*** | 0.124*** | 0.112*** | 0.125*** | 0.121*** | 0.114*** |
| | (0.041) | (0.027) | (0.014) | (0.029) | (0.035) | (0.012) |
| **Adjusted $R^2$** | 0.489 | 0.494 | 0.331 | 0.359 | 0.457 | 0.302 |
| **No. of Obs.** | 198 | 198 | 198 | 295 | 295 | 295 |

Shows the regressions results of future earning on market cap and current earnings. The dependent variable is operating earnings *(EBIT)* for year t + 1, t + 2, and t + 3, separately, scaled by total assets for year t; *Log[MV(t)/TA(t)]* is the natural log of the firm's market value as of the end of March following the firm's fiscal year-end scaled by total assets, and *EBIT(t)/TA(t)* is EBIT scaled by total assets. The regressions include controls for year and industry fixed effects. Entries are coefficients; standard errors clustered at the firm-level appear in parentheses. *** and * indicate significance at the 1% and 10% levels, respectively

A, Table 9). Lastly, the findings reported in Panel B of Table 9 relate to IFRS R&D capitalizers and noncapitalizers, all trading on the Tel Aviv stock exchange and having similar industry composition, but they too exhibit significant differences between the price informativeness of capitalizers and noncapitalizers. All this enhances our confidence that the extra voluntary disclosure by IFRS firms, and particularly by R&D capitalizers, is a major factor in enhancing share price informativeness.

## 8 Summary

We ask in this study whether IFRS' requirement to capitalize product development costs has a spillover effect on voluntary R&D-related disclosures, beyond the recognized capitalized values. For a sample of Israeli technology and science-based firms, some using IFRS and others U.S. GAAP, we indeed document a considerable amount of voluntary R&D-related disclosure by IFRS firms, which is unmatched by GAAP reporters. Within IFRS users, R&D capitalizers disclosed voluntarily significantly more than noncapitalizers. Furthermore, we find that the R&D-related voluntary disclosure is value-relevant to investors beyond the recognized earnings, book values, and capitalized R&D, and is associated with higher share price informativeness. We also identify a set of disclosure cost and financing needs proxies which explain much of the substantial cross-sectional voluntary disclosure variability of our sample. We thus identify an important positive externality of IFRS development cost capitalization rule. Of note, our findings concerning the valuation relevance of the recognized capitalized (asset) R&D and the enhancement of voluntary disclosure relevance caused by the capitalized R&D contribute to the ongoing debate on the merits of capitalization of intangibles.

**Acknowledgements** The authors thank Zack Assaf, Yiwei Dou, Nir Ehud, Zvika Eckstein, Ilan Guttman, Mascia Ferrari, Doron Israeli, Gideon Kandler, Simon Kogan, Tamir Masuri, Dan Segal, Ron Shalev, Michael Tang, Joseph Tendler, Guy Tabibian, Danny Vitan, Paul Zarowin, and workshop participants at Arison School of Business, Interdisciplinary Center, Israel. We gratefully acknowledge the financial support of the New York University Stern School of Business and the Guilford Glazer School of Business and Management at Ben-Gurion University.

## Appendix A: Scoring Procedures for the R&D Disclosure Index

Below are the detailed scores given to the various information items reflected by our disclosure score.

### General development information

To capitalize development costs, IFRS firms must be able to distinguish the initial research phase from the subsequent development of the product or service stage and identify the expenditures incurred in each phase. We assign a score of 1 if the firm discusses the two phases and 0 otherwise. An additional score of 1 is given if the firm provides the amounts of research and development stages and 0 otherwise. The human

capital associated with R&D activities is an important information element.[29] Based on the extent of discussion of the human capital, a score of 3 is given if a detailed description (including names and numbers) of key research personnel is provided, 2 if a general description (including numbers) is provided, 1 for a brief description (no numbers), and 0 if there is no discussion of the R&D human capital.[30] The firm's protection of its innovations through patents, licenses, or trademarks (confirming ownership), along with the various risk factors related to R&D activities, and regulations potentially affecting the products under development are essential information for investors. Based on the extent of discussion of each of these three R&D aspects (patent protection, risk, regulation), a score of 3 is given for each of the three items if a detailed description extending over at least five sentences per product is provided, 2 for a general description covered by three to four sentences, and 1 for a brief description by one to two sentences. Zero score is given if there is no discussion of the product protection, risk factors, or related regulations. Adding these individual scores, the general development information category of the disclosure index has a maximum score of 14 points and a minimum of 0.

### R&D activities

This index category captures attributes of R&D activities provided by the firm: the description of the R&D activities, including the initial exploration, evaluation, and the final selection of research proposals; the search for alternative materials, devices, products, processes, systems or services used by the firm[31]; and the formulation, design, evaluation, and final selection of projects to be developed or improved. Based on the extent of description of such R&D activities, a score of 3 is given if a detailed description (including numbers) that extends over at least five sentences is provided, 2 if a general description (including numbers) covered by three to four sentences is provided, 1 if only a brief description (no numbers) is provided by one to two sentences, and 0 for no description of R&D activities.[32]

The timing of the various stages of R&D is an important information for investors. A score of 3 is given if the firm provides timing details (e.g., "the company plans to launch the combined solution in the second half of 2012 …"), duration information (e.g., "the project's duration started on May 1, 2011, and will extend up until April 30, 2012."), or expenditures frequency (e.g., "we annually invest in changing and improving our products in response to changes …"). A score of 2 (1) is given if the firm provides details on at least two (one) of the three dimensions (timing, duration, frequency) and 0 if none are mentioned. A firm may also discuss the results of trials conducted throughout the development process. A score of 3 is given for a detailed discussion, citing tests and analysis of results; 2 for a general discussion of the results, citing data but not analyzing them; 1 for only a brief discussion of trial results without data; and 0 for no mention of trial results, though trials were included in the development process. A discussion of R&D alliances/collaborations yields a score of 2 if it

[29] Personnel costs constitute about 40% of R&D expenditures (Moris 2004).
[30] No firm provided a brief description with numbers for key research personnel.
[31] This is generally known as "process R&D," aimed at economizing on production processes, in contrast with "product R&D," which is aimed at developing new products or services.
[32] No firm provided a brief description with numbers for R&D activities.

included the names of collaborators or alliance partners; 1 if no names were mentioned; and 0 otherwise. A further point is given for breakdowns of the amounts spent on R&D (e.g., payment to consultants, cost of laboratory equipment, etc.) and 0 otherwise. Finally, regarding the relation of R&D to existing products on the market, a score of 3 is given for a detailed discussion that extends over at least five sentences; 2 points are given for a three to four sentence discussion; a brief description of one to two sentences is given 1 point; and 0 otherwise. Adding the individual scores, the research and development activities category of the disclosure index can have a maximum score of 15 points and a minimum of 0.

**Feasibility of completion**

This index category captures the feasibility aspects of completing the development, as prescribed by IAS 38. We give 3 points for a detailed description of a business plan that highlights the technical requirements and ability to complete development; 2 points for a general discussion of this dimension; 1 point for only a brief mention; and 0 otherwise. Another prerequisite for capitalization is demonstrating adequate financial resources to complete the development. A score of 3 is given for a detailed plan, including amounts, which highlights the financial requirements and ability to secure them; 2 points for a general presentation including numbers, 1 point for a brief discussion with no numbers; and 0 otherwise.[33] The firm is required to indicate its intention to complete the development. A score of 1 is given for such an indication and 0 otherwise. The capitalizing firm is also required to demonstrate (internally) its ability to use or sell the new product. A score of 3 is given for a marketing plan per product that extends over at least five sentences; 2 points for a general description covered by three to four sentences; 1 point for a brief description provided by one to two sentences only; and 0 otherwise. Adding these scores, the firm can have a maximum of 10 and a minimum of 0 points in the feasibility of completion category.

**Future benefits and product market information**

Estimating the future benefits from the products under development and providing relevant target market information is another condition for R&D capitalization. We assign a score of 2 (1, 0) points for a detailed (general, or no) discussion, indicating whether the product is expected to generate revenues or cost savings or other income different from the use of the asset by the entity. The capitalizing firm is also required to generate information about the target market for the product. A score of 3 is given for a description that extends over at least five sentences, including numbers, demonstrating the existence of a viable market for the product; 2 points for a general discussion with numbers covered by three to four sentences; 1 for a brief description provided by one to two sentences only without numbers; and 0 otherwise.

In the event that the project will be used internally (rather than marketed), we give a score of 3 for a detailed description of use per product extending

[33] For example, an entity demonstrates the availability of external funding by obtaining a lender's indication of its willingness to finance the plan or grants from the Office of the Chief Scientist of the Israeli Ministry of Economy.

over at least five sentences, 2 points for a general description covered by three to four sentences, 1 point for a brief description provided by one to two sentences only, and 0 otherwise.[34] The firm must also evaluate the degree of certainty attached to the future economic benefits of the product. Accordingly, we give a score of 2 points if it provides reliable evidence in this regard (e.g., evidence from external sources, such as drug resellers), 1 point if no independent sources are quoted, and 0 if no evidence of benefits is provided. Lastly, information on the timing of marketing or internal use—both dates and duration—grants the firm 2 points; 1 point if only one of the two (dates or duration) is given; and 0 otherwise. A maximum score of 9 points and a minimum of 0 is available for this category.

**Product specifications**

This index category captures information on the properties of the products under development.[35] Based on the extent of discussion of product properties and particularly of the efficacy of the product, a score of 3 is given if the discussion per product extends over at least five sentences, 2 if properties are covered by three to four sentences, 1 if the information is provided by one to two sentences, and 0 for no discussion of product properties. Occasionally, firms compare the product under development with products on the market and point out whether the former is superior. A score of 2 is given if other products are mentioned by name, 1 if other products are discussed without mentioning names, and 0 if no competing products are mentioned.[36] As for the product structure (e.g., chemical, biological, technological aspects), a score of 2 is given if the firm provides a detailed discussion, 1 for a general discussion, and 0 if product structure is not mentioned. With respect to the useful life of the product, 1 point is given if the firm indicates either the period during which it expects to use or generate benefits from the product, or the number of units expected to be sold, and 0 otherwise. Adding the individual scores, the product specifications category has a maximum score of 8 points and a minimum of 0.

**Target uses**

This index category captures information on the intended uses of the product. A score of 2 is given if the firm discusses consumer needs that the product satisfies, or any other uses of the product, mentioning specific consumers or needs (e.g., diseases). One point is given for a general discussion without mentioning specific consumers or needs. Adding these scores, the firm can have a maximum score of 2 and a minimum score of 0 in the target uses category.

[34] We take the maximum score of the two subcategories—information about the target market for the product or information about the usefulness of the intangible asset to be used internally.

[35] Notably, for firms in our sample with more than one product under development, the extent of information provided by the firm was similar for its different products.

[36] We take the maximum score of the two subcategories—the developed product in relation to competing products on the market or in relation to other products under development.

### Future research and development plans

This category reflects the firm's future plans for research and development activities. A score of 3 is given for a detailed description which extends over at least five sentences, including amounts of planned research and development activities; 2 points for a general description, including numbers, covered by three to four sentences; 1 for a brief description with no numbers, covered by one to two sentences; and 0 otherwise. A score of 1 is further given if expected or planned dates are mentioned and 0 otherwise. Also, a score of 1 is given if expected or planned development duration is mentioned and 0 otherwise. In addition, this category includes the firm's plans to form R&D alliances with other entities. A score of 2 is given if alliance partners are mentioned by name, 1 if alliances are generally discussed but not specified by name, and 0 if alliances are not mentioned but other information indicates the firm has alliances. Finally, this category may include plans to test the product for other than original use or in combination with other products. A score of 2 is given if other uses, or if the names of other products, are mentioned; 1 if these plans are discussed without specificity, and 0 otherwise. Adding these scores, the firm can have a maximum of 9 and a minimum of 0 points for the future plans category.

### Innovation revenues

The final category of the disclosure index relates to an important indicator of firm innovativeness—"innovation revenues," namely the percentage of total revenue generated by *recently introduced* products.[37] If the firm launched recently new products, a score of 1 is given for disclosure of innovation revenues and 0 otherwise. If the firm has not introduced new products to the market recently, it gets 1 point so that its total score will be comparable to firms that did launch products recently. Overall, the firm can have a maximum of 1 and a minimum of 0 points in the innovation revenues category.

### Total disclosure index

The total score of the disclosure index for each sample firm is obtained by summing the eight category scores outlined above. In the second category, R&D Activities, one item—trial results—is applicable only to the life sciences industry. As such, life science firms can obtain the maximum score of 15 points in this category, whereas firms in other industries can obtain a maximum score of 12 points only. (The maximum score of the trial results is 3.) To assure the cross-sectional comparability of sample firms' scores, we scale the score of life science firms by 68 (maximum score), and the scores of firms in all the other industries by 65. We thus construct and use a *scaled* disclosure index for each of the 798 firm-years.

[37] Studies have documented a strong association between this indicator and future firm growth; see Thornhill (2006) and Hall, and Bagchi–Sen, S. (2002).

## Appendix B: Examples of voluntary disclosure from sample firms' financial statements

### A description of human capital

| Division | At the time of publishing this report | | On 31st December 2010 | |
|---|---|---|---|---|
| | Employees | Service Providers | Employees | Service Providers |
| Sales, marketing, operations, and business development | 5 | 1 | 6 (1 part time) | 1 |
| Management, finance, and administration | 1 | 3 | 3 (1 part time) | 1 |
| R&D, production and logistics (including chief scientist and regulation) | 1 part time | 2 | 2 (1 part time) | 1 |
| Total | 7 | 6 | 11 | 3 |

Dr. Benyamin Gavish—20 years of experience researching small blood vessels and how breathing influences the cardio-vascular system. Developed the company's technology and IP. Given his knowledge and experience in the area of developing the interactive breathing technology, the IP and the clinical development—which are of crucial importance to the company—we believe that if the need arises it would take a long time to find a suitable replacement for Dr. Gavish.

### A description of the R&D activities

Significant R&D projects nearing maturity or market entry relating to civilian applications: alongside continued development of the 40/40 series of detectors and introducing it to market, the company plans to strengthen the product's market penetration by improving manufacturing processes, completing compliance requirements, and continuing to reduce the prices of raw materials for the series. In addition, the company plans to expand this product lineup with the development of the 40/40 F detector which is a rapid detector that combines an explosion detector (military) with a civilian detector with a 15 m range, that is intended for applications in explosive manufacturing or for areas where an explosion could occur and rapid detection is necessary without harming the sensitivity of the detector. In addition, the company has completed development of a line of accessories for the 40/40 product family.

The company has also begun to explore new and advanced technologies for developing gas detectors using cameras and volumetric analysis of gasses, and developing a fire camera with integrated multi-channel spectral analysis capabilities. Research in these two areas is conducted in partnership with external R&D firms. In addition, the company is nearing the final development stages of a series of gas detectors with improved performances.

**Schedule of research/development activities**

The company plans to begin commercial launch of the combined solution in the second half of 2012, following completion of clinical trial runs in the company's centers for excellence and completion of clinical development.

**Trial results**

Additionally, we have leveraged our ability to manufacture high purity liquid AAT to develop the next generation of our AAT product, Inhaled AAT for AATD, which is in pivotal Phase II/III clinical trials in Europe and is entering Phase II clinical trials in the United States. If approved, Inhaled AAT for AATD will be the first AAT product that is not required to be delivered intravenously and, instead, is administered through an easy to use nebulizer in two short daily sessions. We believe that the non-invasive Inhaled AAT for AATD will increase patient convenience and reduce the need for patients to use intravenous infusions of AAT products, thereby further reducing the risk of infection, decreasing the need for clinic visits or nurse home visits and reducing medical costs**.**

**Alliances/collaborations**

During December 2011 we entered into collaboration with BiolineRx for the purpose of developing and commercializing mutually selected Compugen discovered drug candidates that are not in our areas of focus, ranging from acute and chronic inflammatory diseases through cardiac diseases, retinopathy and cancer. According to this agreement, we will provide promising drug candidates, primarily peptides, which were identified using our predictive drug discovery platforms, while BiolineRx will develop these candidates through Phase II clinical trials, with the goal of ultimately licensing them to pharmaceutical companies for advanced clinical development and commercialization. This collaboration has been initiated with the mutual selection of three peptides discovered by Compugen.

**Is the R&D is related to other research and/or to existing products**

As part of the para-clinical and clinical testing the company performs on these drugs as described above, the company also carries out various development activities for possible companion and complementary products for our drugs, which grow out of the R&D activities carried out by the company. On September 24, 2007, the company announced that it had developed a blood test for measuring levels of Adenosine receptors (A3, the receptor targeted by the company's drugs) for candidate patients for treatment by the company's drugs. The company estimates that this blood test will raise the likelihood for successful trials of our drugs.

**The technical feasibility of completing production**

As of this report's publication date, StemEx is "fresh" product: it must arrive and be transplanted in the patient within no more than 18 h after manufacturing is completed.

This fact has crucial bearing on location of manufacturing sites and the overall logistical support network required at the stage of commercial production. At the end of 2010, in the course of the joint project, Gamida-Cell successfully proved the technological feasibility of producing a frozen StemEx product (henceforth: the frozen product), which would have long-term durability and would allow flexibility in the timeframe between finishing production and the implantation procedure, and as a result would lead to reduction of manufacturing and distribution costs by making it possible to construct a central manufacturing center. In 2011, Gamida-Cell completed, in the course of the joint project, the main development process of the frozen product. However, Gamida-Cell is working to complete various aspects relating to the development of the frozen product. During 2012, Gamid-Cell plans to continue working with the FDA in order to receive guidelines regarding the necessary clinical tests required for receiving approval for marketing the frozen product.

**Availability of adequate financial resources**

We may need additional financing to operate or grow our business. We may not be able to raise additional financing for our capital needs on favorable terms, or at all, which could limit our ability to grow and to continue our longer term expansion plans.

We may need additional financing to operate our business or continue our longer term expansion plans. To the extent that we cannot fund our activities and acquisitions through our existing cash resources and any cash we generate from operations, we may need to raise equity or debt funds through additional public or private financings.

**Timing of marketing or use**

According to a recent international study, the next six years (2011–2017) are predicted to see a significant growth in the market for AMI systems (smart meters). Expected shipments of smart meters are expected to grow from a level of approximately 550 thousand product units in 2011, to around 2300 million product units in 2016. The expected growth is due to regulatory influences, alongside a growth in research and development grants in the field of water conservation. Additionally, in the next 20 years demand for water is expected to rise by 40% and as a result there will be pressure on owners of water utility companies to enforce more efficient monitoring of water usage through smart metering. According to the study, the growth in the smart meter market during the years 2010–2015 is expected to come primarily from countries in North America and Western Europe.

**Why the product is better than previous ones**

In addition to reselling our adapter cards, one of our major OEM customers has begun to embed our ConnectX VPI Ethernet and InfiniBand silicon devices directly on motherboards of a number of server and server blade products. This will increase the proliferation of our IB and Ethernet solutions in the market. Over time, we expect other major OEMs will similarly embed our high-speed interconnect products due to the market demand for higher I/O throughput and performance. We have established significant expertise with high-performance interconnect solutions from successfully

developing and implementing multiple generations of our products. Our expertise enables us to develop and deliver products that serve as building blocks for creating reliable and scalable InfiniBand and Ethernet solutions with leading performance.

**Why is the product better than competing products?**

The following table shows the advantages and drawbacks of the company's product in comparison to competing products. The table also compares safety of the company's product with competing products.

| Attributes | Company's product | Competing product – SEEK | Competing product – DynaVax | Competing product – Juvaris | Competing product – Sanofl-Pasteur |
|---|---|---|---|---|---|
| Universal Vaccination | Yes, based on preserved common peptides for flu viruses | Yes, based on synthetic peptides | Yes, based on whole proteins: M2e, NP | Yes, based on M2e protein and B-type flu | Yes, based on M2e protein |
| Regulatory Compliance | Yes (under the guideline of improving existing vaccines) | No | No | No | No |
| Harmfulness Testing | Vaccine is safe | Vaccine is safe | Vaccine is safe | Hasn't been tested on humans | Vaccine is safe |

## References


Aboody, D. & Lev, B. (1998). The value relevance of intangibles: the case of software capitalization. *Journal of Accounting Research*, 36, 161–191.

Aboody, D., & Lev, B. (2000). Information asymmetry, R&D and insider gains. *Journal of Finance, 55*, 2747–2766.

Bai, J., Philippon, T., & Savov, A. (2015). *Have financial markets become more informative?* Working Paper: New York University.

Barth, M., & Kallapur, S. (1996). The effects of cross-sectional scale differences on regression results in empirical accounting research. *Contemporary Accounting Research, 13*, 527–567.

Basu, S. (1997). The conservatism principle and the asymmetric timeliness of earnings. *Journal of Accounting and Economics, 24*, 3–37.

Callen, J. L., Gavious, I., & Segal, D. (2010). The complementary relationship between financial and non-financial information in the biotechnology industry and the degree of investor sophistication. *Journal of Contemporary Accounting and Economics, 6*, 61–76.

Collins, D., Maydew, E., & Weiss, I. (1997). Changes in the value-relevance of earnings and book values over the past forty years. *Journal of Accounting and Economics, 24*, 39–67.

Deegan, C., & Gordon, B. (1996). A study of the environmental disclosure policies of Australian corporations. *Accounting and Business Research, 26*, 187–199.

Doyle, P., & Hooley, G. J. (1992). Strategic orientation and corporate performance. *International Journal of Research in Marketing, 9*, 59–73.
Easton, P. D., & Harris, T. S. (1991). Earnings as an explanatory variable for returns. *Journal of Accounting Research, 29*, 19–36.
Gavious, I., & Schwartz, D. (2009). The valuation implications of sales growth in start-up ventures. *The Journal of Entrepreneurial Finance, 13*, 1–24.
Gray, R., Kouhy, R., & Lavers, S. (1995). Methodological themes: Constructing a research database of social and environmental reporting by UK companies. *Accounting, Auditing and Accountability Journal, 8*, 78–101.
Grossman, S. (1981). The informational role of warranties and private disclosure about product quality. *Journal of Law and Economics, 24*, 461–483.
Guo, R., Lev, B., & Zhou, N. (2004). Competitive costs of disclosure by biotech IPOs. *Journal of Accounting Research, 42*, 319–355.
Hail, L., Leuz, C., & Wysocki, P. (2010). Global accounting convergence and the potential adoption of IFRS by the United States: an analysis of economic and policy factors. *Accounting Horizon, 24*, 355–394.
Hall, L. A., & Bagchi-Sen, S. (2002). A study of R&D, innovation, and business performance in the Canadian biotechnology industry. *Technovation, 22*, 231–244.
Hayn, C. (1995). The information content of losses. *Journal of Accounting and Economics, 20*, 125–153.
Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica, 47*, 153–162.
Jovanovic, B. (1982). Truthful disclosure of information. *Bell Journal of Economics, 13*, 36–44.
Kim, Y., Li, H., & Li, S. (2012). Does eliminating the form 20-F reconciliation from IFRS to US GAAP have capital market consequences? *Journal of Accounting and Economics, 53*, 249–270.
Kim, J.-B., & Shi, H. (2012). IFRS reporting, firm-specific information flows, and institutional environments: International evidence. *Review of Accounting Studies, 17*, 474–517.
Kimbrough, M. (2007). The influence of financial statement recognition and analyst coverage on the market's valuation of R&D capital. *The Accounting Review, 82*, 1195–1225.
Lev, B. (2008). A rejoinder to Douglas Skinner's 'accounting for intangibles – A critical review of policy recommendations'. *Accounting and Business Research, 38*, 209–213.
Lev, B., & Sougiannis, T. (1996). The capitalization, amortization and value-relevance of R&D. *Journal of Accounting and Economics, 21*, 107–138.
Milne, M. J., & Adler, R. W. (1999). Exploring the reliability of social and environmental disclosures content analysis. *Accounting, Auditing and Accountability Journal, 12*, 237–256.
Moore, G. A. (1999). *Crossing the chasm: Marketing and selling high-tech products to mainstream customers*. New York: Harper Collins Publishers.
Morgan, R. E., & Strong, C. A. (2003). Business performance and dimensions of strategic orientation. *Journal of Business Research, 56*, 163–176.
Moris, F. (2004). Industrial R&D employment in the United States and in U.S. multinational companies, InfoBrief, NSF 05-302, December.
Ohlson, J. A. (1995). Earnings, book value and dividends in security valuation. *Contemporary Accounting Research, 11*, 661–687.
Oswald, D. R., Simpson, A. V., & Zarowin, P. (2016). Capitalization vs. expensing and the behavior of R&D expenditures. Working paper, University of Michigan.
Skinner, D. J. (2008). Accounting for intangibles - a critical review of policy recommendations. *Accounting and Business Research, 38*, 191–204.
Thornhill, S. (2006). Knowledge, innovation and firm performance in high- and low-technology regimes. *Journal of Business Venturing, 21*, 687–703.
Verrecchia, R. (1983). Discretionary disclosure. *Journal of Accounting and Economics, 5*, 179–194.
Vincente-Lorente, J. (2001). Specificity and opacity as resource-based determinants of capital structure: evidence from Spanish manufacturing firms. *Strategic Management Journal, 22*, 157–177.
Wilmshurst, D. W., & Frost, G. R. (2000). Corporate environmental reporting. A test of legitimacy theory. *Accounting, Auditing and Accountability Journal, 13*, 10–26.