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Financing Corporate R&D in the United States Using a Special Purpose Entity and the Political Economy of Accounting Regulation

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Abstract

Firms in the science- and technology-based industries in the United States have been abstaining, since the year 1999, from using an evidently efficient special purpose entity (SPE) to finance R&D projects, known by SWORD. It comprises: (1) an options' approach to investment which preserves these firms' other specific and tacit R&D capital from bankruptcy; and (2) an innovative financial structure which considers the information asymmetry, agency costs and high specificity that characterize R&D and, accordingly, improves its funding. The reason for this abstention is FASB's misinterpretation of its economic and legal reality. The SWORD case illustrates that the accounting regulatory environment over the past decade has been an impediment for the formation of at least one type of efficient SPEs, perhaps many more, but not an impediment for several infamous abusive types. Stimulating corporate R&D requires a larger arsenal of efficient financing methods, not fewer.

Keywords: Corporate R&D investment; Financial innovation; Special purpose entities; Corporate risk management; Financial accounting and reporting regulation; Earnings' management

JEL classification: D82; G14; G18; G32; G38; L24

I. Introduction

During the 1980s and most of the 1990s, many reputable and leading firms in the science- and technology-based US industries created special purpose entities (SPEs), referred to as Stock and Warrant Off-balance-sheet Research and Development (SWORD), to finance their research and development (R&D) programs (see Solt (1993)). The SWORD SPE played an important role in financing corporate R&D during that period.[1] It is intriguing that firms ceased using it since the late 1990s without any evidence they replaced it by an alternative financial innovation.[2] In this paper, we first analyze it on an *a priori* basis to determine its efficiency in financing corporate R&D. Second, we contribute to the evidence on whether it was in fact used for efficient reasons or to misrepresent earnings similar to some of the infamous SPE cases. Third, we investigate why it has not been used since the late 1990s. We aim at illustrating the broad implications of our analyses for two important areas: (1) the area of corporate R&D investment and financing;[3] and (2) the area of financial accounting and reporting regulation pertaining to SPEs.[4]

[1] In the biotechnology industry alone, Schiff and Murray (2004) report that, during their study period from 1982 to 2001, the SWORD SPE enabled firms to raise an amount that averaged 1.5 times the amount of money they raised through their initial public offerings. It also funded diagnostic tests and drugs that reached the market and subsequently generated roughly $23 billion in revenues.

[2] Neither thorough review of the literature on financial innovation and R&D nor detailed search in the Financial Press provide any indication that it was replaced by another (perhaps more efficient) new financial structure.

[3] Zingales (2000) argues correctly that while much of the corporate finance literature has focused on traditional firms and industries, many of the most interesting questions emerge in research intensive environments.

[4] The Financial Accounting Standards Board (FASB) has been working on enhancing the financial accounting and reporting regulation pertaining to SPEs to ensure fair presentation long before the Enron financial disaster unraveled in 2001, and which drew the attention of investors and the public to the possibility of using SPEs to hide losses and

In a typical SWORD structure, a company needing to raise capital to finance some R&D program(s) (R&D Company) establishes a new legal entity (SWORD SPE) that has a CEO and a board of directors, but no employees. It transfers to the SWORD SPE some proprietary technologies. The SWORD SPE issues callable units, which consist of callable common shares and warrants to purchase shares of the R&D Company. The units and common shares of the SWORD SPE are callable by the R&D Company at a strike price that increases over time up to a certain final maturity date. The warrants become separately traded securities after a certain period following issuance. The SWORD SPE typically cannot repurchase its shares, declare dividends, or make any other distributions to its shareholders. Also, it cannot borrow and cannot sell, dispose of, or create any lien on its assets.

The SWORD SPE contracts the R&D Company to continue performing the R&D on the transferred assets and makes payments to it, often based on specific milestone achievements. These payments typically add up to the net proceeds of the units' offering. The R&D Company records all scheduled or milestone payments from the SWORD SPE as revenue; while the latter expenses them. The R&D Company retains the option to buy or exclusively license any new developed technology or product, in addition to the above option to acquire the SWORD SPE. If and when the R&D Company exercises its option to buy or license the developed technologies at the pre-specified price, it typically writes off this expenditure in a single quarter.[5]

On an *a priori* basis, the SWORD structure enables the R&D Company to transfer the idiosyncratic risks of the R&D project to investors who can bear them more efficiently (see Solt (1993)) and, as the uncertainties in various stages of the project are resolved, to then make more informed decisions about further developing the R&D project (*a la* Dixit and Pindyck (1995)). Consequently, it also serves as a risk management tool that preserves the R&D firm's other highly specific and tacit assets that have little value outside their current use (Williamson (1988)) from potential bankruptcy caused by failed R&D investment programs. Moreover, it can alleviate the information asymmetry problem (see Myers and Majluf (1984)), the problem of cross-subsidization of other, perhaps less valuable, growth options at the R&D firm, and the problem of over-investment which might occur with multistage investment options, particularly at firms with very few investment options (see Guedj and Scharfstein (2004)).

However, the SWORD structure may be intended to manage earnings. The payments received from the SWORD SPE are recorded as revenues and offset the R&D expenses on the pertinent R&D programs (until and if the SWORD SPE is purchased). Also, setting up the SWORD SPE eliminates the need for the R&D Company to issue more of its stock to raise the capital needed, which typically dilutes its reported earnings per share.[6] These two factors make the reported (interim) earnings per share of the R&D Company much higher than in the case of on-balance-

window-dress the financial statements of a company. A review of pertinent accounting regulation is readily available from the authors.

[5] We compiled a comprehensive document of all relevant statements of financial accounting standards, technical bulletins, interpretations, and abstracts of the Emerging Issues Task Force (EITF) of the Financial Accounting Standards Board (FASB). It is readily available upon request.

[6] Clearly, if the R&D firm is experiencing losses, then issuing more shares dilutes the loss per share.

sheet funding.[7] Clearly, the true motivation of past use of the SWORD structure by some firms (i.e., for efficiency reasons or to misrepresent earnings) is an empirical question.

Shevlin (1987) and Beatty, Berger and Magliolo (1995) test two explanations for a firm's choice to fund R&D through a limited partnership (i.e., a privately placed SWORD structure): (1) low-tax-rate firms transferring the R&D tax deductions to high-tax-rate limited partners; and (2) off-balance-sheet financing. Shevlin (1987) finds no robust evidence relating to the tax explanation and mixed results for the second motivation. Beatty, Berger and Magliolo (1995) report results contrary to the tax explanation, and they find that the formation decision seems to reflect the R&D firms' severe funds shortages rather than their desire to change investors' perceptions.[8] We add that the tax motivation for R&D LPs cannot explain neither the ones structured by high marginal-tax rate R&D firms nor the publicly issued SWORD SPEs.

We examine a sample of SWORDs and find that our sample R&D firms were significantly more profitable, and therefore had less incentive to manage their earnings, than their industry and R&D-intensity peers that did not use the SWORD SPE. We find that the decision to exercise or not exercise the option to purchase the SWORD entity was typically made much earlier than its maximum duration, which is inconsistent with taking full advantage of the SWORD earnings' effects. Also, controlling for profitability, size and age, the sample R&D firms have significantly higher survivability odds during the three- and five-year post-SWORD-formation periods than their industry-peers that were engaged in R&D as intensively but did not use the SWORD. This evidence is consistent with the proposition that the SWORD SPE enables R&D firms to transfer the idiosyncratic risk of the R&D investment to others who can bear it more efficiently, resolve it, and then make a more informed decision about further developing the R&D output.

Moreover, we find that the sample R&D firms were able to raise significantly more capital through the SWORD than they had raised previously through public stock offerings or that other firms were able to raise through private placements of common stock and warrants to finance R&D programs.[9] Also, the sample R&D firms experienced either significant positive or neutral abnormal returns at public offering and private placement of SWORD units. In contrast, they had suffered severe stock price declines at prior public stock issues, on the magnitude of 16 percent over one month, and firms that privately place shares and warrants to finance R&D experience also negative shareholders' wealth effects.

Furthermore, the sample R&D firms that subsequently exercised their option to acquire the SWORD SPE experienced a (marginally significant) positive event-day abnormal return on the magnitude of 1.2 percent. On the other hand, the sample R&D firms that announced their decision not to exercise the call option on the SWORD SPE experienced a significant negative

[7] A counter argument is that the information disclosed by the R&D Company about the SWORD enables investors to re-compute earnings per share with the assumption of on-balance-sheet funding.
[8] Shevlin (1987) finds low marginal-tax-rate firms more likely than high marginal-tax-rate firms to fund their R&D through LPs, but this finding is not robust to changes in the marginal tax rate measurement. He recommends further testing of the tax explanation of R&D LPs by checking for a decline in their use after the 1986 Tax Reform Act which reduced their income-sheltering attractiveness to wealthy investors. Beatty et al. (1995) find that the tax influence on the formation decision is not reduced by the 1986 Act.
[9] The sample R&D firms had no private placements within a two-year period prior to the SWORD formation to perform same firm comparisons.

two-day event-window abnormal stock return of -2.2 percent. In comparison, Saad and Zantout (2009) report a significant negative investor reaction of -4.4 percent at announcements of discontinuation of R&D programs.

Our results provide no indication that the reason for using the SWORD type of SPEs is to manage earnings. Rather, they indicate that it is an efficient SPE to finance some R&D programs at science- and technology-based firms. Being an efficient structure, it is intriguing that we find no SWORDs formed during the 1999 through 2009 period, and we find no evidence of an alternative (perhaps more efficient) financial innovation to finance corporate R&D investment.

We investigate this issue, and we discover that the Financial Accounting Standards Board (FASB) issued an Exposure Draft of a proposed Statement of Financial Accounting Standards on February 23rd, 1999, *Consolidated Financial Statements: Purpose and Policy*. The latter provides an example of a SWORD SPE and characterizes it as a *risk-sharing* arrangement with outside investors as opposed to a genuine and substantial *transfer of risk*. It also considers the *option* to acquire the SWORD SPE as an *obligation* and requires consolidating the financial statements of the latter with those of the R&D Company. Numerous leading U.S. firms, such as Texas Instruments, Eli Lilly, Pfizer, Corning, Dow Chemical, Motorola, etc., heavily criticized this accounting misinterpretation of the legal and economic reality of the SWORD SPE and its intended objectives. In letters they sent to FASB, these companies expressed their major concern that the proposed changes would create a false appearance of assurance of a future pay-back with a return, when there is no legal basis for it. The changes in the consolidation policy and the excessive broadening of the interpretation of what constitutes a liability apparently made many companies abstain from using this efficient SPE since the year 1999.

We believe our examination of the SWORD SPE makes two contributions. First, it illustrates the difficulty of financing corporate R&D using conventional debt or equity and the need for a structured financial innovation that links the R&D investment and financing decisions.[10] The information asymmetry and agency costs that characterize corporate R&D stipulate using debt financing, but intellectual capital is a poor collateral. The high specificity that characterizes R&D capital stipulates using equity financing, but this latter is often associated with significant stock price declines. Further, the high uncertainty pertaining to each phase of the multi-phase R&D program requires using the options' approach to investment and investors having the option to stop the sequential funding of the R&D program should the R&D-firm researchers deviate from or not achieve the specific milestones.

Second, it illustrates that the accounting regulatory environment over the past decade not only proved ineffective in stopping the recurrence of several infamous abuses of SPEs, as the recent corporate scandals involving several major U.S. banks illustrate, several years after Enron, but it also proved to be an impediment for the formation of at least one type of efficient SPEs, perhaps many more. Given that SPEs are used by numerous U.S. companies from many different industries (e.g., Electric Generation, Financial Services, Manufacturing, Pharmaceuticals, and

[10] Chacko, Tufano and Verter (2001) analyze the decision of the biotechnology firm Cephalon, Inc. to purchase call options on its own stock from SBC Warburg in early 1997 before the U.S. Food and Drug Administration approves or disapproves the former's first major drug (Myotrophin). Broadly, they illustrate as we do in our paper the inexorable link between the firm's risk management, R&D investment, and financing decisions.

Real Estate) and given that accounting standards evidently have very important effects on managerial decisions pertaining to structuring and using SPEs, rational accounting regulation is essential to separate efficient from inefficient SPEs. For example, Professor Shevlin argued back in 1991that "FASB should pay particular attention to the types of required disclosures and not be so concerned with whether the disclosures should be on or off-balance sheet."

The rest of this paper is organized as follows. Section 2 provides a priori analyses of the SWORD SPE. Section 3 describes the sample. Section 4 examines the financial characteristics of the sample firms. Section 5 estimates the "earnings' management" effects and the duration of the sample SWORDs. Section 6 analyzes the effects of using the SWORD SPE on the survivability of the sample R&D firms. Section 7 determines the effectiveness of the SWORD SPE in raising capital. Section 8 examines investors' reactions. Section 9 estimates the actual ex post return to the SWORD investors and cost to R&D firms. Section 10 discusses the reason the SWORD SPE is no longer used after the 1998. Section 11 concludes the paper.

II. A priori analyses of the SWORD structure

II.1 From the R&D Company's perspective

The SWORD structure is similar to sequentially issuing zero-coupon bonds to the same investors and the flotation costs are incurred only once. All these zero-coupon bonds have the same maturity date, which is extendible at the option of the R&D Company, with a corresponding escalating par value (i.e., increasing cumulative return to the bondholders), up to a certain final maturity date. The R&D Company freely receives from the SWORD SPE put options on the bonds by achieving pre-specified milestones for the R&D programs. The R&D Company acquires the right to completely or partially default on this debt obligation, in return for issuing to the bondholders warrants to buy its own shares at a pre-specified price on or before a certain maturity date. These warrants can also be viewed as collateral (albeit a risky one and for less than full face value of debt) for the bondholders. Therefore, the SWORD structure enables the R&D firm to raise *debt-like* capital, without assuming any associated bankruptcy risk, to fund highly specific and intangible assets. This structure might be a good solution for an R&D firm that is reluctant to issue new shares because of its likely significant negative impact on its stock price due to the information asymmetry between the investors and the scientists performing the R&D of that firm (i.e., the problem analyzed by Myers and Majluf (1984)).

Additionally, the SWORD structure enables the R&D firm to postpone investing some of its existing financial resources, resolve some of the idiosyncratic risk pertaining to the investment growth option (at a cost equal to the value of the warrants issued to the SWORD investors), and then make a more informed decision to invest or not invest some of its existing resources to proceed further with the investment growth option. Waiting, gathering more information, and then making a more informed decision increases the expected net present value of the investment opportunity (see Dixit and Pindyck (1995)). Therefore, consistent with Solt's (1993) argument, the SWORD structure may facilitate the undertaking of some R&D programs that would not be considered profitable under conventional financing and the simple NPV rule.

Moreover, the SWORD shifts some of the idiosyncratic risk of the investment growth option to those who can bear it more efficiently, namely, the well diversified investors. The separation of the R&D programs financed with the SWORD structure from the other investments of the R&D

firm bestows on this latter the benefit of multiple limited liability shelters and the valuable option to walk away from R&D program losses (see Scott (1977), Sarig (1985), and Leland (2007)). Accordingly, the SWORD structure helps preserve the R&D firm's other assets from bankruptcy which is particularly important because R&D firms have mostly specific assets and tacit knowledge that have little value outside their current use (see Williamson (1988)).

II.2 From the investor's perspective

The SWORD structure provides some collateral to the investors (i.e., the warrants to purchase shares in the R&D firm) using the R&D firm's entire pool of assets (not just the specific R&D programs being funded through the SWORD SPE). Using the entire pool of assets as collateral dilutes management's private information about the R&D programs being funded through the SWORD structure (see DeMarzo (2005)), and therefore, reduces the risk that the investors at the SWORD SPE are offered a lemon.

Additionally, the sequential payments to the R&D Company are conditional on certain specific milestone achievements in the specified R&D programs. In other words, the investors in the SWORD SPE have the valuable option to terminate or stop funding the R&D program should the R&D-firm researchers deviate from or not achieve the specific milestones (see Lerner and Malmendier (2010) and Schwartz (2004)). Accordingly, the SWORD structure eliminates / reduces the cross-subsidization of other (perhaps less valuable) growth options at the R&D firm and the over-investment problem which might occur with multistage investment options, particularly at firms with very few investment options (see Guedj and Scharfstein (2004)).

Moreover, the R&D Company's decision to exercise or not exercise its option to acquire the output of the R&D program financed through the SWORD structure depends foremost on the resolution of the pertinent idiosyncratic risk(s). Therefore, the return to the SWORD unitholders has a very low beta, which provides them with a valuable diversification opportunity.

Although the above *a priori* analyses of the SWORD structure suggest that the latter is *in principal* efficient to finance some corporate R&D programs, managers of R&D firms may still have used it to disguise their intention to manage or misrepresent their firms' earnings.

III. Sample of SWORDs

We searched the *Factiva-Dow Jones News* Retrieval System for disclosures of formation of SWORD structures over the period 1979 through 2009 using several key search words. After careful screening of all unrelated articles, we identified 75 SWORD cases. We excluded one SWORD formation announcement by Carrington Laboratories in 1992 because it was withdrawn (due to bad market conditions). Additionally, we had to drop out of our sample 8 cases because either the firm did not have CRSP data at the announcement time or we have the announcement of purchase option exercise but we cannot find the SWORD formation announcement.

The final sample consists of 66 non-contaminated public announcements of formation of a SWORD made during the period from 1980 through 1998 by 41 different companies (9 NYSE, 2 AMEX and 30 NASDAQ listed firms) from 17 different four-digit SIC industries. All these 66 SWORD SPEs were successfully issued in the U.S.A. Of these 66 SWORD formations, 20 were public offerings and 46 were private placements of SWORD units. After the period 1992-1993

the frequency of occurrence of these structures declined noticeably, and we found no SWORD formations in the period 1999 through 2009. We address these peculiar observations later.

It is worth noting that some of our sample R&D firms repeatedly used the SWORD structure. Centocor used it six times, each of Elan, Genentech and Genzyme used it four times, Dura Pharmaceuticals used it three times, and each of Alza, Bolt Beranek & Newman, Cetus, International Remote Imaging Systems, KLA Instruments, Paco Pharmaceuticals, Perseptive Biosystems, Gensia, and Storage Technology used it two times. This repeated use of the SWORD structure indicates that these R&D firms were satisfied with it.

III.1 Industry classification of the R&D firms that formed SWORD structures

We examine the industry classification of the sample SWORD formations, using the 1987 Standard Industry Classification (SIC) codes, for the purpose of determining whether the SWORD structure was designed for or used in a particular industry only. There are several possible reasons why a unique financial structure such as the SWORD may be custom-made for a particular industry, including the type of R&D capital being financed and / or some unique financial or strategic characteristics of the R&D firms in that industry.

Our sample indicates that the SWORD structure was used in several science- and technology-based industries; although, not with equal frequency. We observe that about 65 percent of the sample cases pertain to the pharmaceutical and biotechnology industries (SIC codes 2834, 2835 and 2836), about 12 percent of the sample cases pertain to the computer industry (SIC codes 3571, 3572, 3575 and 7373), and about 12 percent of the sample cases pertain to the laboratory and medical instruments industry (SIC codes 3826, 3827, 3841 and 3845). These industry classifications are interesting to note since, as is generally well known, the pharmaceuticals, computer, and medical instruments industries account for most of the R&D activity and innovation output in the U.S.A. Evidently, the SWORD structure does not appear custom-made for a particular science- and technology-based industry only.

III.2 Phases of the corporate R&D programs that were financed by the SWORD structure

We classify the R&D programs that were financed by the SWORD structures into 3 phases, based on the information disclosed with the SWORD formation announcement and / or in the SEC filings. The purpose of this classification is to determine whether the SWORD structure is used to finance R&D programs at a certain phase only. Phase 1 represents the early basic scientific research phase. Phase 2 represents the early development phase (i.e., animal trials, for instance, in the case of a drug development), and Phase 3 represents the late development phase (i.e., human trials, for instance, in the case of a drug development).[11]

We find that 4.55 percent of the sample SWORDs pertain to phase 1 only, 4.55 percent pertain to phase 2 only, 37.88 percent pertain to phase 3 only, 12.12 percent pertain to phases 1 and 2, 33.33 percent pertain to phases 2 and 3, and 7.58 percent pertain to several R&D programs at various phases. In brief, more than 53 percent of the sample SWORDs were used to finance several R&D programs at various R&D phases, and more than 75 percent of the sample cases pertain to phases 2 and/or 3. Therefore, the SWORD structure was predominantly but not

[11] These classifications are consistent with the definitions of "research" and "development" in the Statement of Financial Accounting Standards no. 2 of the Financial Accounting Standards Board (FASB).

exclusively used to finance later stage R&D, and it was sometimes used to simultaneously finance several R&D programs which are in different phases.

IV. Financial characteristics of the R&D firms that formed SWORD structures

We examine in this section the financial characteristics of the firms that formed SWORD SPEs to finance some of their R&D programs. Our objective from this examination is to uncover any particular characteristics these firms may have had, which may shed light on the reason they used such a unique financing structure. For instance, they may have been unable to raise capital through conventional means because they were very small not-well established firms, or they may have been suffering from "debt overhang", or they may have been under-valued, or they may have had negative earnings that they wanted to manage.

We examine five financial characteristics of the sample R&D firms: (1) their R&D intensity (i.e., ratio of R&D expenditures to sales); (2) their market capitalization as a proxy for being well recognized by investors in the capital markets; (3) their financial leverage (i.e., ratio of short and long-term debt to market value of equity) as a proxy for existence of "debt overhang or debt insurance" problem or financial distress; (4) their market-to-book ratio (i.e., ratio of market value of equity to book value of equity) as a proxy for under- or over-valuation; and (5) their asset productivity / cash flow generation (i.e., ratio of operating income to total assets, operating income being earnings before interest and taxes plus depreciation and amortization charges) as a proxy for cash flow generation and relative incentives to manage earnings.

In Panel A of Table 1, we classify the sample firms into COMPUSTAT quintiles, using observations on the above characteristics at the end of the calendar-year prior to the SWORD formation announcement. This classification provides for a comparison with the COMPUSTAT population of firms. In Panel B of Table 1, we compare the sample firms to their industry peers. For this purpose, we match each sample firm with a non-event firm from the same three-digit SIC industry and having the closest (within a ±25% range) ratio of R&D expenditures to sales in year -1 relative to the announcement year. If there is no match within the ±25% range then the two-digit SIC industry is used. Then, we compute an industry- and R&D-intensity-adjusted characteristic as the difference between the value for the event firm and the one for its match. Finally, we perform the parametric t-test and the non-parametric Wilcoxon signed rank test to determine the statistical significance of these adjusted firm characteristics.

In Panel A, we observe that in 74 percent (40 out) of the 54 cases for which COMPUSTAT data are available, the sample R&D firm belongs to the top quintile of R&D-intensive firms; therefore, most firms that formed SWORDs were very R&D-intensive firms. In 79 percent (49 out) of the 62 cases for which COMPUSTAT data are available, the sample R&D firm belongs to the two top market capitalization quintiles; therefore, they were typically large to medium size. In 91 percent (53 out) of the 58 cases, the sample firm belongs to the two bottom debt level quintiles, and none of the sample firms belongs to the two top quintiles; therefore, they had low to medium level debt. In 95 percent (55 out) of the 58 cases, the sample R&D firm belongs to the two top market-to-book quintiles, and none of the sample firms belongs to the two bottom quintiles; therefore, they had high market-to-book-value multiples. Finally, about half of the firms are among the least profitable COMPUSTAT firms, but they exhibit significant variation.

With reference to Panel B, in which the sample firms are compared to their industry peers, we find that firms that formed SWORDs have a mean market capitalization that is statistically not different from the mean market capitalization of their industry peers, but a significantly higher median market capitalization. They have market-to-book multiples and debt ratios that are statistically indistinguishable from those of their industry peers. Finally, they are statistically significantly more profitable than their industry peers.

The finding that the firms that used the SWORD structure were typically large to medium size suggests that they were more recognized by investors and better established than small-size less-known firms. The finding that they did not have high debt ratios, whether compared to all COMPUSTAT firms or to their industry peers, indicates that they were not financially distressed and did not have serious debt overhang or debt insurance problem. The finding that these firms had high market-to-book-value multiples that were similar to those of their industry peers suggests that they were not suffering from under-valuation. The finding that some of them were highly profitable, whether compared to all COMPUSTAT firms or to their industry peers, indicates that some of them were generating positive cash flows internally. All these facts suggest that these firms were not compelled by financial difficulties to resort to the unusual SWORD financing structure instead of raising capital through more customary methods. Additionally, the sample firms had fewer incentives to manage their earnings than peer firms that did not use the SWORD structure despite investing in R&D as intensively.

V. "Earnings' management" effects and duration of the SWORD structures

The SWORD SPE can render the reported earnings per share of the R&D Company much higher than in the case of on-balance-sheet funding for two reasons: (1) the payments received from the SWORD SPE are recorded as revenues and offset the R&D expenses on the pertinent R&D programs (until and if the SWORD SPE is purchased); and (2) setting up the SWORD SPE eliminates the need for the R&D Company to issue more of its stock to raise the capital needed which dilutes earnings per share (unless the firm is experiencing losses). Rationality suggests that if "earnings' management" was the motivation for using the SWORDs, then the R&D firms in our sample must have taken full advantage of them by not retiring them much earlier than the date of expiration of the longest-maturity call option on their stock. In this section, we quantify the effects of using the SWORD on the income statements and net earnings of the sample R&D firms, and we analyze the actual duration of these SPEs relative to their maximum duration.

V.1 Method of assessing the income statement and earnings' effects of a SWORD structure

We determine the effects of the SWORD entity on the R&D Company's income statement by assuming the latter could have alternatively raised the same gross proceeds from the SWORD offering through a regular stock issue during the same month. We calculate the number of shares needed to raise the gross proceeds by dividing the latter by the average stock price of the R&D firm in the announcement month. We compute the earnings per share of the R&D firm with the existence of the SWORD structure as net income divided by weighted number of outstanding shares. We calculate the adjusted net income and adjusted earnings per share under the assumption that the R&D Company issued its own stock to finance the R&D programs that were financed through the SWORD structure. Accordingly, the adjusted net income is net income plus the total cost of acquisition or the cash part of the acquisition in the case of royalty payments (there is a cash payment typically at the time of acquisition and subsequent royalty payments

linked to revenues) of any previous SWORDs minus the current SWORD's contribution. We calculate the adjusted earnings per share by dividing the adjusted net income by the sum of the weighted number of outstanding shares plus the number of shares needed to raise the same gross proceeds. The percentage change in earnings per share is equal to [(adjusted earnings per share – earnings per share) / absolute value of earnings per share]. Companies which report better adjusted earnings are companies that would have shown better earnings per share if they had raised the gross proceeds through the regular issuance of their own shares instead of using the SWORD financing structure. For effects across all years until expiration or exercise of the call option on the SWORDs, in the case of multiple SWORDs by a firm, we add up all SWORD payments into a single payment, and the number of shares needed to raise the same gross proceeds is the sum of shares needed to raise the gross process for all SWORDs making payments in that year (adjusted for splits). We obtained all data for the SWORD gross proceeds, contributions, payments and acquisition costs, R&D firm revenues, R&D expenses, net income, and weighted number of shares outstanding from the SEC filings (ARS) of the R&D firms.

V.2. Effects on the income statement and net earnings of the R&D firm

In Table 2, we find that the payments received from the SWORD SPEs and recorded as R&D revenue (i.e., SWORD contribution) represented around 19.4 percent, on average, of the total revenues of the R&D firms across all years until expiration or exercise of the call option on the SWORDs, and the median value is 13 percent. The SWORD contributions represented around 42.7 percent, on average, of the R&D spending at the R&D firms, with a median value of 32.9 percent. The ratio of the SWORD contribution to adjusted net income of the R&D firm has a mean value of 188.8 percent and a median value of about 53 percent.

In the year following the SWORD formation (Year +1), the percentage change in earnings per share of the R&D firms that would have resulted from financing the pertinent R&D programs on-balance sheet has an average of about -210 percent and a median of about -57 percent. Both of these statistics are significant at the 1 percent level. Also, the number of companies that would have reported better earnings per share without the SWORD structure (i.e., had they used on-balance-sheet financing) compared to the number of those that would have reported worse earnings per share is 6 to 38. Similarly, in Year +2 relative to SWORD formation, the percentage change in earnings per share of the R&D firms that would have resulted from financing the pertinent R&D programs on-balance sheet has an average of about -132 percent and a median of about -37 percent, and both of these statistics are significant at the 1 percent level. The ratio of companies with better to companies with worse adjusted earnings per share without the SWORD structure is 2 to 37. Across all years, the mean percentage change is -41percent, the median percentage change is -39.2 percent (significant at the 1 percent level), and the ratio of company-years with better to company-years with worse adjusted earnings per share is 33 to 113.

The above results show that the SWORD structure had major "window dressing" effects, and that it financed a significant part of the total R&D spending at these firms.

V.3. Maximum and actual durations of the sample SWORD SPEs

We examine the maximum and actual durations of the sample SWORDs in Table 3. We define the maximum-duration of a SWORD SPE as the length of time (in months) from its formation date to the exercise date of the longest-maturity call option on its stock and the actual-duration as

the length of time (in months) from its formation date to the date of actual exercise of the call option on its units or stock. The expiration date of the longest-maturity call option is not disclosed in 34 cases. The longest call exercise date is set contingent upon certain future events in nine cases. Also, six of the SWORD SPEs were terminated without being acquired.

With reference to Table 3, we find that SWORD SPEs were typically structured for medium-term financing. The mean (median) value of the maximum-duration of our sample SWORDs is 54.4 (56.5) months, with a maximum observation of 75.7 months and a minimum observation of 37.5 months. Additionally, we find that the actual-duration of these SPEs was far shorter than their maximum-duration. The mean value for the actual-duration to maximum-duration ratio is 68.4 percent, and the median value is 57.6 percent.

As argued above, rationality suggests that if "earnings' management" was the motivation for using the SWORD SPEs, then the R&D firms in our sample must have taken full advantage of them by not retiring them much earlier than the expiration date of the longest-maturity call option on their common stock. However, our results show that the decision to exercise (or not exercise) the option to purchase the SWORD SPE was typically made much earlier than the expiration date of the longest-maturity call option on the shares (or maximum-duration of the SWORD SPE). This finding is consistent with the alternative explanation that the decision to exercise or not exercise the option must have been optimally-timed with the often undisclosed (favorable or unfavorable) resolution of some idiosyncratic risk(s). There is anecdotal evidence in our sample that supports this conclusion. For instance, Cephalon, Inc. purchased call options on its own stock from SBC Warburg in early 1997 and justified that transaction by its need to finance the exercise of its option on Cephalon Clinical Partners L.P. immediately following approval from U.S. Food and Drug Administration of its first major drug Myotrophin.

VI. Post-SWORD-formation survivability of R&D firms compared to their peers

In this section, we examine the extent to which the limited liability shelter that the SWORD structure bestows on the R&D firm through shifting the idiosyncratic risk(s) of the pertinent R&D programs to outside investors reduces its bankruptcy risk. For that purpose, we form a sample that is comprised of 36 companies which formed SWORD entities for the first time and their non-event matched companies. We select the matched firms using the following criteria: the 3-digit SIC industry code and the firm's R&D intensity (R&D-to-sales ratio). All matching criteria values are from the year preceding the announcement year. Similar to Schultz (1993), we characterize a firm as a non-survivor if it has a delisting code in the 500s (excluding codes 501-520) in the three or five years following the SWORD structure formation month.

We estimate the effect of forming a SWORD entity on the probability of the R&D firm surviving the following three or five years using the following logit regression:

$$\pi_i^n = \frac{e^{\delta_0+\delta_1 SWORD+\delta_2 ln(\ SLS\ )+\delta_3 ln(\ AGE\ )+\delta_4 PROFIT}}{1-e^{\delta_0+\delta_1 SWORD+\delta_2 ln(\ SLS\ )+\delta_3 ln(\ AGE\ )+\delta_4 PROFIT}}$$

The dependent binary variable in the logit model is *SURV* which takes the value of 1 if the company survives in the next three or five years or 0 otherwise. The variable *n* can take as value 3 or 5 (years). The independent variables are: (1) the binary variable *SWORD* which equals 1 if the company formed a SWORD structure or 0 otherwise; (2) the logarithm of the sales *SLS* of the company (expressed in $ millions) which proxies for revenue generating / market power or firm

size; (3) the logarithm of the age *AGE* of the company (expressed in months) which proxies for stage of development of firm; and (4) a binary variable *PROFIT* which equals 1 if the company's operating income to total assets ratio is greater than the median of both the sample R&D firms and their matches or 0 otherwise. The estimation method for the parameters of the above model is the maximum likelihood binary logit and the algorithm is the quadratic hill climbing. The hypothesis tested is that the coefficient δ_i is zero. The odds ratios are computed as e^{δ_i}.

With reference to Table 4, two of the four independent variables are statistically significant determinants of the probability of surviving the three- and five-year post-SWORD-formation periods. The coefficient δ_1 for the variable *SWORD* is positive and statistically significant at the 5 percent level for the three- and five-year periods, and not surprisingly the coefficient δ_4 for the *PROFIT* variable is positive and statistically significant at the 10 and 5 percent levels for the three- and five-year periods. The coefficients δ_2 and δ_3 are statistically insignificant.

These results indicate that, while accounting for the effects of the pre-SWORD-formation profitability of the sample R&D firms and their peers on the probability of surviving the three- and five-year post-SWORD-formation periods, firms that used the SWORD structure had survival odds that were 13 and 17 times those of industry-peers that did not form SWORD structures despite investing in R&D as intensively. This conclusion is consistent with the above finding that the percentage change in earnings per share of the R&D firms that would have resulted from financing the pertinent R&D programs on-balance sheet across all years has an average of -41 percent and a median of -39.2 percent. Such a significantly lower earnings performance over several years followed by failure in the R&D programs may be devastating for an R&D firm. This evidence supports the proposition that the SWORD structure is a means to transfer the idiosyncratic risk(s) of the R&D programs to outside investors.

VII. Gross proceeds of public issuance and private placement of SWORD units and other securities to finance R&D programs

We examine in this section the gross proceeds raised through different methods to finance R&D programs to determine whether the SWORD structure enabled the sample R&D firms to raise more capital than: (1) they had been able to do previously through public stock offerings; or (2) they could have raised through private placements of stock and warrants to finance R&D programs. The sample R&D firms had 19 announcements of public issuance of common stock (none is an initial public offering) made within a two-year period prior to the SWORD formation. We identified these announcements using the SDC Platinum database. Since we found no cases of private placements of stock made by the sample R&D firms within a two-year period prior to the SWORD formation, we constructed (as a second best alternative) a sample of 37 public announcements of successful private placement of common stock and warrants to finance R&D programs made by non-event firms in the U.S.A. All the announcements in this sample are non-contaminated and they were made by 1 NYSE, 11 Amex, and 25 Nasdaq listed firms with sufficient data on CRSP. 34 of the 37 issues pertain to firms in SIC codes 2834, 2835 and 2836. We obtained the private placement announcements forming this sample through a computer search of the *Factiva-Dow Jones News Retrieval* and the *LEXIS NEXIS Newswires* databases over the period 1979 through 2004. We obtained the proceeds of the public offerings and private placements from the SEC filings of the companies, which are available on *LEXIS NEXIS*. We adjusted the amounts raised through the SWORD structures and stock and warrant

offerings to finance R&D to reflect year 2000 values. We used the CPI index from the website of the Federal Reserve Bank of Minnesota for that purpose. Finally, we compared the adjusted gross proceeds from different security offerings or placements to detect statistical differences.

With reference to Table 5, the mean (median) of the adjusted gross proceeds of publicly issued SWORDs is about U.S.$ 70 million (U.S.$ 69 million). The mean (median) of the adjusted gross proceeds of the 19 public stock issues made by the same R&D firms in the two-year period prior to SWORD formation is about U.S.$ 51 million (U.S.$ 48.5 million). Thus, the public issuance of SWORD units enabled the R&D firms to raise, on average, about 37 percent more capital than they had managed to do previously through public stock offerings. This average difference is statistically significant at the 10 percent level. The difference in the median amounts is about 42.6 percent and is statistically significant at the 5 percent level.

The mean (median) of the adjusted gross proceeds of privately placed SWORDs is about U.S.$ 50 million (U.S.$ 49 million). The mean (median) of the adjusted gross proceeds of the private placements of stock and warrants to finance R&D programs made by other R&D firms is about U.S.$ 11 million (U.S.$ 9 million). Thus, the private placement of SWORD units enabled the R&D firms to raise on average about 366 percent (or 438 percent using the medians) more capital than other firms managed through the private placement of stock and warrants to finance R&D. The mean and median differences are statistically significant at the 1 percent level.

We conclude that these results indicate that the SWORD SPE enabled the sample R&D firms to raise significantly more capital than they had been able to do previously through public stock offerings. It also enabled them to raise significantly more capital than they could have raised through private placements of stock and warrants to finance R&D programs.

VIII. Investors' reactions to SWORD and other security offerings to finance R&D and the subsequent exercise or not exercise of call option on the SWORD SPE

In this section, we examine first the immediate effect of announcements of formation of a SWORD on the stock price of the R&D companies. Since our sample includes 20 U.S. public offerings and 46 private placements of SWORD units, we split it to two sub-samples based on the method of issuance. We compare the results pertaining to the SWORD public offerings to those pertaining to the public stock issues made by the same sample firms during the two-year period prior to SWORD formation. We also compare the results pertaining to the SWORD private placements to those pertaining to a sample of private placements of common stock and warrants to finance R&D programs. As explained above, we had to collect this latter sample because we found no cases of private placements of stock made by the sample R&D firms within a two-year period prior to the SWORD formation to perform same firm comparisons. Following our examination of the immediate stock price effect of announcements of formation of a SWORD, we examine shareholders' wealth effects of announcements of decision to exercise the call option to acquire the SWORD SPE and announcements of decision not to exercise the latter.

VIII.1. Method of determining the immediate stock price effect of an event

We estimate the immediate event-induced abnormal stock return for a firm i as the prediction error ε_{it} in the market model: $R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$ where R_{it} and R_{mt} are respectively the continuously compounded rates of return to stock i and the equally-weighted CRSP index over

day t, and α_i and β_i are ordinary-least-squares (OLS) estimates. The parameters' estimation period is day -120 through day -31 relative to the initial disclosure date on the *Factiva-Dow Jones News*. We determine the statistical significance of each of the cumulative average abnormal returns over the period from day T1 through day T2 ($CAAR_{T1,T2}$) using the t-test statistic (shown below the $CAAR_{T1,T2}$) (based on the cross-sectional standard deviation of the abnormal returns) and the Wilcoxon test statistic (shown below the percent positive).

VIII.2. Immediate stock price effects of public issuance and private placement of SWORD units and other securities to finance R&D programs

With reference to Table 6, we find that announcements of SWORD unit offerings are associated with a positive $CAAR_{T1,T2}$ on the magnitude of 3.19 percent over the period day -5 through day +5 relative to the announcement date in the *Factiva-Dow Jones News*. This $CAAR_{T1,T2}$ is statistically significant at the 5 percent level, and about 62 percent of the individual abnormal returns are positive. The average abnormal return on the event day 0 is also positive, but statistically insignificant at conventional levels. These positive abnormal returns suggest that the shareholders of R&D firms generally consider SWORD structure formations good news.

In the case of publicly issued SWORD units, we find a positive $CAAR_{T1,T2}$ of 3.6 percent over the period day -5 through day +5, with 70 percent of the abnormal returns being positive. The average abnormal return on the announcement day 0 is 1.83 percent, which is similarly positive but also statistically significant at the 10 percent level. These results are interesting to compare to the stock price effects that these same firms experienced when they publicly issued stock in the two-year period prior to forming a SWORD. They experienced a significant average abnormal return of -2.47 percent on the announcement day 0, a significant $CAAR_{T1,T2}$ of -3.33 percent over the period day 0 through day +1, and a significant $CAAR_{T1,T2}$ of -13.03 percent over the period day +2 through day +30. The $CAAR_{T1,T2}$ of -16.36 percent over days 0 through +30 to the R&D firms translates to a value loss of U.S.$ 1,520 million, expressed in year 2000 dollar value. Ironically, this shareholder value loss of -16.36 percent is about equal to the total proceeds raised through these public stock offerings, which is 16 percent of the R&D firms' market value, on average. Clearly, the public issuance of stock was prohibitively expensive at these firms.

In the case of privately placed SWORD units, we find a positive $CAAR_{T1,T2}$ of 3.01 percent over the period day -5 through day +5, with about 59 percent of the individual abnormal returns being positive. However, this abnormal return is statistically insignificant at conventional levels. Also, the average abnormal return on the announcement day 0 is only 0.22 percent and is statistically insignificant. In contrast, firms that privately place common stock and warrants to finance R&D programs experience a negative abnormal return on the announcement day. The latter is about -2.15 percent and is significant at the 10 percent level, with about 64 percent of the individual abnormal returns being negative. We conclude that while these firms experienced neutral abnormal returns at private placements of SWORDs, they could have experienced negative abnormal returns had they instead placed privately some shares and warrants.

Overall, these results indicate that using the SWORD structure helped the R&D firms avoid the significant negative stock price effects which they experienced previously at public issuance of stock, or that they could have experienced through private placements of stock and warrants. In addition, the SWORD SPE enabled the sample R&D firms to raise more capital than they

previously did in public stock issues or that they could have raised through private placements of stock and warrants. One can, therefore, make a conjecture that without the SWORD structure, the sample R&D firms would have been unable to undertake those R&D investments.

VIII.3. Immediate stock price effects of decisions to acquire or to abandon SWORD SPEs

With reference to Table 7, the subsequent announcement of exercise of the call option to acquire the SWORD SPE (N = 31) is associated with an announcement-day abnormal return of 1.17 percent (significant at the 5 percent level). However, the two-day event-window $CAAR_{T1,T2}$ is statistically insignificant. In comparison, Saad and Zantout (2008) find that acquisitions of technologies from external sources are associated with statistically significant positive two-day announcement-period abnormal stock returns of about 1.37 percent.

The subsequent announcement of decision not to exercise the call option to acquire the SWORD entity (N = 6) is associated with a statistically significant (at the 5 percent level) negative announcement-day abnormal return of -1.78 percent and a two-day $CAAR_{T1,T2}$ of -2.21 percent with 100 percent of the abnormal returns being negative. In comparison, Saad and Zantout (2009) find that firms which disclose the discontinuation of some of their R&D programs (whose idiosyncratic risks have not been shifted to other investors) usually experience a significant negative announcement-period stock price response on the magnitude of -4.42 percent with 61 percent of the abnormal returns being negative. Therefore, the SWORD structure, which shifts the idiosyncratic risk(s) of the pertinent R&D programs to other investors, enabled the sample firms to reduce the significant negative shareholder wealth consequences of abandonment of unsuccessful R&D programs that they would have experienced without it.

IX. Eventual fate of the SWORD SPEs, ex post return to the SWORD unit holders, and ex post cost of capital to the R&D firms

We describe in Panel A of Table 8 what subsequently happened to the SWORD SPEs. We also provide in Panel B of Table 8 summary statistics on the ex post (or actual) return to the SWORD unit holders and the ex post cost of capital to the R&D firms. We compute the ex post compounded annual return to investors as the internal rate of return computed using all the following cash flows, *if* and *when* they occurred (clearly some of the following cash flows are mutually exclusive): (1) the price paid by investors for the SWORD units at issuance (cash outflow at time zero); (2) the actual price paid by the R&D firm (if any) for the units or shares at end of period p (cash inflow); (3) the value of any remaining outstanding warrants at end of period p (cash inflow); (4) the royalty and technology license fees paid by the R&D firm (if any) to the SWORD SPE after end of period p (cash inflows); and (5) the price paid by the R&D firm (if any) for the shares of the SWORD SPE after end of period p (cash inflow), where p is the time period (measured in years) which begins on the date of issuance of the SWORD units and ends on either the date of actual repurchase of the SWORD units or shares or the date of expiration of the longest-maturity call option on the shares of the SWORD SPE, whichever is shorter. We use the Black-Scholes (1973) model for European call options to estimate the value of any remaining outstanding warrants. Following Yermack (1995), we use the 120 logarithmic stock returns preceding the exercise date times 254 to estimate the annualized volatility of the R&D firm's stock. We also use the U.S. Treasury interest rates, for the same time period remaining till maturity of the warrants, to calculate the warrant values. We compute the ex post cost of capital for the R&D firm by also accounting for the following two factors: (1) the tax

consequences of reporting the periodic or milestone payments received from the SWORD SPE as revenues and the expensing of the R&D acquisition cost (if any) at the call exercise time; and (2) the one-time flotation costs of the SWORD units. We obtained the needed information for this table from the prospectuses, SEC filings, the *Factiva-Dow Jones* articles, and the websites of the Federal Reserve Bank of St. Louis and the Internal Revenue Service.

With reference to Panel A, we find that of the 66 sample cases, we have information about the eventual fate of 58 of them. Of these 58 cases, nine SWORDs (or 15.5 percent) were not repurchased by the R&D firms which means that the SWORD investors experienced a significant loss. Three SWORD SPEs among the 58 cases are still operating and may later be purchased by their respective R&D firms. In fifteen (or 25.9 percent) of the 58 SWORDs, the respective R&D firms licensed exclusively the technology rights. Finally, thirty-one (or 53.4 percent) of the 58 SWORDs were purchased by the respective R&D firms at either the call option exercise price or at a negotiated price.

Among the remaining 31 cases of R&D firms exercising their option to purchase the SWORD SPE, we have the payment terms for only 19 cases. In these cases, the ex post or actual compounded annual return to the SWORD investors is on average 35.3 percent and the median value is 26.6 percent. From the perspective of the R&D firm, tax effects and one-time flotation costs factored in, we find that the actual ex post cost of capital is on average 38.2 percent per year, with a median value of 20.7 percent. This ex post cost may be considered high; however, it is *willingly incurred* by the R&D firms as the price to acquire the technologies owned by the SWORD investors, after the resolution of some idiosyncratic risk(s). Additionally, given that the issuance of stock was prohibitively expensive for the sample firms, as we report above, the SWORD structure enabled R&D-intensive firms in the science- and technology-based industries to undertake R&D programs that would not have been feasible otherwise.

X. Reasons the SWORD SPE was no longer used after 1998

As indicated above, there are no SWORD SPE formations during the 1999 through 2009 period. We investigated reasons for this peculiar observation and we found that FASB issued on February 23, 1999 an Exposure Draft (194-B) for a proposed Statement of Financial Accounting Standards (SFAS), *Consolidated Financial Statements: Purpose and Policy*, which was a revision of an earlier Exposure Draft issued on October 16, 1995 (154-D). Both Exposure Drafts were heavily criticized by numerous major U.S. firms in the science- and technology-based industries. The website of FASB (WWW.FASB.ORG) lists 161 letters from major U.S. companies and other important interest groups commenting on Exposure Draft 154-D and 113 letters commenting on Exposure Draft 194-B. Particularly, however, the latter Exposure Draft issued in February 1999 provides an example of a SWORD structure (Example 5) and characterizes it as a *risk-sharing* arrangement with outside investors (as opposed to a genuine and substantial *transfer of risk*). It further concludes that in such a structure the R&D Company has control over the SWORD SPE and should consolidate its financial statements with its own.

Science- and technology-firms argued strongly against this accounting misinterpretation of the legal and economic reality of the SWORD structure and its intended objectives. They expressed their major concern that the proposed changes would create a false appearance of assurance of a

future pay-back with a return, when there is no legal basis for it. Following are excerpts of few of the letters that were sent to FASB in response to Exposure Draft 194-B:

> This action would… create some disorder in the process of pharmaceutical research… The research performed would not have occurred had the Research (i.e., SWORD) Company not supplied the funds… Sponsors (i.e., R&D Companies) do have the right to acquire Research Companies... Contractual rights do not, however, create contractual obligations… When a Sponsor forms a Research Company, it does not "share" the risk as stated in Example 5, it transfers the risk… consolidation of Research Companies with Sponsors will create a false sense that a future re-acquisition is assured when history indicates that only eight of fourteen Research Companies were acquired by the Sponsors…. Allergan, Inc. May 24, 1999

> … BioChem found itself in the fortunate position of having several products emerge through the pre-clinical research stage ready for further development including clinical trials in humans. The magnitude of the costs of these trials, which will last for several years, were such that the nature of BioChem's existing business would have been significantly transformed. The formation of CliniChem and the undertakings between BioChem and CliniChem allowed for the separation of the development risk in the new product portfolio… Pharmaceutical and biotechnology research and development is unique from the point of view of time, cost and risk … It is these characteristics, …, that have led biotechnology companies to sponsor special purpose R&D vehicles. Such vehicles have also been an effective financing means for development work… BioChem Pharma, Inc. May 21, 1999

> We are concerned that consolidation of R&D special purpose entities by their sponsors implies that development risk has not been transferred to a separate group of shareholders. This premise is inconsistent with the realities of the market. Dura Pharmaceuticals, Inc. May 21, 1999

An underlying issue in FASB's interpretation of SWORDs in Exposure Draft 194-B is whether the R&D Company has an *implicit or moral* obligation to pay-back to the investors their capital with a certain positive return. With reference to paragraphs 28 and 7 in SFAS 68:

> Concepts Statement No. 3 uses the term *obligation* to include duties imposed legally or socially; that is, what an enterprise is bound to do by contract, promise, or moral responsibility. Therefore, an enterprise may have a liability that is recognized for financial reporting even though it is not a legal liability.

> Even though the written agreements or contracts under the arrangement do not require the enterprise to repay any of the funds provided by the other parties,….[if] …it is probable that the enterprise will repay any of the funds regardless of the outcome of the research and development, there is a presumption that the enterprise has an obligation to repay the other parties.

An R&D firm should rationally want to maintain good relations with investors to preserve its ability to raise additional funds on future occasions. Additionally, investors who previously earned a high positive return on a SWORD structure will likely have high expectations of earning again a high positive return from a similar structure by the same firm or another similar firm. Following the aforementioned, the R&D firm in a SWORD SPE arrangement then has an obligation to repay the SWORD investors. However, this conclusion conflicts with the explicitly stated terms of this structure, which are designed to shift the idiosyncratic risks of the R&D programs to those who can bear them more efficiently. Clearly, the above excessive broadening of what constitutes a liability changes the economic reality of the SWORD SPE.

XI. Summary and implications

This paper examines the 'Stock and Warrant Off-balance-sheet Research and Development' (SWORD) structure. The SWORD is a special purpose entity (SPE) that firms from several

science- and technology-based industries used to create during the 1980s and most of the 1990s to finance and undertake some R&D programs. These firms may have used this SPE to manage or misrepresent their earnings, or they may have used it to solve some real financing problems associated with R&D investment, which include the high uncertainty, information asymmetry, agency costs and asset specificity that characterize it. Our evidence along with prior findings by Shevlin (1987) and Beatty, Berger and Magliolo (1995) on R&D Limited Partnerships indicates that the "earnings' management explanation" is not the likely motivation.

Being evidently an efficient SPE to finance corporate R&D, it is intriguing that science- and technology-based firms stopped using it after 1998 without any indication that an alternative structure replaced it. The reason they stopped using it after 1998 is FASB's misinterpretation of its economic and legal reality. The economic consequences of not being able to use an efficient means of financing R&D are incalculable but most likely negative and significant for corporate R&D investment since firms should have more (not fewer) means to finance it.

More broadly, this paper contributes to the literature in two important areas: (1) the area of corporate R&D investment and financing; and (2) the area of financial accounting and reporting regulation pertaining to SPEs. The fact that many reputable and leading firms in the science- and technology-based industries resorted to a financial innovation to finance some of their R&D programs, and stopped doing that only because of a *regulatory force majeur*, illustrates the difficulty and inefficiency of financing some corporate R&D projects using conventional means. It is interesting to develop in future research additional financial structures that address the challenges of financing corporate R&D programs.

Also, given that SPEs are widely used in many different industries in the U.S.A., *rational* (not a question of more versus less) accounting regulation is essential to separate efficient from inefficient uses of SPEs. However, this paper illustrates that accounting regulation during the past decade has been and continues to be an impediment for the formation of at least one efficient type of SPEs, but not an impediment for many abusive uses of SPEs by major U.S. companies as the media has been reporting recently, years after Enron. Whether other types of efficient SPEs are being discouraged as well is an interesting question for future research.

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Table 1

Financial characteristics of the firms that formed SWORD structures

The purpose of this table is to uncover any peculiar financial characteristics for the sample R&D firms that may shed light on the reason they used such a unique or innovative financing structure. Appurtenance of an event firm to a COMPUSTAT quintile using a particular firm characteristic is determined based on data at the end of the calendar-year prior to the announcement of SWORD formation. For the peer comparisons in Panel B, each sample firm is matched with a non-event firm from the same three-digit COMPUSTAT SIC industry and having the closest (within a ±25% range) ratio of R&D expenditures to sales at the end of the year prior to the announcement year. If there was no match within the ±25% range then the two-digit SIC industry is used. An industry- and R&D-intensity-adjusted characteristic is the difference between the value for the event firm and the one for its match. Reported in parentheses are the statistics pertaining to the parametric t-test and the non-parametric Wilcoxon signed rank test. The symbols a, b, and c denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Panel A: Comparisons with the COMPUSTAT population of firms						
Firm characteristic	Sample	COMPUSTAT quintile (from smallest to largest)				
		Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
R&D-to-sales ratio	Privately placed SWORDs (N = 38)	1	0	1	7	29
	Publicly issued SWORDs (N = 16)	0	0	1	4	11
	Full sample of SWORDs (N = 54)	1	0	2	11	40
Market capitalization	Privately placed SWORDs (N = 42)	0	5	4	17	16
	Publicly issued SWORDs (N = 20)	0	2	2	8	8
	Full sample of SWORDs (N = 62)	0	7	6	25	24
Short & long term debt to market value ratio	Privately placed SWORDs (N = 40)	26	11	3	0	0
	Publicly issued SWORDs (N =18)	9	7	2	0	0
	Full sample of SWORDs (N = 58)	35	18	5	0	0
Market-to-book value ratio	Privately placed SWORDs (N = 40)	0	0	1	14	25
	Publicly issued SWORDs (N = 18)	0	0	2	3	13
	Full sample of SWORDs (N = 58)	0	0	3	17	38
Operating income to total assets ratio	Privately placed SWORDs (N = 44)	23	2	5	7	7
	Publicly issued SWORDs (N = 18)	7	4	4	2	1
	Full sample of SWORDs (N = 62)	30	6	9	9	8

Panel B: Comparisons with peer firms				
Industry and R&D-intensity adjusted characteristic	Statistic	Privately placed SWORDs	Publicly issued SWORDs	Full sample of SWORDs
Market capitalization ($ millions)	Mean ; Median (t-test ; Wilcoxon test) (N)	-357.79 ; 144.44 (-0.66 ; 2.58[b]) (25)	-3195.08 ; 89.48 (-1.08 ; 0.42) (13)	-1328.44 ; 109.22 (-1.24 ; 2.20[b]) (38)
Short & long term debt to market value ratio (%)	Mean ; Median (t-test ; Wilcoxon test) (N)	-13.85 ; -0.54 (-1.51 ; 1.69) (25)	2.43 ; 0.00 (0.61; 0.43) (13)	-8.28 ; -0.09 (-1.32 ; 1.14) (38)
Market-to-book value ratio	Mean ; Median (t-test ; Wilcoxon test) (N)	1.57 ; 0.26 (0.55 ; 0.96) (23)	-17.20 ; -1.33 (-1.11 ; 0.84) (13)	-5.21 ; 0.05 (-0.87 ; 0.13) (36)
Operating income to total assets ratio (%)	Mean ; Median (t-test ; Wilcoxon test) (N)	27.15 ; 16.35 (4.05[a] ; 4.12[a]) (38)	49.32 ; 12.31 (2.72[b] ; 1.99[c]) (16)	33.72 ; 16.35 (4.69[a] ; 4.59[a]) (54)

Table 2
The effects of using the SWORD structure on the R&D firm's income statement

The effects of the SWORD entity on the R&D Company's income statement are determined by assuming the latter could have alternatively raised the same gross proceeds from the SWORD offering through a regular stock issue during the same month. The number of shares needed to raise the gross proceeds is calculated as gross proceeds divided by the average stock price of the R&D Company in the announcement month. Earnings per share are equal to net income divided by weighted number of outstanding shares (i.e., with existence of the SWORD structure). The adjusted net income and adjusted earnings per share are calculated under the assumption that the R&D Company issued its own stock to finance the R&D programs that were financed through the SWORD structure. Accordingly, the adjusted net income is computed as net income plus the total cost of acquisition or the cash part of the acquisition in the case of royalty payments (there is a cash payment typically at the time of acquisition and subsequent royalty payments linked to revenues) of any previous SWORDs minus the current SWORD's contribution. The adjusted earnings per share are calculated by dividing the adjusted net income by the sum of the weighted number of outstanding shares plus the number of shares needed to raise the same gross proceeds. The percentage change in earnings per share is calculated as [(adjusted earnings per share – earnings per share) / absolute value of earnings per share]. Companies which report better adjusted earnings are companies that would have shown better earnings per share if they had raised the gross proceeds through the regular issuance of their own shares instead of using the SWORD financing structure. For effects across all years until expiration or exercise of the call option on the SWORDs, in the case of multiple SWORDs by a firm, all SWORD payments are summed into a single payment, and the number of shares needed to raise the same gross proceeds is the sum of shares needed to raise the gross process for all SWORDs making payments in that year (adjusted for splits). All data for the SWORD gross proceeds, contributions, payments and cost of acquisition, the R&D company revenues, R&D expenses, net income, and weighted number of shares outstanding were obtained from the SEC filings (ARS) of the R&D Company. The symbols a, b, and c denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Variables	Year +1			Year +2			Year +3			All years		
	Mean	Median	N	Mean	Median	N	Mean	Median	N	Mean	Median	N
SWORD contribution / revenues (%)	20.64	14.12	51	17.48	11.47	43	12.61	9.05	29	19.44	13.02	158
SWORD contribution / R&D (%)	46.63	33.25	48	41.99	32.51	40	25.40	18.84	28	42.75	32.92	146
SWORD contribution / adjusted net income (%)	230.13	56.87	52	141.29	52.07	44	99.96	18.83	28	188.80	53.09	160
Number of shares needed to raise gross proceeds / weighted number of outstanding shares (%)	12.65	11.16	46	11.09	9.31	40	11.10	11.12	28	18.32	16.60	147
Earnings per share ($)	-0.13	0.18	52	-0.02	0.05	44	-0.36	-0.35	28	-0.19	0.04	158
Adjusted earnings per share ($)	-0.56	-0.42	44	-0.50	-0.67	39	-0.26	-0.41	28	-0.43	-0.47	146
Percent change in earnings per share (%) (t-test) and (Wilcoxon-test) respectively	-209.71 (-3.01[a])	-57.13 (4.99[a])	44	-132.11 (-2.79[a])	-36.96 (5.28[a])	39	-65.99 (-1.24)	-8.75 (1.65)	28	-41.08 (-0.35)	-39.18 (7.14[a])	146
Number of companies with better / worse adjusted earnings per share without the SWORD structure	6 / 38			2 / 37			10 / 18			33 / 113		

Table 3
Maximum and actual durations of the sample SWORD structures

This table examines the maximum and actual durations of the sample SWORD structures. This examination determines whether these latter were used as short, medium or long-term R&D financing vehicles, and whether the R&D firms used these vehicles as temporary financing until the resolution of some of the idiosyncratic risk pertaining to the subject R&D programs. The maximum duration of the SWORD structure is the length of time (in months) from the formation date to the exercise date of the longest-maturity call option on the common stock of the SWORD entity. The actual duration of the SWORD entity is the length of time (in months) from the formation date to the date of actual exercise of the call option on the units or common stock of the SWORD entity. The expiration date of the longest maturity call option is not disclosed in 34 cases. In nine cases, the longest call exercise date is set contingent upon certain future events. Six of the SWORD entities were terminated without being acquired.

Statistic	Maximum duration (months)	Actual duration (months)	Actual to maximum duration (%)
Mean	54.40	45.72	68.36
Median	56.50	38.30	57.62
Maximum	75.70	136.10	136.00
Minimum	37.50	12.20	34.37
Standard deviation	9.70	23.37	24.90
Number of observations	23	46	22

Table 4
Survivability of R&D firms that formed SWORD structures during the following three and five years

The purpose of this table is to examine the extent to which the limited liability shelter that the SWORD structure bestows on the R&D firm reduces this latter's bankruptcy risk. The sample is comprised of 36 R&D firms which formed SWORD entities for the first time and their non-event matched firms. Matched firms are selected using the following criteria: the 3-digit SIC industry code and the firm's R&D intensity (R&D-to-sales ratio) at the end of the year preceding the announcement date. Following the method of Schultz (1993), a company is characterized as a non-survivor if it has a delisting code in the 500s (excluding codes 501-520) in the three or five years following the SWORD announcement month. The logit regression $\pi_i^n = \frac{e^{\delta_0+\delta_1 SWORD+\delta_2 ln(SLS)+\delta_3 ln(AGE)+\delta_4 PROFIT}}{1-e^{\delta_0+\delta_1 SWORD+\delta_2 ln(SLS)+\delta_3 ln(AGE)+\delta_4 PROFIT}}$ is used to estimate the effect of forming a SWORD entity on the probability of the R&D Company surviving the following n (three and five) years. The dependent binary variable in the logit model is *SURV* which takes the value of 1 if the company survives in the next n (three or five) years or 0 otherwise. The independent variables are: 1) the binary variable *SWORD* which equals 1 if the company formed a SWORD structure or 0 otherwise; 2) the logarithm of the sales *SLS* of the company (expressed in $ millions); 3) the logarithm of the age *AGE* of the company (expressed in months); and (4) a binary variable *PROFIT* that takes the value of 1 if the company's operating income to total assets ratio is greater than the median of both the sample R&D firms and their matches or 0 otherwise. The estimation method is the maximum likelihood binary logit and the algorithm is the quadratic hill climbing. The hypothesis tested is that the coefficient δ_i in the logit regression is zero. Reported statistics below are the z-values (in parentheses) and the odds ratio of each independent variable [in brackets]. The odds ratio = e^{δ_i} . The symbols a, b, and c denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Period following SWORD formation	δ_0 (z-value)	δ_1 (z-value) [odds ratio]	δ_2 (z-value) [odds ratio]	δ_3 (z-value) [odds ratio]	δ_4 (z-value) [odds ratio]	McFadden R^2	Number of observations
Three years	0.86 (1.27)	2.58[b] (2.20) [13.20]	-0.00 (-0.00) [1.00]	-0.21 (-1.16) [0.81]	2.47[c] (1.93) [11.85]	0.31	72
Five years	-0.02 (-0.05)	2.83[b] (2.41) [16.91]	-0.04 (-0.33) [0.96]	-0.02 (-0.16) [0.98]	2.89[b] (2.23) [18.05]	0.34	72

Table 5
Gross proceeds of public issuance and private placement of SWORD units and other securities to finance R&D programs

This table examines whether the SWORD structure enabled the sample R&D firms to raise more capital than: (1) they had been able to raise previously through a public stock offering; or (2) they could have raised through a private placement of common stock and warrants to finance R&D programs. The sample R&D firms had 19 announcements of public issuance of common stock (none is an initial public offering) made within a two-year period prior to the SWORD formation. These announcements are identified using the SDC Platinum database. We found no cases of private placements of stock made by the sample R&D firms within a two-year period prior to the SWORD formation. For this reason (and as a second best alternative) we constructed an alternative sample which consists of 37 public announcements of successful private placement of common stock and warrants to finance R&D programs made by non-event firms in the U.S.A. All the announcements in this sample are non-contaminated and they were made by 1 NYSE, 11 Amex, and 25 Nasdaq listed firms with sufficient data on CRSP. 34 of the 37 issues pertain to firms in SIC codes 2834, 2835 and 2836. The private placement announcements forming this latter sample were obtained through a computer search of the *Factiva-Dow Jones News Retrieval* and the *LEXIS NEXIS Newswires* databases over the period 1979 through 2004. The sample and a description of the pertinent R&D programs are readily available from the authors. The proceeds of the offerings/placements are obtained from the SEC filings of the companies, which are available on *LEXIS NEXIS*. The amounts raised through the different security offerings or placements to finance R&D programs are adjusted to reflect 2000 values and then compared to detect size differences. The CPI index was obtained from the website of the Federal Reserve Bank of Minnesota. The test statistics reported in parentheses are the t-statistic for differences in the means and the Wilcoxon / Mann-Whitney statistic for differences in the medians. The symbols a, b, and c denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Measure of funds raised	Statistics	Publicly issued SWORD units	Prior public common stock offerings made by the same R&D firms	Privately placed SWORD units	Private placements of common stock and warrants to finance R&D made by other R&D firms
Adjusted (2000) gross proceeds ($ millions)	Mean, median, and number of observations	70.21; 69.17 N = 19	51.28 ; 48.49 N = 19	49.69 ; 49.11 N = 41	10.67 ; 9.12 N = 37
	Tests for differences in means and medians	(1.75[c] ; 2.19[b])		(6.51[a] ; 5.44[a])	

Table 6

Immediate stock price effects of public issuance and private placement of SWORD units and other securities to finance R&D programs

The immediate event-induced abnormal return for a firm *i* is the prediction error ε_{it} in the market model: $R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$ where R_{it} and R_{mt} are respectively the continuously compounded rates of return to stock *i* and the equally-weighted CRSP index over day *t*, and α_i and β_i are ordinary-least-squares (OLS) estimates. The parameters' estimation period is day -120 through day -31 relative to the initial disclosure date on the *Factiva-Dow Jones News*. The statistical significance of each of the cumulative average abnormal returns over the period from day T1 through day T2 ($CAAR_{T1,T2}$) is determined using the t-test statistic (shown in parentheses below the $CAAR_{T1,T2}$) (based on the cross-sectional standard deviation of the abnormal returns) and the Wilcoxon test statistic (shown in parentheses below the percent positive). The $CAAR_{T1,T2}$ of -16.36 percent over days 0 through +30 for the sample R&D firms that publicly issued stock within two years before the SWORD formation translates to a value loss of U.S.$ 1,520 million, expressed in 2000 dollar value (or U.S.$ 1,195 million without adjusting for inflation). Ironically, these firms raised through the stock issues an amount equal to 16 percent of their market value, on average). The symbols a, b, and c denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Period relative to disclosure date	Full sample of SWORD offerings (N = 66)		Publicly issued SWORD units (N = 20)		Prior public common stock offerings made by the same R&D firms (N = 19)		Privately placed SWORD units (N = 46)		Private placements of common stock and warrants to finance R&D made by other R&D firms (N = 36)	
	$CAAR_{T_1T_2}$	Percent positive	$CAAR_{T_1T_2}$	Percent positive	$CAAR_{T_1T_2}$	Percent positive	$CAAR_{T_1T_2}$	Percent positive	$CAAR_{T_1T_2}$	Percent positive
[-30 to -1]	1.29 (0.41)	48.5 (0.35)	-1.53 (-0.36)	55.0 (0.00)	0.97 (0.22)	47.4 (0.12)	2.52 (0.61)	45.7 (0.43)	14.75 (1.55)	58.3 (0.97)
[-5 to +5]	3.19 (2.04[b])	62.1 (2.21[b])	3.60 (1.38)	70.0 (1.72)	-2.82 (-0.94)	31.6 (1.05)	3.01 (1.54)	58.7 (1.39)	6.44 (1.28)	52.8 (0.95)
[0 to 0]	0.71 (1.48)	47.0 (0.71)	1.83 (2.06[c])	55.0 (1.57)	-2.47 (-3.32[a])	15.8 (2.70[a])	0.22 (0.39)	43.5 (0.19)	-2.15 (-1.71[c])	36.1 (1.85[c])
[0 to +1]	0.34 (0.45)	45.5 (0.11)	1.67 (1.13)	50.0 (1.01)	-3.33 (-3.39[a])	21.1 (2.70[a])	-0.23 (-0.26)	43.5 (0.92)	0.02 (0.01)	47.2 (0.37)
[+2 to +30]	0.75 (0.30)	51.5 (0.78)	2.72 (0.57)	55.0 (0.97)	-13.03 (-2.93[a])	21.1 (2.58[b])	-0.10 (-0.03)	50.0 (0.22)	1.71 (0.31)	58.3 (0.21)

Table 7

Stock price effects of announcements of acquisition and announcements of abandonment of a SWORD

This table examines the response of the stock price of the R&D firm to: (1) the subsequent announcement of exercise of the call option to acquire the SWORD SPE (31 such announcements); and (2) the subsequent announcement of decision not to exercise the call option to acquire the SWORD SPE, i.e. decision to abandon / terminate the R&D programs being financed through the SWORD structure (7 such announcements, 1 without return data on event date). The immediate (short-term) event-induced abnormal return for an event-firm i is the prediction error ε_{it} in the market model: $R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$ where R_{it} and R_{mt} are respectively the continuously compounded rates of return to stock i and the equally-weighted CRSP index over day t, and α_i and β_i are ordinary-least-squares (OLS) estimates. The parameters' estimation period is day -120 through day -31 relative to the initial disclosure date on the *Factiva-Dow Jones News*. The statistical significance of each of the cumulative average abnormal returns over the period from day T1 through day T2 ($CAAR_{T1,T2}$) is determined using the t-test statistic (shown in parentheses below the $CAAR_{T1,T2}$) (based on the cross-sectional standard deviation of the abnormal returns) and the Wilcoxon test statistic (shown in parentheses below the percent positive). The symbols a, b, and c denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Period relative to disclosure date	Announcements of decision to exercise the call option to acquire the SWORD SPE (N = 31)		Announcements of decision not to exercise the call option to acquire the SWORD SPE (N = 6)	
	$CAAR_{T_1T_2}$	Percent positive	$CAAR_{T_1T_2}$	Percent positive
[-30 to -1]	0.00 (0.00)	58.1 (0.70)	13.48 (2.86[b])	100.0 (2.10[b])
[-5 to +5]	-0.93 (-0.35)	51.6 (0.84)	-3.17 (-0.80)	33.3 (0.63)
[0 to 0]	1.17 (2.03[b])	51.6 (1.73[c])	-1.78 (-2.87[b])	0.0 (2.10[b])
[0 to +1]	0.22 (0.22)	38.7 (0.27)	-2.21 (-4.21[a])	0.0 (2.10[b])
[+2 to +30]	-3.30 (-0.97)	38.7 (1.01)	5.61 (1.16)	66.7 (1.05)

Table 8
Eventual fate of the sample SWORDs, ex post return to SWORD unit holders, and ex post cost of capital to the R&D firms

This table provides in Panel A information about what eventually happened to the sample SWORD structures. It also provides summary statistics in Panel B on the ex post (or actual) return to the SWORD unit holders, and the ex post cost of capital to the R&D firms. The ex post or actual compounded annual return to investors is the internal rate of return computed using all the following cash flows, *if* and *when* they occurred (clearly some of the following cash flows are mutually exclusive): (1) the price paid by investors for the SWORD units at issuance (cash outflow at time zero); (2) the actual price paid by the R&D firm (if any) for the units or shares at end of period p (cash inflow); (3) the value of any remaining outstanding warrants at end of period p (cash inflow); (4) the royalty and technology license fees paid by the R&D firm (if any) to the SWORD SPE after end of period p (cash inflows); and (5) the price paid by the R&D firm (if any) for the shares of the SWORD SPE after end of period p (cash inflow), where p is the time period (measured in years) which begins on the date of issuance of the SWORD units and ends on either the date of actual repurchase of the SWORD units or shares or the date of expiration of the longest-maturity call option on the shares of the SWORD SPE, whichever is shorter. The Black-Scholes (1973) model for European call options is used to estimate the value of any outstanding warrants. Following Yermack (1995), the 120 logarithmic stock returns preceding the exercise date times 254 are used to estimate the annualized volatility of the R&D firm's stock. The U.S. Treasury interest rates, for the same time period remaining till maturity of the warrants, are used to calculate the warrant values. The ex post cost of capital for the R&D firm differs from the ex post return to investors because of two factors: (1) the tax consequences of reporting the periodic or milestone payments received from the SWORD SPE as revenues and the expensing of the R&D acquisition cost (if any) at the call exercise time; and (2) the one-time flotation costs of the SWORD units. The sources of information for this table are the prospectuses, SEC filings, the *Factiva-Dow Jones* articles, and the websites of the Federal Reserve Bank of St. Louis and the Internal Revenue Service. Missing data reduce the number of observations.

Panel A: Eventual fate of the sample SWORD structures		
Description	Number of cases	Percent
The R&D firm purchased the SWORD SPE	31	46.97
The R&D firm did not purchase the SWORD SPE but exercised its option to obtain exclusive technology license(s) from it	15	22.73
The SWORD SPE still exists and may be purchased by the R&D Company	3	4.54
The R&D firm did not purchase the SWORD SPE and the longest-maturity call option expired	7	10.61
The SWORD SPE was liquidated	2	3.03
The fate of the SWORD SPE is undetermined	8	12.12
Total	66	100.0

Panel B: Summary statistics on the ex post return to SWORD unit holders and ex post cost of capital to R&D firm						
Return measure	Mean	Median	Maximum	Minimum	Standard deviation	N
Ex post compounded annual return to the SWORD investors (%)	35.25	26.58	176.22	-52.89	59.26	19
Ex post cost of capital to the R&D firm (%)	38.18	20.74	155.36	-15.18	48.66	13