Quantifying the dream: Valuation approaches in biotechnology

Bioentrepreneurs should have a keen grasp of how Wall Street determines value in order to prepare their company for public markets.

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I had just successfully defended my PhD thesis. Years of graduate student anxiety were finally behind me, but all was not well. Now I had to tend to important career decisions, a matter made somewhat difficult by my uneasiness about following a traditional academic career in the biological sciences. Wandering through the lab, I found myself joining a small group of colleagues gathered around the cork board, the communications nerve center of any lab. On that day, the center of attention was an article cut out from the *New York Times* placed next to a picture of a postdoc's family dog, the business card of the NEN salesman, and a "Thank you" note for a baby shower. The article under scrutiny reported on Genentech's successful initial public offering, and the topic was causing quite a stir within the lab.

At that time, I may not have known a stock from a bond, but somehow I knew immediately that I wanted to be part of this nascent embrace of biology and commerce. Since I had met a pharmaceutical analyst the previous summer, I had spent some time contemplating a career on Wall Street. The excitement over Genentech that day brought me to a swift and irrevocable conclusion: Once the biotech sector reached a critical mass, there would be a need for stock coverage. Just like that, I decided to change my life. I was to become a biotechnology analyst. It was October 1980.

The valuation enigma

Soon the excitement of the moment gave way to practical considerations. Despite my newly won PhD, I was sure that the financial world would expect more tangible proof of my business skills than a genetic predisposition to business. As I took inventory of the

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skills required, I realized that it would be useful to demonstrate certain talents, such as being able to read a balance sheet or analyzing a P&L statement. So, for the next three years, I lived a Jekyll and Hyde existence between academia and business: I was a scientist at NYU Medical Center during the day, and devoured everything I could learn in business school classes at night. In between, I voraciously collected every bit of financial data, every magazine article, and the entire Library of Congress catalog of books written about biotechnology. By 1985, the dream I had while standing next to the lab's cork board was a reality. I was employed on Wall Street as Donaldson Lufkin & Jenrette's first biotechnology analyst—one of a handful of equally naive and enthusiastic newcomers to the Street.

Even before I joined DLJ, the issue of valuation caught my imagination more than anything else. The question, "What is the proper method for making a connection between the fundamental value of a company and its stock price?" represented the central challenge for all biotechnology analysts in the early 1980s: Looking back, the early attempts were quite feeble. Some of us tried counting the number PhDs hired, how much money the company had spent, and even the total square footage of lab space. The essence of the problem arose from the fact that young biotechnology enterprises, as development stage companies, are not amenable to traditional methods of financial analysis applied to sales-driven manufacturing companies. Notwithstanding the

efforts of many analysts and bankers since that time, the methodology is not markedly better today than it was in its primitive state in the 1980s.

The discount model

The discounting of future cash flows has been a fundamental approach to stock valuation; In other words, the present value of a stock is driven by the aggregate cash flows a business is likely to generate over a period of time, discounted appropriately to reflect

their diminishing contribution as they occur further in the future. A simplified version of this approach, customized for biotechnology stocks, was introduced in April 1986 by a pioneer of the industry, Peter Drake, at that time Kidder Peabody's biotechnology analyst. When this approach was introduced, it had a significant impact in the sector because for the first time it presented investors with a framework within which they could make rational buy-sell decisions.

This method, still widely used in the biotechnology sector, ignores the intervening cash flows and involves only the discounting of a so-called terminal stock price. An arbitrarily established terminal period—many years in the future—is selected and sales are projected for that date to form the basis of an income statement and an earnings-per-share (EPS) estimate. An appropriate price-to-earnings (P/E) ratio is then chosen to establish the stock price at that future date. Once all those projections are in place, a discount rate that reflects the associated risk is used to work backward from the terminal price to deduce what the current price should be.

When using this approach, typically, practitioners choose to go forward at least 4–5 years, and sometimes as many as 15 years. Most commonly, the time chosen for young companies developing therapeutics is 7–10 years. This is based on the assumption that at that point the company's revenues and earnings will be growing at a predictable rate. The obvious disadvantage of such a valuation scheme is the inherent uncertainty associated with long-term sales projections.

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Another problem is the selection of a suitable P/E ratio. If, for example, it turns out that the company's revenues and earnings rate are average at the projected date, then applying an average market P/E is appropriate and one of the variables is removed. When expected growth rates become very high, the relationship between P/E and growth rate is much less robust.

Another problem with this method is establishing a discount factor that properly accounts for the risk associated with product and business development. Discount rates are selected by the individual investor to reflect his or her expected rate of return for the perceived risk. For young biotechnology companies, appropriate discount rates usually fall between 30–50%.

A practical application: BioWidget

With so many variables influencing the outcome, this method has the potential to generate absurd results. Consider, as an example, BioWidget, a company in which the analyst chooses the terminal period to be 5 years out, and projects an EPS estimate ranging from a worst case scenario of \$1 to a best case of \$3.

Assuming that the expected growth rate calls for a P/E between 15 and 30 and the discount rate chosen is between 30% and 50%, the current stock price would be predicted in the approximate range of \$2–\$24. The \$2 price represents a terminal value of \$15 (\$1 EPS multiplied by a P/E of 15) discounted over 5 years at 50%. At the other extreme, \$24 is \$90 discounted over 5 years at 30%. Such broad range for the stock price renders the calculation uninformative.

In actual practice, implementing this method is much more complex than sketched out here. The earnings per share prediction can be made more reliable by shortening the time horizon. But if one does this, the appropriate P/E range broadens, because the company is evaluated during a growth phase—making the selection of P/E ratio is far more difficult.

What further complicates matters is that the one parameter that is the most difficult to estimate, namely the discount rate, has the greatest impact in the calculation. Because values are discounted from some time in the future back to the present, the discount rate affects the calculation as an exponential function.

Valuing technological assets

In March 1986, with an eye to my previous training as a scientist, I proposed a different valuation approach. The basic premise of the method is that the future success of a young biotechnology company is based on how effectively it has invested in R&D. In its simplest form, value is determined by how

management performs on the one hand and the amount of R&D dollars invested on the other. A good biotechnology company looks a lot like a well-funded lab, populated by hard working, creative scientists.

The first question I had to come to terms with is, "How does one evaluate management?" In a simplistic manner, this method assesses performance in three areas: science, business, and strategy. To evaluate the scientific capabilities of a company, one examines the quality of the scientists, the approaches employed in their work, their historical performance vis-a-vis competing

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groups, and the extent of collaboration with quality university scientists. On the business side, one looks at the depth and breadth of management's past experience, its success in negotiating contracts with corporate partners, and its expertise in regulatory and legal affairs.

Finally, one looks at the company's overall strategic plan, in the context of market realities and also considers other intangibles, such as the interaction of the company's technical and business staff. For each individual category, then, a score is assigned which, in the opinion of the analyst, reflects the performance of the company over the past several years. Averaging the three scores generates a single index which, as first approximation, reflects the historical average efficiency in managing the R&D effort.

The second valuation parameter is the amount invested in R&D. For many, the simple answer to this valuation index would be to calculate cumulative R&D expense. But this would be incorrect because the real value of the R&D investment varies significantly, depending on both the source of the investment and its timing. For example, research funded internally is far more valuable to the company than research carried out in the context of a corporate alliance. This is because the latter would generally bring to the company only a portion of the profits in the form of royalties.

Using the same logic, earlier spending is more valuable than recent spending because it gives the company a head start in product

development, earlier understanding of key technological issues, and potentially broad patents—thus increasing value. By taking these factors into consideration, an analyst can calculate an R&D investment index that reflects the amount expended on R&D, modulated by the efficiency of managing that effort.

The advantage of this approach is that it recognizes young companies not as businesses but as collections of technological assets that are likely to create value. Admittedly, the rankings for management's performance are subjective, but its strength lies in establishing a format where one can quickly discern where there are extreme discrepancies between price and value within a group of companies. As such, it is a valuable screening tool for isolating potentially overvalued or undervalued stocks for further analysis. Perhaps this model's strongest point is that it does not depend on long-term projections to determine value but relies on past performance, which is easy to document.

Valuation today

Much of the valuation work done in biotechnology today employs variations on the discounting model—most often in a far more sophisticated form than was proposed in the 1980s. What Wall Street depends on to bring these valuations into line is a comprehensive analysis of a group of similar companies.

However, more often than not, such universes of comparable companies show valuation ranges where the largest market value is ten times that of the smallest one. Rather than seeking to answer why such extreme differences exist, most valuation exercises wind up being attempts to defend intuitive decisions by placing them in a quantitative context. As a result, at present, the most widely used valuation models for biotechnology are less than robust.

What Wall Street needs now is a new metric that would be able to evaluate and combine, with an appropriate weighting system, the multiple factors driving biotechnology values. These factors would include management, science, market opportunity, proprietary position, competition, regulatory issues, commercial agreements, cash, and interest rates into a single value parameter.

Perhaps, given the long history and the large size of the industry, a comprehensive, large-scale, retrospective analysis can be carried out now that would serve as the basis for the determination of the coefficients of a polynomial model. To build such a model, the major question that remains is, "Is anyone standing at the cork board reading this?"

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