Nature Reviews Drug Discovery | AOP, published online 19 June 2009; doi:10.1038/nrd2923

FROM THE ANALYST'S COUCH

The 'big pharma' dilemma: develop new drugs or promote existing ones?

Dan Weiss, Prasad Naik and Ram Weiss

RD21 chair, www.cohda.com

Pharmaceutical companies decide how much to invest in developing new drugs and promoting existing ones, thereby influencing the rate of drug discovery and the state of biomedical research funding[1]. The relative emphasis on innovation compared with marketing depends on how these activities affect the short-term profitability and the long-term value of the company. To understand why companies invest extensively in promoting existing products when drug discovery seems to be their core value-generator, we examined the spending on research and development (R&D) versus sales and marketing by pharmaceutical companies over the past three decades.

Investment trends

Pharmaceutical companies allocate their resources between three primary domains (BOX 1): manufacturing activities, R&D of new compounds, and expanding sales and market share of existing products (through sales, general and administrative costs (SG&A)). Manufacturing costs depend on the product portfolio and products' technological attributes. The cost of compound development is high[2] because it is a lengthy and risky process that yields a small number of profitable products[3]. Consequently, companies invest extensively in boosting profits from marketed products through spending on promotions to caregivers and consumers[4,5].

Based on Compustat data[6] for pharmaceutical companies, such as Bristol–Myers Squibb, Eli Lilly, Genentech, Merck, Pfizer and Schering–Plough that are traded on the American Stock Exchange, New York Stock Exchange or NASDAQ, FIG. 1 shows the trends in manufacturing costs of goods sold (COGS), R&D investments and investments in SG&A over three decades from 1975 to 2007. Manufacturing costs decreased from 43% of sales in the late 1970s to about 23% of sales in the 2000s, whereas R&D expenditures increased from about 5% to 17%, and SG&A expenditures increased from 32% to 39% during this period.

R&D versus promoting existing drugs

Market valuation of investments. Because stock prices incorporate investors' expectations of future performance, they serve as indicators of the long-term company value[7]. To estimate the relative effects of R&D and SG&A investments on company value, we followed valuation theory[8] and used a linear regression model with a company's stock price at the end of each year as the dependent variable and its annual R&D and SG&A expenditures as the independent variables (see Supplementary information S1 (box) for details).

Our results indicate that investments in R&D have a positive effect on stock prices, and thus increase a company's long-term value, whereas investments in promoting existing products have a negative effect on stock prices. To check the robustness of these results, we performed two tests. First, we tested whether these results vary with company size, as large pharmaceutical companies (those with annual sales exceeding $100 million) might have a different perspective on resource allocation between R&D and SG&A than smaller companies with a limited product portfolio. The positive effect of R&D investment on stock prices and the negative effect of SG&A investment hold for small and large companies; both the effects were more pronounced for smaller companies. Second, to better capture the investments in promoting existing products, we excluded the salaries and bonuses of the top five executives in each company from SG&A expenditures and found that the R&D effect on stock price remained significantly positive, whereas the SG&A effect remained significantly negative. Interestingly, stock price decreases as top management compensation increases, suggesting that high compensation of senior executives might negatively affect a company's value in the long-term[9].

Overall, these analyses indicate that investors in capital markets expect investments in R&D to enhance long-term company value, and perceive investments in promoting existing products to reduce long-term company value, irrespective of company size and the inclusion of top-management compensation within SG&A expenditures.

Why do companies spend resources on promoting existing products? Given the negative effect of SG&A investments on long-term company value, why do companies promote existing products extensively? Specifically, on average, over the three decades analysed, pharmaceutical companies allocated about 36% of sales to SG&A compared with 12% to R&D (TABLE 1). As a possible explanation, we hypothesize that managers invest in promoting existing products to boost short-term profits in a reliable way. Although senior executives are concerned with the long-term company value and may also own shares or options, they care about short-term performance because their reputation and bonuses depend on profits.

We next analysed the relative effects of R&D and SG&A investments on annual profits. Regression analysis (see Supplementary information S1 (box)) indicates that both R&D and SG&A investments exert positive effects on annual profits. In other words, annual profits increase as either R&D or SG&A (or both) increase. We applied the robustness checks mentioned above and found that these effects apply for both small and large companies.

So, overall, the development of new drugs via R&D investments has a positive (but risky) effect on profits, whereas the promotion of existing drugs via SG&A investments boosts sales and short-term profits reliably[10,11]. As FIG. 1 illustrates, over three decades, a typical pharmaceutical company increased its investments in both R&D and SG&A. Interestingly, investment in R&D (240% growth, from 5% to 17%) increased more than in SG&A (22% growth, from 32% to 39%). ▸

Implications

Our analysis indicates that investments in promoting existing products have opposing effects — that is, they increase annual profits, but decrease long-term company value. At first glance, the opposing effects of SG&A imply that extensive marketing investment seems out of line with the goal of increasing the company's value in the long-term. One potential reason is that short-term profits affect the prestige and compensation of senior executives who devise the investment strategy. However, it should also be noted that short-term profits generate cash flows, which can be used to accelerate R&D projects.

Moreover, this study indicates that R&D investments exhibit positive effects on both short-term profits and long-term company value. So, to maximize long-term company value, it seems that pharmaceutical companies should allocate greater resources to R&D rather than promoting existing products. Indeed, over the span of three decades, pharmaceutical companies have increased the proportion of resources allocated to R&D at a greater rate than that for SG&A, suggesting that this has been recognized to some extent. Investment in R&D involves an insightful selection of projects, multiple decisions along the development path considering the risk of further investments in a problematic project, as well as other financial considerations[12]. Involvement of scientific leaders in investment decisions might, because of their vision and insights, promote the development of compounds that would otherwise be abandoned based purely on financial considerations. Overall, we hope that this analysis might encourage further investment in R&D to address the decline in innovation, as it indicates that investments in R&D benefit not only patients' health, but also investors' wealth.

Dan Weiss is at Leon Recanati Graduate School of Business Administration, Tel Aviv University, Tel Aviv, Israel.

Prasad Naik is at the Graduate School of Management, University of California at Davis, California, USA.

Ram Weiss is at the Department of Human Nutrition and Metabolism and Braun School of Public Health, Hebrew University School of Medicine, PO Box 12272 Jerusalem 91120, Israel.

Correspondence to: R.W.
e-mail: ram.weiss@ekmd.huji.ac.il

doi:10.1038/nrd2923
Published online 19 June 2009

1. Loscalzo, J. The NIH budget and the future of biomedical research. *N. Engl. J. Med.* **354**, 1665–1667 (2006).
2. DiMasi, J. A., Hansen, R. W. & Grabowski, H. G. The price of innovation: new estimates of drug development costs. *J. Health Econ.* **22**, 151–185 (2003).
3. Sewing, A. *et al.* Helping science to succeed: improving processes in R&D. *Drug Discov. Today* **13**, 227–233 (2008).
4. Gagnon, M. A. & Lexchin, J. The cost of pushing pills: a new estimate of pharmaceutical promotion expenditures in the United States. *PLoS Med.* **5**, e1 (2008).
5. Donohue, J.M., Cevasco, M.& Rosenthal, M.B. A decade of direct-to-consumer advertising of prescription drugs. *N. Engl. J. Med.* **357**, 673–681 (2007).
6. *Wharton Research Data Services (WRDS)* [online], <http://wrds.wharton.upenn.edu/demo/databaselist.shtml> (2009).
7. Lev, B. *Intangibles: Management, Measurement, and Reporting* (Brookings Institution Press, Washington D.C., 2001).
8. Chan, L.K.C., Lakonishok, J. & Sougiannis, T. The stock market valuation of research and development expenditures. *J. Finance* **LVI(6)**, 2431–2456 (2001).
9. Bebchuk, L .A. & Fried, J. M. *Pay Without Performance* (Harvard University Press, Massachusetts, 2006).
10. Kothari, S.P., Laguerre, T.E. & Leone, A.J. Capitalization versus expensing: evidence on the uncertainty of future earnings from capital expenditures versus R&D outlays. *Rev. Account Stud.* **7**, 355–382 (2002).
11. Lev, B. & Sougiannis, T. The capitalization, amortization and value-relevance of R&D. *J. Account Econ.* **21**, 107–138 (1996).
12. Cuatrecasas, P. Drug discovery in jeopardy. *J. Clin. Invest.* **116**, 2837–2842 (2006).

Box 1 | **Definition of variables**

- R&D. Research and development expenditures include raw materials and professional services used in R&D projects, salaries of R&D personnel, depreciation of infrastructure and cost of utilities committed for R&D purposes. R&D expenditures do not include costs of knowledge or formulas acquired from other companies.
- SG&A. Sales, general and administrative expenditures include costs of sales, promotions, customer support and training, marketing, advertising campaigns, public relations, distribution, sponsorships, general corporate activities and compensation of senior executives.
- COGS. Costs of goods sold include manufacturing costs such as raw materials, subcontractors, salaries of production labour, depreciation of machines, production lines and infrastructures, utilities, maintenance costs and other manufacturing costs.

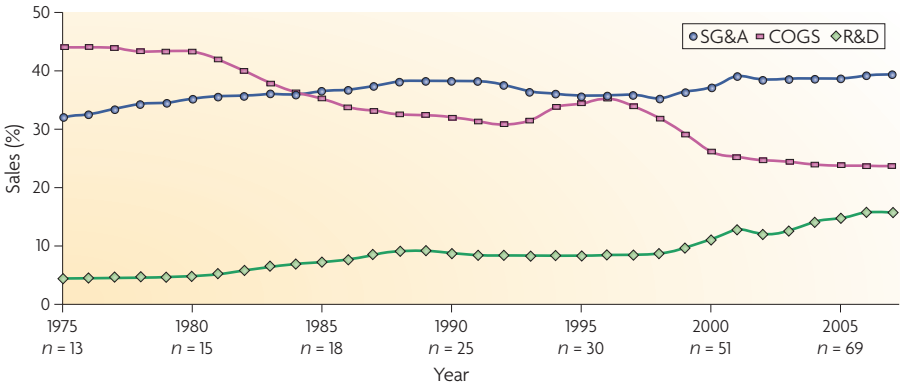

Figure 1 | **Trends in resource allocation to SG&A, R&D and COGS in the pharmaceutical industry: 1975–2007.** The figure plots median percentage of sales (smoothed). Investment in SG&A (sales, general and administrative costs) is shown in blue circles, COGS (costs of goods sold) is shown in pink squares and R&D (research and development) is shown in green diamonds.

Table 1 | **Sales and resource allocation by pharmaceutical companies: 1975–2007**

Variables (calculated per annum)	Mean	Median	Standard deviation	Sample size (*n*)
Sales (US$ billion)	4.81	1.18	8.52	1,048
R&D/sales (%)	11.81	8.33	12.62	1,048
SG&A/sales (%)	36.32	36.59	16.78	1,048
COGS/sales (%)	35.95	34.44	16.29	1,048

The table presents descriptive statistics of financial variables for pharmaceutical firms with available data on the Compustat database and annual sales exceeding US$50 million. R&D (research and development), SG&A (sales, general and administrative costs) and COGS (costs of goods sold) represent the primary cost components in the pharmaceutical industry, comprising an average of about 84% of sales.