

# Industry and Market Background

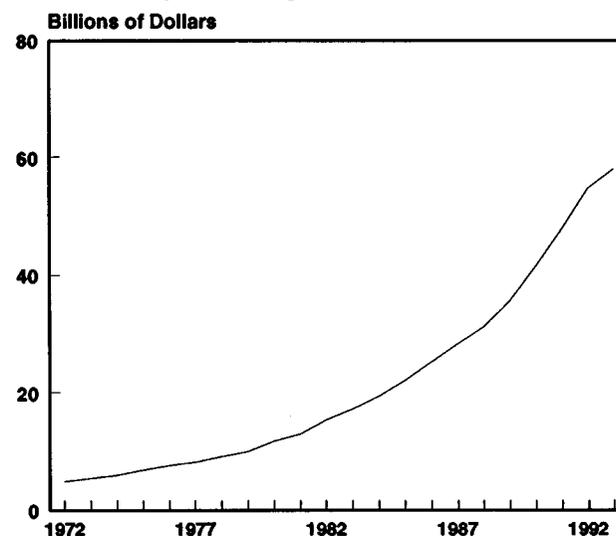
The U.S. prescription drug market has grown rapidly in recent years (see Figure 1). The industry estimates that domestic prescription drug sales, both institutional and outpatient, have almost doubled since 1988, reaching an estimated \$58 billion in 1993.<sup>1</sup> Since 1980, U.S. spending for prescription drugs has grown at an average annual rate of 13 percent. (These estimates are not adjusted for inflation. Many economists are concerned about the accuracy of the Bureau of Labor Statistics' measures of price changes for pharmaceuticals (see Box 1). Instead of using them, this study presents pharmaceutical spending in relation to the economy and the rest of the health care sector.)

Although spending on prescription drugs has grown rapidly, it accounts for only a relatively small portion of national health expenditures (see Figure 2). Since 1972, prescription drug shipments have accounted for between 4.5 percent and 6.5 percent of total national health expenditures. Indeed, their share of national health expenditures has risen by almost half since 1981. These figures represent manufacturers' sales and do not reflect the final retail cost to consumers. The share of retail sales would be higher, but this estimate reflects the share of health expenditures that go to drug manufacturers.

Prescription drug spending has doubled its share of the gross domestic product (GDP) since 1972 (see Figure 3). In 1972, prescription drug shipments accounted for 0.4 percent of GDP. By 1993, this share had risen to 0.8 percent of GDP.

This estimate differs from other analyses in that it deals exclusively with prescription drugs. The national health accounts gather into one category

**Figure 1.**  
**U.S. Prescription Drug Sales**



SOURCE: Congressional Budget Office based on Pharmaceutical Manufacturers Association, *Trends in U.S. Pharmaceutical Sales and R&D* (Washington, D.C.: PMA, October 1993), p. 8.

NOTE: Includes institutional and outpatient prescriptions. Estimate for 1993 was revised by PMA in 1994 and adjusted by the Congressional Budget Office to reflect missing data.

1. This estimate excludes many over-the-counter drugs. Pharmaceutical Manufacturers Association, *Trends in U.S. Pharmaceutical Sales and R&D* (Washington, D.C.: PMA, October 1993), p. 8. Data for 1993 were revised by PMA in February 1994 and adjusted to reflect missing data. The Congressional Budget Office obtained a similar estimate by adjusting data on industry shipments for over-the-counter drugs and net exports from the Census of Manufacturers.

**Box 1.**  
**Measurement Issues in Pharmaceutical Price Increases**

By conventional measures, the pharmaceutical industry has consistently high inflation rates. But these conventional measures are not well suited to industries, such as the pharmaceutical business, that frequently introduce new products.<sup>1</sup> The measures may overstate the rate of increase in pharmaceutical prices. In essence, conventional inflation gauges fail to reckon with major forms of competition in the pharmaceutical industry and therefore may not be useful indicators of true inflation in the industry.

Measured by the producer price index (PPI), increases in pharmaceutical prices have been dramatic. The PPI for pharmaceuticals doubled between 1982 and 1993, while the PPI for all finished goods rose by only one-quarter. In other words, the average annual increase in pharmaceutical prices (6.5 percent) was more than triple that for all finished goods (2 percent).

Several economists have criticized the sample used by the Bureau of Labor Statistics (BLS) to measure pharmaceutical price increases in the PPI, saying:

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1. The number of drugs on the Department of Health and Human Services list of existing drugs increased by 50 percent between 1982 and 1987. See David Cleeton, Vally Goepfrich, and Burton Weisbrod, "What Does the Consumer Price Index for Prescription Drugs Really Measure?" *Health Care Financing Review* (Spring 1992), p. 45.

- o The sample is too narrow,
- o It is biased toward older drugs,
- o It improperly incorporates generic drugs, and
- o The measure excludes changes in quality.<sup>2</sup>

These critics argue that the relatively small sample of drugs used by the BLS does not represent the movements of the larger universe of drugs. In one instance, the economists recalculated the degree of pharmaceutical inflation using a larger sample than that of the BLS and weighted the prices in a way that more appropriately reflected the increasing sales of new drugs. These two changes decreased the measured inflation for the 1988-1991 period from 8.4 percent as measured by the BLS to 6 percent with the corrected methodology and a larger sample.<sup>3</sup> (The PPI for all finished goods increased at an annual rate of 4.1 percent during this period.)

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- 2. Although the studies analyzed the PPI in detail, similar comments apply to the consumer price index (CPI) with some modifications.
  - 3. Ernst Berndt and Paul Greenberg, "Price Growth of Prescription Pharmaceutical Preparations: An Update and Explanation" (paper presented at the American Enterprise Institute Conference on Competitive Strategies in the Pharmaceutical Industry, Washington, D.C., October 27-28, 1993).

(drugs and medical nondurables) both prescription drugs sold through retail outlets and other nondurable medical supplies, most notably over-the-counter drugs. Most estimates of prescription drug spending as a proportion of national health expenditures do not separate these out. Conversely, the national health accounts leave out of this category drugs that are consumed in hospitals, nursing homes, and doctors' offices.

After the Food and Drug Administration (FDA) approves a prescription drug, the drug's manufacturer often applies to have the product changed to over-the-counter status to take advantage of consumer brand loyalty, especially when the patent is nearing expiration.<sup>2</sup> How the Administration's pro-

posal would alter the incentives to change a drug's status is beyond the scope of this study, which focuses on prescription drugs (see Figure 4 for a comparison of the U.S. over-the-counter and consumer outpatient prescription drug markets).

Although federal statistical sources tally prescription drugs according to where they were purchased, these categories do not necessarily correspond to the reimbursement categories used by Medicare, Medicaid, and private insurance compa-

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2. "Self-Medication Boom," *Med Ad News* (February 1994), p. 44. See also "Switches Don't Come Easy," *Med Ad News* (January 1994), p. 21.

The BLS agreed with the first two criticisms and began to revise its pharmaceutical sampling methodology. The economists also argued that BLS methodology did not properly include generic drugs. When the BLS includes generic drugs, it usually classifies them as "new" drugs. Under most circumstances, the BLS does not link a name brand to its generic replacement. Only when the brand-name manufacturer of a particular drug also produces a generic version of that drug is the connection sometimes made.

This lack of connection between brand-name and generic versions of the same drug means that the BLS inflation measure usually misses the price decline caused by movement to a cheaper generic drug. For example, if a generic version costs 20 percent of what the brand-name version costs, shifting 40 percent of quantities purchased to the generic form would bring the average cost down by 32 percent.<sup>4</sup> If each drug is classified as different, however, the BLS will never measure a price drop. The BLS may catch future changes in the price of the generic drug, but a one-time shift to cheap sources would be missed. In the market for one drug, cephalexin, the conventional inflation measure showed a price rise of 14 percent during the April 1987-September

4. Generic drug sales account for almost 40 percent of all drug sales.

1990 period, while one that included generic versions showed a drop of 48 percent.<sup>5</sup>

The BLS price measures also have no way of incorporating the added benefit to consumers of better drugs; the prices of new drugs are not adjusted to reflect additional therapeutic value. Recently, one economist tried to make quality adjustments in one product class (ulcer medicine) to see how much prices had increased once the improvements were factored in. She found that nominal price measures had risen by 11 percent a year for the 1977-1989 period, but her quality-adjusted measure rose by only 6 percent a year for the same period.

Thus, two central policy goals for the pharmaceutical industry--controlling prices through new and generic drugs and encouraging the development of better drugs--are systematically mismeasured by both the consumer price index and the PPI.

5. Zvi Griliches and Iain Cockburn, *Generics and New Goods in Pharmaceutical Price Indexes* (Cambridge, Mass.: Harvard Institute of Economic Research, Harvard University, December 1993).

6. Valerie Suslov, "Are There Better Ways to Spell Relief? A Hedonic Pricing Analysis of Ulcer Drugs" (paper presented at the American Enterprise Institute Conference on Competitive Strategies in the Pharmaceutical Industry, Washington, D.C., October 27-28, 1993).

nies.<sup>3</sup> Most important, drugs purchased in nursing homes are often classified as outpatient drugs for the purposes of private insurance and Medicaid reimbursement. Some drug purchases in certain skilled nursing facilities, however, are classified as inpatient for the purposes of reimbursement by Medicare, just as they would be in a hospital.

The Congressional Budget Office assumes that if outpatient prescription drug benefits are extended

to Medicare enrollees, most nursing home drug expenditures not now covered by Medicare would be included. In 1991, nursing homes accounted for 3 percent of total U.S. pharmaceutical sales. Conversely, some drugs purchased in hospitals are for outpatient use. In 1991, hospitals accounted for 23 percent of total U.S. pharmaceutical sales. CBO assumes that these two sources of error in estimating the inpatient portion of the prescription drug market will largely offset each other and that the inpatient market is 23 percent of the total prescription drug market. CBO assumes the remainder is the outpatient market.

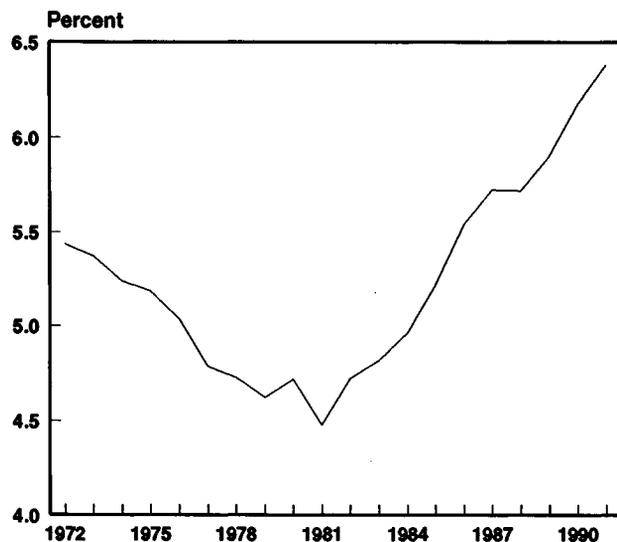
3. Office of Technology Assessment, *Pharmaceutical R&D: Costs, Risks and Rewards* (February 1993), pp. 238-240.

## Structure of the U.S. Pharmaceutical Industry

The U.S. pharmaceutical industry is internationally competitive and research-intensive. It produces medicines for both human and veterinary use. Within the human-use category, the industry includes companies that produce brand-name and sometimes generic drugs; those that manufacture brand-name drugs and products often related to other aspects of medical care; and makers of generic drugs, diagnostic substances, and bulk chemicals.

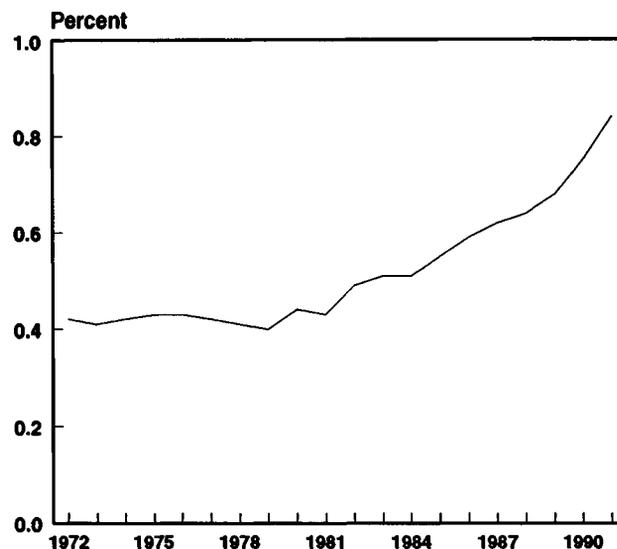
The industry is one of the most research-oriented in the United States. In 1991, it spent almost three times as much on research and development (as a percentage of sales) as the average for all U.S. manufacturers.<sup>4</sup>

**Figure 2.**  
Prescription Drug Spending as a Percentage of National Health Expenditures



SOURCE: Congressional Budget Office based on Pharmaceutical Manufacturers Association, *Trends in U.S. Pharmaceutical Sales and R&D* (Washington, D.C.: PMA, October 1993), p. 8, and data from the Health Care Financing Administration.

**Figure 3.**  
Prescription Drug Spending as a Percentage of Gross Domestic Product



SOURCE: Congressional Budget Office based on data from the Bureau of Economic Analysis and Pharmaceutical Manufacturers Association, *Trends in U.S. Pharmaceutical Sales and R&D* (Washington, D.C.: PMA, October 1993), p. 8.

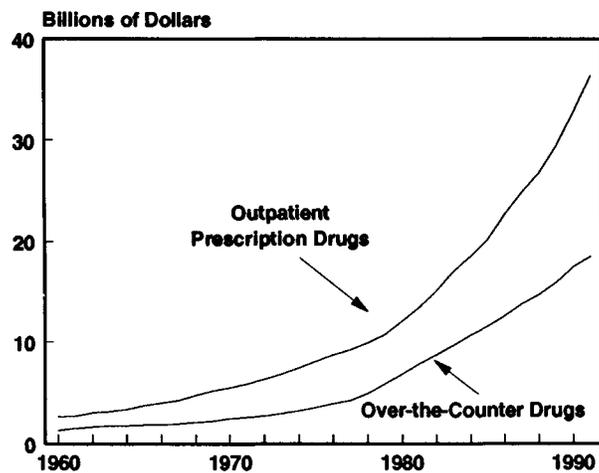
## Competition and Barriers to Entry in the Drug Industry

Manufacturers of the drugs that are most commonly prescribed do not enjoy a monopoly. Instead, they have competitors. In 1989, some 70 percent of prescriptions were written for multisource drugs, both brand-name and generic.<sup>5</sup> For the most part, these are drugs for which the patent has expired and that are now made by both generic and brand-name companies. Alternatively, the drug might still be under patent, but manufactured or marketed under license by more than one company. Only 30 percent of prescriptions were for single-source drugs.

4. National Science Foundation, *Selected Data on Research and Development in Industry: 1991* (1993), Table SD-9. Industry sources presented below differ.

5. Richard Caves, Michael Whinston, and Mark Hurwitz, "Patent Expiration, Entry, and Competition in the U.S. Pharmaceutical Industry," *Brookings Papers on Economic Activity: Microeconomics*, 1991 (1991), p. 6.

**Figure 4.**  
**U.S. Consumer Spending on Pharmaceuticals**



SOURCE: Congressional Budget Office based on data from the Bureau of Economic Analysis and the Health Care Financing Administration.

Just because a drug is made by only one company does not mean that it has no competitors--often several different drugs will be available to treat the same medical condition.<sup>6</sup>

Although much of the policy debate has been focused on breakthrough drugs, the imitative drugs also play a major role in the pharmaceutical market. Imitative or "me-too" drugs use the same biological mechanism as breakthrough drugs and can therefore serve as alternative treatments. By providing therapeutic alternatives, these drugs can introduce competition into a market well before patents expire, thus limiting the ability of the breakthrough-drug manufacturers to sustain high prices. Me-too drugs are often competing single-source drugs.

When Prozac was introduced into the antidepressant market in 1988, for example, it offered a new treatment with fewer side effects than many of

the older antidepressants.<sup>7</sup> The result was that Prozac became one of the five most widely prescribed drugs in the United States, enjoying worldwide sales of \$1 billion in 1992.<sup>8</sup> Such a market was a tempting target for other companies. Within five years, three lower-priced drugs, all using some variant of the same treatment, were on the market in the United States. Four other drugs are being sold in Europe and await FDA approval for U.S. sale. Because there are several close rivals, manufacturers of antidepressant drugs are being forced to offer discounts, even though their patents last until after the year 2000, when generic versions will be permitted to enter the market.

One explanation for the rapid entry of rival drugs into the market is that all were exploiting a basic biomedical discovery and that the competing companies had products already in the approval process when Prozac was sanctioned for sale. In many instances, the first company to exploit a new biological discovery is merely the first among several to complete a race to market. In some cases, however, it is years before substitutes for truly innovative drugs are introduced, although this is probably correlated with the size of the market they serve.<sup>9</sup>

The Prozac experience is not unique. According to one recent study sponsored by the industry, in therapeutic areas where treatments already existed, new drugs introduced during 1991 and 1992 were launched with prices that averaged 14 percent below that of the market leader. New products in the most active therapeutic categories averaged 36 percent less.<sup>10</sup> Another recent study of 148 drugs introduced into the U.S. market between 1978 and 1987 indicated that more than half of those substances that provided the same benefits as existing drugs but offered no increase in therapeutic potential were

6. A drug is considered multisource if bioequivalent versions are available from more than one company. Other sources can be brand-name or generic. If a drug is single source, it may have close therapeutic substitutes, but not bioequivalent competitors. Imitators (or "me-too" drugs) use different molecules to accomplish the same treatment as a single-source drugs. A generic drug is certified by the FDA as being bioequivalent to the original drug that has lost its patent.

7. Milt Freudenheim, "The Drug Makers are Listening to Prozac," *New York Times*, Business Section, January 9, 1994, p. 7.

8. "100 Powerhouse Drugs," *Med Ad News Supplement* (May 1993), pp. S5, S7, and S14.

9. Z. John Lu and William S. Comanor, "Strategic Pricing of New Pharmaceuticals" (paper presented to the American Economics Association, Boston, Mass., January 1994).

10. Boston Consulting Group, *The Changing Environment for U.S. Pharmaceuticals* (New York: Boston Consulting Group, April 1993), pp. 8-9.

introduced at prices below the market leaders.<sup>11</sup> After drugs were launched at low prices, however, price increases for many of them were higher than average. (Drugs that provided new therapeutic capabilities were introduced at a premium.) But in general the authors found, "*both the introductory price and subsequent price increases are lower when there are more substitutes in the market.*"<sup>12</sup> [Authors' emphasis.]

In some instances, when there are only one or two imitators, competitive pressures may not be substantial. Often several drugs will be appropriate to treat a given condition, but will be imperfect substitutes. Each drug may have its particular strengths and weaknesses, and often side effects. Thus, a doctor may treat the same malady differently in different patients. Even when firms compete, they may primarily use nonprice factors to do so. A firm may, for example, increase its promotional efforts as a way of increasing market share. Price competition is more likely to occur after several rival manufacturers enter the scene. The fact that some drugs may not have identical substitutes gives the pharmaceutical companies some market power.

Although it is relatively easy to begin R&D in the pharmaceutical industry, it is difficult to initiate marketing. Some barriers are regulatory, such as the seven- to eight-year process of getting a drug approved by the FDA.<sup>13</sup> Others are legal, such as the monopoly provided by the patents on new medicines. Other barriers are economic, such as the large research infrastructure necessary to produce new and sophisticated chemicals that can compete in the world marketplace.

There are many small firms in the industry, but large firms play a disproportionate role in sales and R&D. During the 1980s, the largest 20 companies accounted for almost two-thirds of the pharmaceuti-

cal industry's total shipments.<sup>14</sup> But when only prescription drugs are counted, the top 20 firms account for more than 80 percent of the industry's sales.<sup>15</sup>

In recent years, biotechnology firms have entered the industry in large numbers, but they have yet to produce more than a handful of commercially successful products. If new technology reduces the cost of developing drugs, a substantial increase should take place in the number and role of these companies and their effect on prices and quantities of drugs sold in the U.S. market. This change would reduce some nonregulatory barriers to entry into the industry.

### Pharmaceutical Company Profits

High profits are commonly cited as proof of the lack of competition in the pharmaceutical industry. Although the industry does have high profit rates by conventional measures (even accounting for higher risk), such as the return on assets or return on equity, these gauges are not well suited to such industries as the pharmaceutical business, which invests heavily in intangible capital, such as marketing and R&D.<sup>16</sup> These measures of profitability may introduce a bias that results in an understatement of a firm's capital assets, which in turn produces an overstatement of its profit rate. In essence, conventional accounting measures of profit systematically

11. Lu and Comanor, "Strategic Pricing of New Pharmaceuticals."

12. *Ibid.*, p. 26.

13. Joseph DiMasi and others, "Cost of Innovation in the Pharmaceutical Industry," *Journal of Health Economics* (1991), p. 123. See also Office of Technology Assessment, *Pharmaceutical R&D*, p. 151.

14. International Trade Commission, *Global Competitiveness of U.S. Advanced-Technology Manufacturing Industries: Pharmaceuticals* (September 1991), p. 4-2. Shipments cover the received net selling values at the manufacturing plant of all product shipped.

15. Ernst Berndt and Paul Greenberg, "Price Growth of Prescription Pharmaceutical Preparations: An Update and Explanation" (paper presented at the American Enterprise Institute Conference on Competitive Strategies in the Pharmaceutical Industry, Washington, D.C., October 27-28, 1993).

16. Most of the marketing expenses of the pharmaceutical industry are not in advertising, but in promotional visits to doctors, usually called detailing. In 1989, detailing accounted for three-quarters of marketing expenses. Almost a quarter was devoted to advertising in medical journals, with a small amount spent on direct mail advertising. Caves, Whinston, and Hurwitz, "Patent Expiration, Entry, and Competition in the U.S. Pharmaceutical Industry," p. 12.

ignore major forms of investment by the pharmaceutical industry and may therefore not be the most appropriate measure by which to judge competition in this industry.<sup>17</sup> Economists have found that properly measured, pharmaceutical company profits are only slightly above the average for companies in all industries.

Conventional accounting rules permit firms to accumulate certain types of spending as capital assets, but require other types to be deducted from income in the year in which the expenditure is incurred. Expenditures for intangibles present special problems. Clearly, in the right circumstances, spending on marketing and R&D can benefit a company for years to come, just as it would benefit from money spent on a manufacturing plant. In a practical sense, such spending is an investment in company assets. But conventional accounting practice does not classify it as such. Instead, accounting practice treats it as a short-lived expense. Accounting measures of profitability are usually based on the level of a firm's assets; expenses are deducted from revenue to determine the profit level, which is measured in relation to company gross or net assets.

Because industries vary in their level of R&D and marketing, conventional accounting rules affect their measures of profit differently. Firms in industries in which high levels of both R&D and marketing are important, such as the pharmaceutical industry, may find their asset-based measures of profit systematically overstated. Conventional accounting more accurately measures assets and profits in such industries as heavy manufacturing in which neither R&D nor marketing has played an important role.

Recently, Kenneth Clarkson, an economist specializing in the field of intangible assets, analyzed the effects of conventional accounting rules on the stated profit rates of 113 firms in 14 industries, including the pharmaceutical industry.<sup>18</sup> He found that the rules distorted the measures of profitability

in many industries, in different directions, and to different degrees.

First, Clarkson measured the importance of intangible assets in the pharmaceutical industry. Using income tax and census data, he found that among the 14 groups examined, the pharmaceutical industry was one of three that spent the greatest proportion, as a share of net sales, on marketing. Similarly, his measure of R&D showed the pharmaceutical industry to be third highest in spending share. He split R&D into its components, on the grounds that each would turn out marketable products at a different rate. Significantly, based on previous studies of the economic life of R&D, he argued that R&D in the pharmaceutical industry translates into products (accumulates) at between one-half and three-quarters of the rate of other high-R&D industries, partly because of lags in regulatory approval. Slower accumulation would mean that the R&D assets in the pharmaceutical industry are lower than their high share of sales would imply.

Next, Clarkson recalculated the rates of return on assets and equity (including the intangible assets) for the firms in these industries during the 1980-1989 period. He found that when he corrected for differing rates of investment in intangible assets, the average return on equity for all 113 firms fell slightly, from 14 percent to 11 percent. By contrast, the pharmaceutical industry's rate of return on equity fell from 21 percent to 13 percent. Although still higher than in most industries (it ranked third highest, after computer software and foods), the rate of return in the pharmaceutical industry was much closer to the mean--2 percentage points, not 7 percentage points, higher.

Clarkson's results are higher than, but generally consistent with, earlier studies that attempted similar adjustments. In general, the earlier studies found that (1) the measured pharmaceutical industry profit rate declined by between 2 percentage points and 6 percentage points when intangible capital was ad-

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17. F. M. Scherer, "Pricing, Profits, and Technological Progress in the Pharmaceutical Industry," *Journal of Economic Perspectives* (Summer 1993), p. 104.

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18. Kenneth Clarkson, "Intangible Capital and Profitability Measures: Effects of Research and Promotion on Rates of Return" (paper presented at the American Enterprise Institute Conference on Competitive Strategies in the Pharmaceutical Industry, Washington, D.C., October 27-28, 1993).

justed for and (2) despite this, the industry profit rate remained above the average by 3 percentage points. The Office of Technology Assessment (OTA) also sponsored an independent study of the pharmaceutical industry's profitability, using a different methodology. This study's conclusions are similar to Clarkson's.<sup>19</sup>

Thus, differing pictures of the pharmaceutical industry emerge, depending on the measures of profitability applied. The more conventional measures point to a very profitable industry in which monopoly profits generated by patents raise the industry return to very high levels. A more sophisticated look--one that more nearly matches the industry investment profile--shows a less but still quite profitable industry, but one in which R&D spending and patent rights generate imperfect competition rather than monopoly. This latter picture is consistent with the analysis presented later in this report, which shows that the average new drug produces a small amount of excess profits; that is, profits beyond those necessary to reward the investors after manufacturing and other costs have been paid. These excess profits also help explain why drug companies may have increased their R&D dramatically during the 1980s and why more firms are seeking to enter the market.

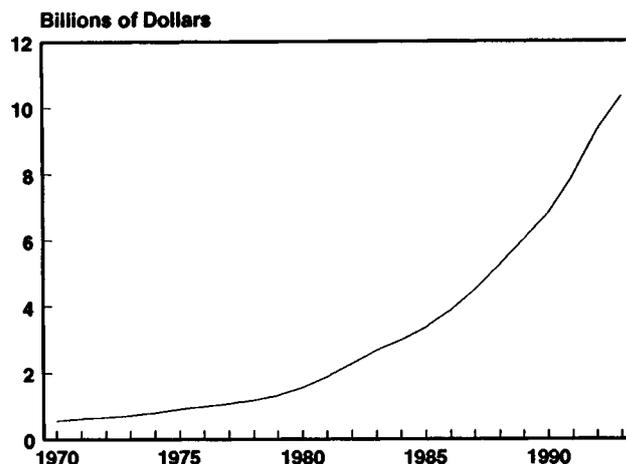
## The Role of R&D in the Pharmaceutical Industry

The U.S. pharmaceutical industry has always invested heavily in R&D. The process starts in the laboratory with the discovery of chemicals and

19. See Office of Technology Assessment, *Pharmaceutical R&D*, pp. 96-99. In fairness, Clarkson's sample of companies is the broadest, both within the pharmaceutical industry and generally, of any study reviewed by OTA. See William Baber and Sok-Hyon Kang, "Accounting-based Measures as Estimates of Economic Rates of Return: The Case of the U.S. Pharmaceutical Industry, 1976-1987" (paper produced under contract with the Office of Technology Assessment, July 1991).

Some people have argued that pharmaceutical companies have greater profits, but that they dissipate these profits in R&D races or by paying too much for the R&D they undertake. One study examined by CBO suggested that fears about R&D races were overstated. See Rebecca Henderson and Iain Cockburn, "Racing to Invest? The Dynamics of Competition in Ethical Drug Discovery" (Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Mass., May 1993).

**Figure 5.**  
Research and Development Spending by the U.S. Pharmaceutical Industry (In billions of dollars)



SOURCE: Congressional Budget Office based on Pharmaceutical Manufacturers Association, *Trends in U.S. Pharmaceutical Sales and R&D* (Washington, D.C.: PMA, October 1993), p. 6.

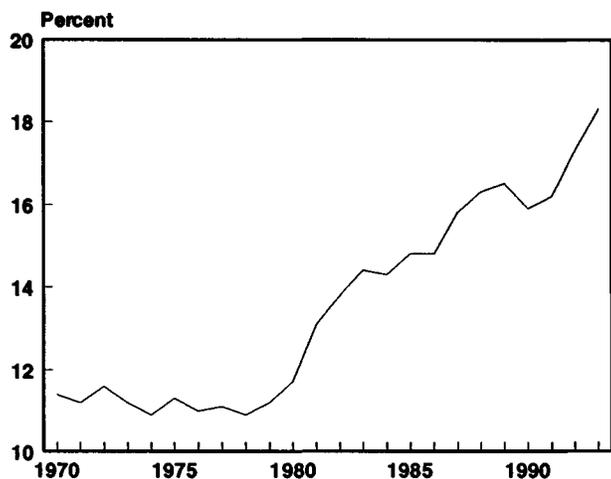
molecules that have therapeutic potential, turns these substances into products, and culminates in testing on animals. Industry R&D then moves to clinical trials, where first safety, then efficacy, of the products are tested in three phases on ever-increasing numbers of people. Long-term animal trials typically continue during the human clinical trials. Drugs that fail one step typically do not proceed to the next.

Industry research and development (both foreign and domestic) has increased continuously for the last two decades, both in absolute terms and as a percentage of sales (see Figures 5 and 6).<sup>20</sup> At least part of the increase in R&D is the result of rising costs of clinical trials.<sup>21</sup> Half of the industry R&D

20. Pharmaceutical Manufacturers Association, *Trends in U.S. Pharmaceutical Sales & R&D*, pp. 4-8, and National Science Foundation, *Selected Data on Research and Development in Industry: 1991*. Both sources agree roughly on patterns and trends in R&D spending. There is a 15 percent discrepancy between the different sources. The industry and NSF also have different classifications for industry sales so their R&D-to-sales ratios differ.

21. Measured by number of clinical trials or patients per drug approval. Some analysts argue that these costs are rising because the pharmaceutical industry is now grappling with more long-term and complicated illnesses that do not lend themselves to straight-

**Figure 6.**  
**Research and Development Spending**  
**by the U.S. Pharmaceutical Industry**  
**(As a percentage of sales)**



SOURCE: Congressional Budget Office based on Pharmaceutical Manufacturers Association, *Trends in U.S. Pharmaceutical Sales and R&D* (Washington, D.C.: PMA, October 1993), p. 7.

expenses occur once clinical trials have begun.<sup>22</sup> Furthermore, the share of trial-related expenses has been rising over the last decade.

Although the federal government spends heavily on biomedical research, it spends relatively little directly on drug development. Overall, federal agencies spent \$750 million in clinical and preclinical pharmaceutical evaluations in 1990.<sup>23</sup> By comparison, the U.S. drug industry spent \$10.8 billion worldwide on pharmaceutical R&D for human use in 1992.<sup>24</sup>

forward analysis. Boston Consulting Group, *The Changing Environment for U.S. Pharmaceuticals*, pp. 25-32. OTA also finds that the size of clinical trials is rising. Office of Technology Assessment, *Pharmaceutical R&D*, pp. 64-65.

22. Pharmaceutical Manufacturers Association, *Trends in U.S. Pharmaceutical Sales & R&D*, p. 29.

23. Office of Technology Assessment, *Pharmaceutical R&D*, pp. 214-215 and 311-315.

24. Pharmaceutical Manufacturers Association, *Trends in U.S. Pharmaceutical Sales & R&D*, p. 26.

**R&D and the Industry Cost Structure.** It is well known that researchers in the pharmaceutical industry typically test thousands of chemicals in order to find one that passes all the clinical trials and is finally approved by the FDA. It is less well known that, on average, only 3 of 10 drugs approved by the FDA and brought to market sell sufficiently well to earn back the average investment in R&D for a new drug, which includes the cost of the pharmaceuticals that do not even make it to market.<sup>25</sup> Of these three, in the recent past, only one has been a principal source of industry income. Thus, a few very successful discoveries provide most of the income (see Figure 7).

As a share of sales price, pharmaceutical production costs are low; the Office of Technology Assessment estimates that the share is 25 percent.<sup>26</sup> One implication of this cost structure (high sunk costs, low production costs) is that a larger pharmaceutical market (in terms of quantity) permits lower prices because it allows the sunk costs, or money that has already been committed and spent for R&D costs, to be spread over a larger number of buyers. For drugs marketed during the early 1980s, these R&D costs, including funds spent during FDA clinical trials, averaged close to \$200 million per drug.<sup>27</sup> Such costs are considered to be largely fixed, or constant, because the R&D is the same whether the company sells one or one billion pills.<sup>28</sup>

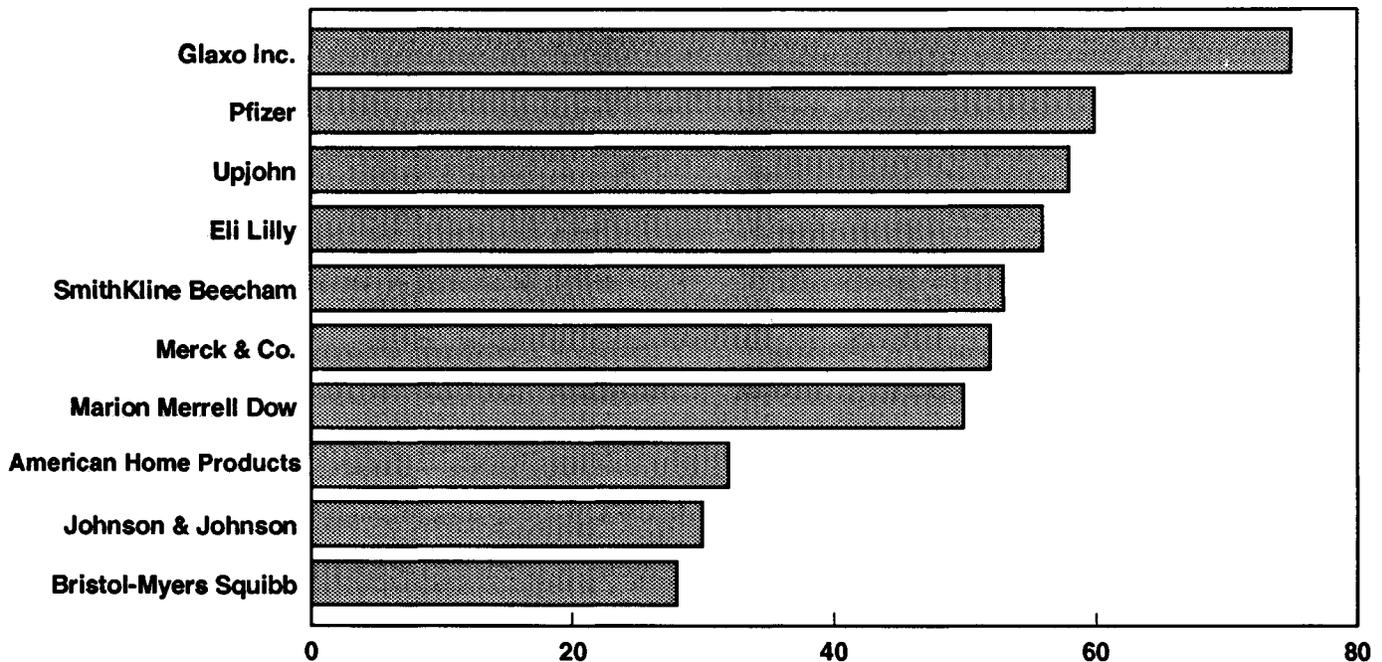
25. Henry Grabowski and John Vernon, "A New Look at the Risks and Returns to Pharmaceutical R&D," *Management Science* (July 1990), p. 816. Analysts lack published data on costs by project; only the average cost is available. Thus, a drug might still be profitable even if sales do not cover the average amount spent on R&D, but it is unlikely to be very profitable unless its R&D costs are also very low.

26. Office of Technology Assessment, *Pharmaceutical R&D*, p. 91. This 25 percent includes plant depreciation. Pure variable costs account for an estimated 17 percent to 21 percent of price. See the discussion of the rate of return calculations below.

27. These costs are capitalized—that is, they included the time value of money. Office of Technology Assessment, *Pharmaceutical R&D*, pp. 47-72.

28. There is some post-launch R&D—in enhancing production, for example—that can be varied, especially during the early years of the market. Obviously, there is R&D to sell improved versions of a product. But since the improved version also has to be approved by the FDA, this analysis is considering it as a new product. In addition, the marketing costs can largely be considered fixed.

**Figure 7.**  
**Sales of Ten Companies' Top Three Drugs as a Percentage of Prescription Sales by Each Firm**



SOURCE: Congressional Budget Office based on Boston Consulting Group, *The Changing Environment for U.S. Pharmaceuticals* (New York: Boston Consulting Group, April 1993), p. 41.

Consequently, it is often profitable for pharmaceutical companies to sell drugs at deep discounts as long as the price is above the low cost of production. The high level of fixed costs also helps to explain why pharmaceutical companies try to market their drugs worldwide, even in countries that control prices; every foreign sale, even at a low price, helps to pay not only for the low production cost but also for the single large R&D investment. The fact that pharmaceutical companies can offer some consumers prices that they do not offer to others also encourages discounting.

**R&D and International Competition.** U.S. pharmaceutical companies are highly competitive in the international marketplace. The strength of the U.S. industry lies in its large R&D infrastructure and ability to produce new products of high quality. According to one recent survey, U.S. companies developed 113 of the 265 major globally prescribed drugs that were developed between January 1970 and May 1992.<sup>29</sup> U.S. companies develop a small-

er share of all drugs, but produce almost half of all new drugs sold in all major markets. This technological success (and the R&D that precedes it) is not concentrated in a few therapeutic categories, such as anti-infective and cardiovascular drugs, but occurs in most major therapeutic categories.

In 1990, nine of the largest twenty pharmaceutical firms in the world were based in the United States.<sup>30</sup> According to the Department of Commerce, U.S. firms accounted for almost half of the world's pharmaceutical sales on a value basis. And the industry runs a positive balance of trade (that is, exports exceed imports). Most of the U.S. pharmaceutical exports went to Organisation for Economic Cooperation and Development (OECD) countries. Almost half of U.S. exports went to the European Community, which has several nations with strong pharmaceutical industries.<sup>31</sup>

29. Heinz Redwood, "New Drugs in the World Market," *The American Enterprise* (August 1993), pp. 72-80.

30. International Trade Commission, *Global Competitiveness of U.S. Advanced-Technology Manufacturing Industries: Pharmaceuticals*, p. 4-2.

31. Department of Commerce, *U.S. Industrial Outlook 1994* (January 1994), p. 43-2.

The U.S. market accounts for one-third of world pharmaceutical sales.<sup>32</sup> Not all countries consume the same drugs, however. Many drugs are local, sold in protected or specialized markets. Global drugs are those that are sold in all or most major markets. The U.S. market for global drugs accounts for an even larger fraction of world sales for these drugs. Global drugs are usually considered more technologically advanced. Because the U.S. market possesses such a large fraction of the total sales of these drugs, U.S. health policy may have a disproportionate impact on the development of pharmaceuticals throughout the world. Alternatively, sales abroad represent more than half of the market for drugs patented in the United States and will therefore not be affected by health care reform.

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## Competition in the U.S. Pharmaceutical Market

The U.S. pharmaceutical market has major structural features on both the supply and demand sides that impede the functioning of a perfectly competitive market. These factors have served partially to shelter firms in the industry from competition, as the profit figures discussed above suggest. But changes are taking place in the market, independent of proposed federal policy changes, that are lowering some of these impediments to competition.

### Consumers' Insensitivity to Cost

One factor that exacerbates the imperfect competition is the presence of doctors in the decision-making process. Doctors are relatively cost-insensitive in prescribing medicine, for which they do not pay. A doctor's objective is to treat the patient and not necessarily to provide the most cost-effective treatment.<sup>33</sup> Since prescription drugs typically constitute, in nonchronic cases, only a small fraction of the total cost of treating the patient, the doctor's

incentive to examine drug costs declines even more. Moreover, because the consumer often cedes large parts of his or her decisionmaking power to a physician or other medical expert--and indeed is often not in a position to judge the medical cost-benefit trade-offs--the usual cost-controlling mechanisms of the marketplace become less effective. The substitution of generic drugs, which is at the patient's choice in most states, is the major--and relatively recent--exception to the medical consumer's usual attitude toward costs.

Nor is judging the cost-effectiveness of treatment straightforward: different patients might value the same costs differently. Some patients might prefer more effective treatment at a higher cost, while others might be willing to incur some risk to save some money. Doctors, fearing malpractice suits or perhaps a negative reputation based on unsuccessful treatment, might also value the trade-off between costs and risks differently.

Another element of the U.S. pharmaceutical market that serves to make demand less sensitive to price is the widespread coverage of pharmaceuticals by insurance and other third-party payers. Although only one-quarter of outpatient pharmaceutical expenditures were covered by insurance in 1977, by 1987 more than 40 percent of all outpatient prescription drug expenditures were covered by third-party payers.<sup>34</sup> Because patients are often reimbursed or because they only pay a small flat fee per prescription, they do not respond as much to costs as they would if they were bearing the full expense.

The presence of these cost-desensitizing factors, however, does not mean that consumers ignore price, just that they are less aware of it than they otherwise might be. Many consumers have large deductibles as well as coinsurance or copayments in their pharmaceutical coverage, making them more sensitive to cost. The result is that consumers bear a much higher share of the expenditures for prescription drugs than they do for physician or hospital services. In 1991, consumers paid out of pocket for 55 percent of prescription drug expenditures, 18 percent of physician services, and 3 percent of hos-

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32. "Single Digit Growth for World Pharma [sic] Market," *Scrip Magazine* (January 1994), p. 32.

33. Doctors in managed health care provider groups may face different incentives.

34. Office of Technology Assessment, *Pharmaceutical R&D*, p. 239.

pital services.<sup>35</sup> And, as noted above, generic substitution is available in most states.

## Changing Factors in the Market

The behavior of consumers and third-party payers is changing. Third-party payers are increasing the share of total prescription costs that they pay, but also increasingly trying to rein in their costs. In addition, consumers are increasing their use of generic substitutes.

**Pharmaceutical Benefit Management.** The desire to control pharmaceutical costs has generated a growing number of companies devoted to managing pharmaceutical benefits for unions, insurance companies, and large corporations. The net effect of their efforts is to reduce pharmaceutical costs to the consumer through increased use of generic drugs and other techniques. (Managed care providers also perform many of these cost-reducing functions within their organizations.)

In a sense, these benefit-management companies act as agents of the pharmaceutical-purchasing public. They buy generic drugs where and when they can. When generic drugs are not available, they use buying power to get a good price, especially when imitative drugs are available. In economic terms, these techniques make demand for the products of any drug manufacturer more elastic--that is, more price sensitive--for whole segments of the population. This greater price sensitivity lowers the market power of a drug manufacturing firm by reducing its ability to price its products above the unit cost, which would be the price in a purely competitive industry.

In order to wield this buying power, a benefit-management firm has to press purchasing discipline on doctors and patients. It can negotiate a significantly better price with a drug company only if it can ensure that its members will only buy specific drugs. Among the tools at its disposal are approved drug lists (often called formularies) and even electronic point-of-sale technology, so that the pharma-

cist can intervene to persuade doctor and patient to use listed drugs. Similarly, organizations that manage prescription benefits can vary drug reimbursement for the patient according to the formulary: a high percentage for drugs on the formulary, a low percentage for drugs not on it. According to some industry estimates, the majority of people who have pharmaceutical benefits either have such restrictions on their benefits or will soon have them.

Even now, those companies that choose to can enforce their restrictions in order to get the discounts. Kaiser Permanente, the largest health maintenance organization in the United States, for instance, distributes its formulary to its doctors, tracks their prescribing behavior, restricts access to them by representatives of pharmaceutical companies, and provides information to them concerning the reasons that certain drugs are on the formulary. Consequently, as of May 1993, 96 percent of Kaiser's prescriptions were from the formulary and 75 percent of the prescriptions were for generic drugs.<sup>36</sup>

In general, however, it is difficult to estimate how much consumers and third-party payers truly have exercised buying power to reduce pharmaceutical costs. Although the trend seems to be definitely in the direction of managing pharmaceutical benefits, the actual carrying out of the demand management techniques may still be sparse and uneven. For example, a recent study in the *Journal of the American Medical Association* suggests that marketing by pharmaceutical companies can influence the inclusion of drugs on formularies, even when there is little, if any, therapeutic advantage.<sup>37</sup> The study showed that doctors are still able to choose the drugs they deem necessary for treating hospital patients, despite the attempts of hospital administrators to limit pharmaceutical spending through approved drug lists, and that doctors' decisions are substantially influenced by direct contact with pharmaceutical companies.

35. Congressional Budget Office, *Trends in Health Spending: An Update* (June 1993), pp. 56, 60, 66.

36. Sylvia Morrison, "Prescription Drug Prices: The Effect of Generics, Formularies and Other Market Changes" (Congressional Research Service, August 17, 1993).

37. About half of the doctors' requests for addition were for drugs with some therapeutic advantage. Mary-Margaret Chren and C. Seth Landefeld, "Physicians' Behavior and their Interactions with Drug Companies," *Journal of the American Medical Association* (March 2, 1994), pp. 684-689.

The definitions of managed care are also murky. Some traditional fee-for-service health plans have managed drug benefits. Even when drug benefits are managed, it does not necessarily mean that the plan is exercising substantial market power on behalf of consumers. For instance, although Merck recently reported that fully half of its sales come from managed care plans and that the company expects this share to rise, the firm's definition of a managed care plan is unclear.<sup>38</sup>

One factor limiting the further penetration of formularies is the lack of reliable studies of cost-effectiveness. The group with the largest individual incentive to undertake such studies, the pharmaceutical companies, is limited by FDA regulations that require its promotional claims to be backed by high-quality university studies, which are time-consuming and expensive.<sup>39</sup> The FDA must approve the claims, a process that also takes time. All users, including their agents in the health plans, may have sufficient economic incentive to explore the cost-effectiveness of medical procedures and drugs, but they cannot do it individually. Thus, such research, although growing rapidly, is still in its infancy.

**Increasing Use of Generic Drugs.** Another growing force in the U.S. pharmaceutical industry is the increasing penetration of the market by generic drugs. Under the Drug Price Competition and Patent Term Restoration Act of 1984, the Congress and the Reagan Administration chose to make generic drugs the principal cost containment vehicle in the pharmaceutical market by establishing a shorter process of regulatory approval for generic drugs. Consequently, the market share of generic drugs has been increasing. In 1980, generic drugs accounted for 23.3 percent (in units) of all pharmaceuticals sold in the United States.<sup>40</sup> By 1991, generic drugs accounted for a much higher share of the units sold

--almost 40 percent, according to one estimate.<sup>41</sup> (In terms of value, generic drugs represented 13 percent of U.S. sales in 1989.)<sup>42</sup>

The existing group of generic drugs is large and should grow further over the next several years because many brand-name pharmaceuticals will be losing their patent protection. Drugs losing their patents between 1992 and 2000 include 54 of the 100 most popular drugs and account for an approximately equal share of such sales. Furthermore, only one of the 10 most widely used drugs will not lose its patent between now and 2000. That drug is Zantac, and although it is not losing its patent, its closest competitor, Tagamet, did this year.<sup>43</sup> Because of the number of important drugs that will lose their patents during the early 1990s, the revenue share filled by generic drugs is expected to rise to more than one-quarter of the market by the middle of this decade.<sup>44</sup>

The market-based movement towards generic drugs is likely to lower the profitability of investment in R&D less than regulatory or government-based attempts at cost containment. One reason is that generic versions of a pharmaceutical product come at the end of its patent life, which means that the present value of the lost sales is lower than if the generics could compete right away. By contrast, rebates, such as those currently given drugs paid for by Medicaid and proposed by the Administration for Medicare, are given from the date of introduction of a new drug and have a higher present value. Thus, an immediate rebate is likely to have a larger effect on the expected profitability of a drug than will its eventual displacement by generic equivalents. Similarly, other aspects of the Administration's proposal

38. Michael Waldholz, "Pharmaceutical Firms' Profits Rise Expected to be Slim," *The Wall Street Journal*, January 18, 1994, p. B12.

39. For one proposal, see John Calfee, "The Leverage Principle in FDA Regulation of Information" (paper presented at the American Enterprise Institute Conference on Competitive Strategies in the Pharmaceutical Industry, Washington, D.C., October 27-28, 1993).

40. Alison Masson and Robert Steiner, *Generic Substitution and Prescription Drug Prices: Economic Effects of State Drug Product Selection Laws* (Federal Trade Commission, 1985), p. 1113.

41. Morrison, "Prescription Drug Prices," p. 1.

42. International Trade Commission, *Global Competitiveness of U.S. Advanced-Technology Manufacturing Industries: Pharmaceuticals*, pp. 4-3 and 4-4.

43. "100 Powerhouse Drugs," *Med Ad News Supplement* (May 1993), pp. S5 and S30. In addition, there is a lawsuit regarding the status of the patent on Zantac.

44. International Trade Commission, *Global Competitiveness of U.S. Advanced-Technology Manufacturing Industries: Pharmaceuticals*, pp. 4-3 and 4-4.

that have an immediate impact on a drug's price would be more likely to affect the profit on investment in R&D than would competition from a generic.

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## Conclusions

In the continuum between a perfect monopoly and perfect competition, the pharmaceutical industry can

probably best be described as imperfectly competitive: firms have some power to raise prices and generate excess profits. But events in the pharmaceutical market--including growth in generic drug use and more use of collective buying strength on the part of third-party payers--are beginning to undermine this power and make the industry more competitive.