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# Does Intellectual Property Restrict Output? An Analysis of Pharmaceutical Markets

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## Abstract

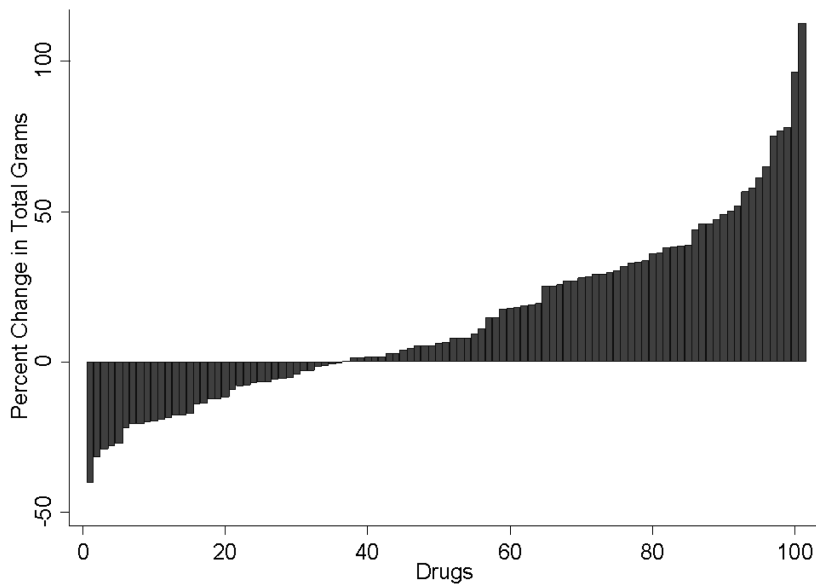
Standard analysis of intellectual property focuses on the balance between incentives for research and the welfare costs of restraining output through monopoly pricing. We present evidence from the pharmaceutical industry that output often fails to rise after patent expirations. Patents restrict output by allowing monopoly pricing but may also boost output and welfare by improving incentives for marketing, a form of nonprice competition. We analyze how nonprice factors such as marketing mitigate and even offset the costs of monopoly associated with intellectual property. Empirical analysis of pharmaceutical patents suggests that, in the short run, patent expirations reduce output and consumer welfare by decreasing marketing. In the long run, patent expirations benefit consumers, but by 30 percent less than would be implied by the reduction in price alone. Focusing only on the pricing issues of intellectual property may lead to incomplete or even inaccurate conclusions for welfare.

## 1. Introduction

Intellectual property (IP) spurs innovation by increasing the rewards for discovery, but it does so by granting a monopoly in the event of discovery. According to standard analysis (see Nordhaus 1969), the research and development (R&D) benefits of a patent system must be weighed against the associated output lost to patent monopolies, which reduce price competition. This analysis implies that patent expirations always lead to increased competition, lower prices, and higher market output. From this point of view, Figure 1 is surprising. The figure depicts

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**Figure 1.** Effect of patent expirations on quantity sold, for a sample of prescription drugs

the percentage change in quantity—comparing the month before patent expiration with the month after—for a sample of U.S. pharmaceutical products whose patents expired between 1992 and 2002.<sup>1</sup> For about 40 percent of drugs, output falls after patent expiration and expands only modestly for many others.

Figure 1 suggests that there may be more to a patent expiration than the end of monopoly pricing alone, and consequently more to the welfare effects of IP protection. We argue that the standard analysis of IP must incorporate various aspects of nonprice competition, which may reinforce or mitigate the effects of monopoly pricing. For example, while monopolists have incentives to restrict quantity through higher prices, they may also have different incentives to promote their product through advertising, to provide durability of goods, and to vertically integrate with upstream or downstream firms. These forms of nonprice competition can change the efficiency impact of IP regulations by either mitigating or reinforcing the conventional effects on price competition.

Motivated by this idea, we examine the effect of marketing—a particularly important form of nonprice competition—on the static and dynamic efficiency

<sup>1</sup> To be specific, Figure 1 shows the percentage decline or growth in prescriptions filled (in grams) between the month before and the month after expiration. More detail on the data is given in Section 3.2.

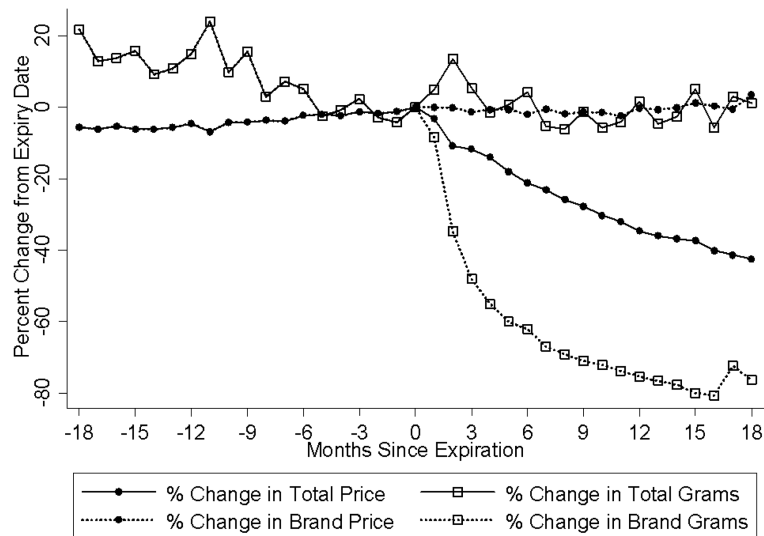


Figure 2. Mean trends in price and quantity for fully advertised drugs

of patents.<sup>2</sup> Patent expirations decrease the private returns to marketing, which may be limited when goods are sold at marginal cost. As a result, expirations may actually reduce output if they decrease marketing effort by enough to offset the impact of price reductions. From a normative point of view, advertising by a monopolist is valuable because it moves output toward its efficient level. Notably, this is true even if advertising is purely persuasive and provides no valuable information to consumers.

To assess the importance of these arguments more fully, we estimate the impact of marketing on welfare using patent expirations in the U.S. pharmaceuticals market between 1990 and 2003. This industry is a natural choice for empirical analysis of R&D and marketing because it is among the highest spending industries in both categories. The industry spends approximately 15 percent of sales on marketing and 16 percent of sales on R&D.<sup>3</sup> By comparison, about 2 and 3 percent of U.S. gross domestic product are allocated to advertising and R&D, respectively.

Figures 2 and 3 provide some illustrative data from the pharmaceutical in-

<sup>2</sup> Different forms of nonprice competition merit separate analyses. For example, monopoly has a range of possible effects on quality provision. Mussa and Rosen (1978) show that monopolists will overdifferentiate their product and induce a lower quality choice by consumers. Subsequent authors have demonstrated how these results can be altered or even reversed under different specifications for demand (Gabszewicz and Wauthy 2002).

<sup>3</sup> Many drugs have seen dramatic increases in direct-to-consumer (DTC) advertising since the change in Food and Drug Administration guidelines on such advertising in 1997.

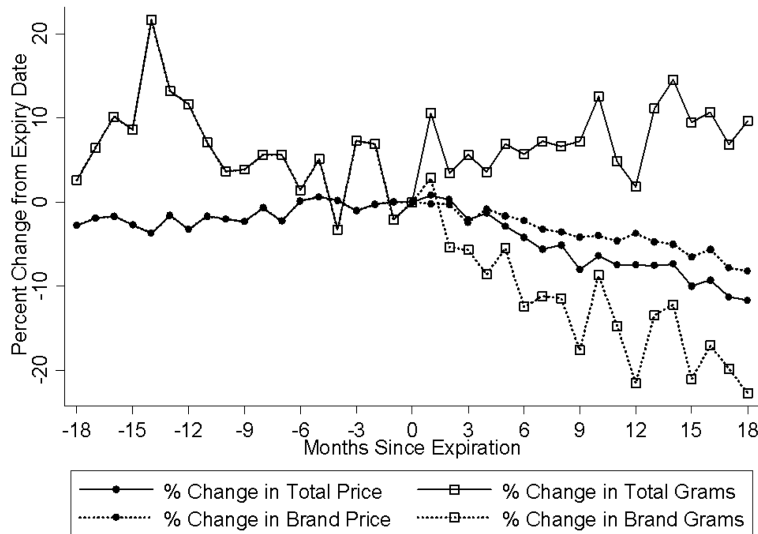


Figure 3. Mean trends in price and quantity for drugs not fully advertised

dustry. The figures are based on data—described in Section 3.2—from 101 molecules with expiring patents. Each figure depicts monthly time series, relative to the month of patent expiration, for branded quantity, branded price, total quantity, and total price, at the molecule level. Figure 2 depicts these trends for molecules that are advertised, while Figure 3 does so for molecules that are not.<sup>4</sup> For all drugs, price declines steadily after the month of patent expiration. For the nonadvertised drugs, quantity rises fairly steadily over this period as well. However, for the advertised drugs, quantity appears flat after patent expiration. This suggests that patent expirations have different effects for advertised drugs than for their nonadvertised peers.

To estimate these effects more formally, we use the timing of patent expirations as instruments for the price and incentives of a molecule. Changes in supply induced by patent expiration allow us to identify the demand for drugs as a function of both price and advertising effort. The estimated demand function implies that in the short run (the first 5 months), output decreases after patent expiration because the reduction in advertising more than offsets the reduction in price. This output loss is estimated to cost consumers roughly \$1 million per month for each drug whose patent expires. Not until several years have elapsed

<sup>4</sup> Figures 2 and 3 show the percentage change between the month of patent expiration and the month shown on the *x*-axis. In all cases, price is per gram. A fully advertised drug has at least 1 month of nonzero samples dispensed, at least 1 month of nonzero promotional visits to doctors, and at least 1 month of nonzero medical journal advertisements. Drugs that do not meet these criteria are considered to be not fully advertised. The figures are discussed in more detail in Section 3.3.

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