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A multiple regression model to explain the cost of brand-drugs

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ABSTRACT

The goal of this study is to examine how four factors - level of competition, therapeutic purpose, age of the drug, and manufacturer play a role in the pricing of brand-name prescription drugs. Understanding how these factors contribute to high drug prices will allow players in this supply chain to negotiate more favorable contract terms. This can be a large benefit to society as this insight can lead to improved efficiency in pricing and increased savings, which can be passed to the consumer.

We develop measures for these factors based on publicly available information. Using data on the wholesale prices of prescription drugs, we estimate a model for drug prices based on our measures of competition, therapeutic purpose, age, and manufacturer. Our analysis reveals that these factors are significant in estimating drug prices. We observe that proliferation of dosing levels tends to reduce the prices, therapeutic conditions which are both less common and more life-threatening lead to higher prices, older drugs are less expensive than newer drugs, and some manufacturers set prices systematically different from others even after controlling for other factors. These findings indicate that publicly observable factors can be used to explain drug prices.

1. Introduction

Recently, the pharmaceutical industry has been under much public scrutiny. Consumer watchdogs and the media have raised concerns over the rising cost of health care, of which prescription drugs account for 10% [29]. U.S. health care spending has increased 2.4% faster than GDP since 1970 and is expected to exceed $4.3 trillion in 2018 [29]. In 2009, health care spending hit an unprecedented 17.6 percent of GDP [33].

Prescription drug prices have been a key contributor to the rise of health care expenditures [11]. Moreover, drug research and development (R&D) costs continue to rise, making it more difficult for manufacturers to maintain their high levels of profitability without increasing drug prices. In response to public concerns, the vice president of The Pharmaceutical Research and Manufacturers of America (PhRMA) stated that: “All companies make their own independent pricing decisions based on many factors, including patent expirations, the economy, … and huge research and development costs…” [38]. Whether or not these statements are true, identifying factors that drive prescription drug prices is in the public interest.

Understanding the factors which correlate with high drug prices will allow pharmacies, hospitals, insurance providers and the government to negotiate more favorable contract terms/pricing. Competition among health care providers will result in some of these negotiated savings being passed on to consumers in the form of lower prices. As a result, healthcare costs will be lower than they otherwise would be and health outcomes have the potential to be improved as more patients are able to afford the appropriate medication. This paper offers a practical tool to assist participants down the health care supply chain to negotiate effectively with drug manufacturers, which can ultimately be of enormous benefit to society.

However, one challenge of such research is data – some of the important factors, such as R&D costs, marketing efforts, and supply chain costs of individual drugs, are not observable to the public. In absence of these data, we have to take a different approach by developing measures based on publicly observable information for four classes of factors: the level of competition, the nature of the condition that the drug treats, the number of years that the drug has had FDA approval, and the manufacturer who developed the product. The objective of this paper is to test the significance of these measures in estimating prices for brand drugs.

The price measure we focus on in this paper is the Wholesale Acquisition Cost (WAC) set by the manufacturer. This wholesale

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price, WAC, is formally defined in the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 as "the manufacturer's list price for the pharmaceutical or biological to wholesalers or direct purchasers in the United States, not including prompt pay or other discounts, rebates or reductions in price, for the most recent month for which the information is available, as reported in wholesale price guides or other publications of pharmaceutical or biological pricing data [40]."

WAC plays an important role in the pharmaceutical supply chain because it serves as a reference for all other prices, rebates, and reimbursements. While WAC is not the true price between players in the supply chain, it is the basis in which the actual prices are determined [50]. For example, a major manufacturer disclosed that the distributor pays between 93% and 97% of WAC. Almost all distributors also receive a prompt-pay discount that is 2% of WAC [50]. The manufactuer also revealed that the retailer obtains a discount between 1% and 3% of WAC. All other prices in the supply chain, including production costs and holding costs are also based off of WAC. The exact discount depends on the negotiations that take place between the two players (obviously larger players are able to negotiate larger discounts) and is proprietary information. However, the discount percent is consistent across drugs for each player. Thus, while WAC is almost never the price paid, it is still worth estimating because it determines the final price paid by players in the supply chain, including government drug plans.

We develop a linear model to estimate WAC using covariates that are easily accessible to all market participants. While previous research has studied some of these factors, our analysis is unique in two aspects: first, we develop measures for the aforementioned four classes of factors based on information observable to the public; second, we develop a unifying framework to explain prescription drug prices by this broad range of factors. With such a reference model at hand, wholesalers and insurers can be more informed and stand at a better position to estimate and negotiate prices with the manufacturers.

The rest of this paper is organized as follows: Section 2 provides a literature review. Section 3 presents the research methodology and several hypotheses regarding drug prices in the pharmaceutical industry. We also discuss the data used in the study. In Section 4, we present our findings and discuss their implications. Finally, we conclude the paper in Section 5 and discuss extensions and limitations of our study.

2. Literature review

There have been a number of studies discussing the costs and accessibility of health care (i.e. [36]. For example [34], describe an R & D strategy for cost reduction and applies it to the pharmaceutical industry [26]. Performs flow analysis strategy to highlight cost reduction opportunities in Medicaid [6]. Discuss different funding options for physician and hospitals that will achieve sufficient resource allocation. They jointly simulate the behavior of both players to consider their interactions under different funding strategies.

There are a number of studies that focus on the price-setting mechanism of prescription drugs [16]. Explain that the healthcare industry is different from other industries at price setting because the consumer is not always conscious of the price of a product. Indeed, if the patient has some form of insurance that pays for some or all cost of the drug, the patient may not be aware of the drug price. Consequently, unlike other industries, the demand for prescription drugs may not be strongly influenced by prices [30]. Defends the high price of prescription drugs, showing how an innovative drug can keep a patient out of the hospital altogether or delay the illness. He points out that while some drugs do not reduce healthcare expenses, they do improve the quality of life. He argues that drug pricing should be based on the benefit provided to the patient [31]. Perform an empirical study and conclude that drug prices are determined by the level of therapeutic advancement and the prices follow a modified skimming/penetration pricing strategy introduced by [15].

[14] argue that drug prices should be based on the health benefit. They look at cancer drugs and find that manufacturers have an incentive to charge higher prices because consumers are not price sensitive. They further show how insurance companies do not set adequate constraints to keep prices in line with health benefits [2]. Examines the variables that may influence manufacturers when they set the price of patent-protected brand drugs. He concludes that the price is determined by the marginal value that the drug brings to the end-users rather than marginal production cost. He notes that prices are relatively constant across dosage levels and concludes that prices are not affected by active ingredient levels. In addition, he discusses a number of other economic factors that contribute to drug prices, but argues that for short-run pricing, R&D costs are sunk and therefore irrelevant to the manufacturer's pricing decision. We refer the reader to [44] for a summary of the trade off between maintaining low prices to stimulate demand versus setting high prices to provide incentives for new product development.

Building on this line of work are a number of papers that discuss the retail price of brand drugs when generic substitutes are introduced [2]. Finds that brand drugs do not engage in price competition with generic substitutes. Instead, brand drug prices may actually increase as their sales are concentrated in the smaller market of brand-loyal customers. Consistent with Berndt's theorized explanation, some empirical research [21,23] has shown that brand prices do rise in the face of generic competition. Other research does not support the findings of these studies, and conclude that brand prices may fall but only by a small percentage when generics are introduced. For instance [8], perform a regression study on thirty drugs that went off patent between 1976 and 1987 and conclude that brand-drug prices have a small response when generics are introduced [20]. To study the pricing behavior when generics were introduced. They found that increased competition among generic drug producers did account for reduced generic prices. However, this increased competition among generic drugs did not affect brand-drug prices. See [42,43]; and [3] for more discussion on the relationship between prices and generic entry.

Other articles look at factors such as market share rebates to explain drugs prices [19]. Compare brand price changes with high shares (55% or more) of elderly purchasers and those with relatively low shares (35% or less) of elderly purchasers. They find that prices for drugs used more heavily by the elderly grew 24.2% over the three years compared with 18.8% for those less heavily used [5]. Describe how the prices influence how insurers set coverage for drugs. They examine three scenarios: one where a brand drug has no substitutes in the therapeutic class, one where several drugs are partial but not perfect substitutes within a therapeutic class (two or more drugs are still on patent), and one where generics are present to compete in the class. They find that insurers set preferred drugs and tiers to stimulate competition and that the number of manufacturers that compete with each other within a class has implications for the extent of price competition among manufacturers. Many such articles discuss the prices that consumers pay for a drug. However, reimbursements and negotiations of prices by those in the supply chain are based off of WAC, which is rarely analyzed. Our analysis examines the WAC of drugs to determine how this benchmark is derived.