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# THE ROLES OF MARKETING, PRODUCT QUALITY AND PRICE COMPETITION IN THE GROWTH AND COMPOSITION OF THE U.S. ANTI-ULCER DRUG INDUSTRY

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## ABSTRACT

The introduction of Tagamet in the United States in 1977 represented both a revolution in ulcer therapy and the beginning of an important new industry. Today there are four prescription $H_2$-antagonist drugs: Tagamet, Zantac, Pepcid and Axid, and they comprise a multi-billion dollar market for the treatment of ulcers and other gastric acid conditions. In this paper, we examine the determinants of sales in this market, using a carefully constructed data set made possible by IMS America. We concentrate particularly on the marketing of these drugs to physicians through detailing and medical journal advertising, and we make an innovative attempt to distinguish between "industry-expanding" and "rivalrous" marketing efforts. We find that the impact of total marketing on the expansion of overall industry sales declines as the number of products on the market increases. In addition, we find that the stock of industry-expanding marketing depreciates at a near-zero rate, while the stock of marketing oriented towards rivalrous market share competition depreciates at a 40% annual rate. We also find that the products' sales are affected significantly by price, quality attributes (such as number of FDA-approved indications and number of adverse drug interactions), and order of entry into the market.



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# THE ROLES OF MARKETING, PRODUCT QUALITY AND PRICE COMPETITION IN THE GROWTH AND COMPOSITION OF THE U.S. ANTI-ULCER DRUG INDUSTRY

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## I. INTRODUCTION

The introduction of Tagamet into the U.S. market in 1977 marked the beginning of a revolutionary treatment for ulcers, and the emergence of a new industry. What distinguished the products of this new industry was their ability to heal ulcers and treat pre-ulcer conditions pharmacologically on an outpatient basis, thereby substituting for traditional, and costly, hospital admissions and surgeries. Tagamet, known medically as an $H_2$-receptor antagonist, promoted the healing of ulcers by reducing the secretion of acid by the stomach.

A striking feature of the anti-ulcer market is that it has sustained growth in sales (quantity, not just revenue) for over fifteen years, and still shows no sign of slowing. New prescribing habits have clearly diffused to an ever-increasing number of physicians. Today there are a total of four $H_2$-receptor antagonists: Tagamet, Zantac, Pepcid and Axid. Zantac is now the United States' (and the world's) largest selling prescription drug, having estimated worldwide sales in 1992 of about $3.5 billion. Moreover, both Zantac and Tagamet are among the ten top selling prescription drugs in the U.S.[1]

In this paper we attempt to explain the growth and changing composition of the anti-ulcer drug market. Although we examine the impacts of pricing and product quality, we devote particular attention to the role of firms' marketing efforts. We distinguish between two types of marketing: (i) that which concentrates on bringing new consumers into the market ("industry-expanding" advertising), and (ii) that which concentrates on competing for market shares from these consumers ("rivalrous" advertising). Note that of these two types, the market-expanding advertising has particular economic importance in a new market, because no matter how potentially beneficial is the new product, it can generate no consumer surplus until consumers have been informed about the new product and have been induced to experiment with it.

As others have done, we estimate the effects of industry-expanding advertising on sales. However, we also examine how the effectiveness of this socially-beneficial type of advertising varies with market structure. We exploit two facts. First, in the earliest years of the market when Tagamet was a monopoly product, by definition, all of the Tagamet advertising was market-enhancing. Second, the timing of entry is largely exogenous in this industry, for patent protection ensures that firms cannot enter until their research laboratories develop a new molecule that has the desired impact and approval for use is given by the Food and Drug Administration (FDA).

We also analyze factors affecting the market shares earned by the limited number of firms in this market. A principal theme is that the patent and pioneer advantages to Tagamet were overcome by Zantac, the second entrant, through costly but effective marketing efforts, especially efforts that interacted with the apparent existence of favorable adverse drug interaction profiles relative to Tagamet. Moreover, Zantac's relative price, although higher than Tagamet's, declined substantially over time. Thus, evidence from this industry suggests that while the barriers to entry from patent and first-mover advantages are considerable, they are not insurmountable.

Our empirical analysis is based on an unusually rich and detailed data set. Beginning with the introduction of Tagamet in July 1977, we have obtained monthly data, for each of the products in this market, on quantity and average price of sales (separately for the retail drug and hospital markets), marketing efforts (minutes of detailing by sales representatives to physicians, and professional medical journal advertising), as well as product quality information including side effect profiles, adverse drug interactions, efficacy, dosage forms, and indications for which the product had received approval from the U.S. Food and Drug Administration.

We begin in Section II by providing background information on ulcers and ulcer treatments.

Then in Section III we present an overview of data trends. We describe the growth of the anti-ulcer market, as well as the pricing and marketing behavior of the various market participants. We move on in Section IV to develop an econometric framework for modeling the growth of the anti-ulcer industry. In particular, we examine the effects of "informative" or market-expanding marketing efforts on industry sales. In Section V we report findings from an analogous attempt to model factors affecting market shares earned by the various products in this industry. Here we examine in particular the roles of rivalrous marketing, product quality, order of entry and price competition. Finally, in Section VI we offer some concluding observations and suggestions for future research. The paper also includes a data appendix.

## II. BACKGROUND ON ULCER TREATMENTS[2]

Peptic ulcer disease occurs in 10-15% of the U.S. population. Ulcers located in the stomach proper are termed gastric ulcers (GU), while those in the duodenum (the bulb connecting the stomach to the small intestine) are called duodenal ulcers (DU). A related non-ulcerous condition is gastroesophageal reflux disease (GERD), which occurs in the esophagus. What the three conditions have in common is that they involve inflammation of tissue in the digestive tract that is exacerbated by the presence of the body's naturally occurring gastric acid. GERD and duodenal ulcers have roughly the same rates of occurrence in the U.S. population, whereas gastric ulcers are about one-fourth as likely. The incidence of ulcers in adult males is about twice that in adult females, and appears to be most common in individuals twenty to fifty years old.

Ulcers have a long history of clinical treatment. There is evidence that already in the first century A.D., coral powder (calcium carbonate, an antacid) was used to relieve symptoms of dyspepsia.[3] Early in the 20th century, conventional medical wisdom conformed to the notion "no acid, no ulcer." As a result, until the 1970's recommended treatments sought to neutralize gastric acid, and often

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