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Competitive diffusion of new prescription drugs: The role of pharmaceutical marketing investment

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ABSTRACT

We investigate the impact of marketing interventions on the diffusion of new products in a competitive setting. We develop a family of trial–repeat diffusion models to identify the longitudinal effects of marketing efforts, and complement this with a cross-sectional analysis to identify the between-drug effects. We believe that we are the first to consider both longitudinal and cross-sectional marketing effects in a trial–repeat diffusion context. The models are calibrated on 34 drugs in three therapeutic categories using monthly data. Our longitudinal analyses demonstrate that the trial rate responds positively to increases in own marketing expenditures but is affected negatively by competitors' expenditures. We show how these within-drug analyses provide opportunities for accelerating the diffusion process by reallocating marketing expenditures over time. The cross-sectional analyses demonstrate that pharmaceutical marketing has both an informative and a persuasive influence on the diffusion of new drugs. We find that direct-to-consumer advertising does not affect the trial nor repeat rates during the first months after introduction. We illustrate the managerial relevance of our results and find that a reallocation of marketing budgets does not alter the saturation level, but can help in attaining this level faster. We show that this has a great effect on sales, market share and ROI.

1. Introduction

Product innovation is widely recognized as an important source of competitive advantage and a driver of firm's growth and profitability (Salomo et al., 2007), the stock returns for the Top 25 innovative companies are 134% higher than the others over 5 years (Appel, 2013). In many, if not all, industries, new product development represents a top priority, because modern product life cycles are shrinking, and competition has intensified in the drive to satisfy customer needs (Filippini et al., 2004). However, almost half the resources that U.S. industries devote to product development go to products that fail. The failure rate of new products reaches 90% (Nielsenwire, 2013). Others estimate that only 5% of new consumer products launched are successful in the market (Nobel, 2011). The situation is even more challenging for manufacturers of pharmaceuticals, an industry characterized by long development times, low success rates, high development costs, high capital requirements for manufacturing facilities, delayed feedbacks, and broad uncertainty in sales estimates (Blau et al., 2004; Chiou et al., 2012). Typically, the process of clinical trials and Food and Drug Administration (FDA) approvals required of a pharmaceutical company takes approximately 10 years after filing a patent for a particular molecule. On average, only one or two of every 10,000 substances synthesized in laboratories, will successfully pass all the phases to become marketable drugs (EFPIA, 2012). The average cost of successfully launching a drug to market achieves $1,137 million (Deloitte and Thompson Reuters, 2013). In fact, pharmaceutical firms such as GlaxoSmithKline and Eli Lilly

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outsource much of their research on new products to reduce the amount of dollars that the development and launch of new drugs require (Calantone and Stanko, 2007). The R&D internal rate of return of leading pharmaceutical firms was 7.2% in 2012 (Deloitte and Thompson Reuters, 2013).

As time-based competition increases due to the globalization of business (Harvey and Griffith, 2007), it is important for any manufacturer to discover factors that increase and accelerate adoption of newly developed products, which can increase the profitability and shorten the earn-back period of R&D investments. For innovative pharmaceutical companies this is even more important, because the competitive advantage of a new pharmaceutical product is usually only temporary due to patent expirations. Also from a patient's point of view it is important to accelerate new product adoption as health outcomes may improve as a result of the rapid diffusion of new drugs that provide unique and superior benefits.

Which role plays pharmaceutical marketing in the diffusion process of new drugs? Measuring the effects of pharmaceutical marketing and understanding the importance of their informative and persuasive roles on the diffusion process of new drugs can help manufacturers allocate resources to pharmaceutical marketing more efficiently. In this study, we address these important issues.

Firstly, we therefore develop diffusion models that determine the effects of pharmaceutical marketing expenditures on the diffusion of new drugs. Explicitly including marketing variables in diffusion models not only provides a better description of reality but also offers guidance for managerial decision makers on how to spend their marketing budget (Kalish and Sen, 1986; Mahajan and Muller, 1991; Bass et al., 2000). However, the literature is inconclusive about the appropriate inclusion of marketing variables in diffusion models. Earlier diffusion studies that accommodate the effects of marketing variables can be classified according to the way they include these effects in the model. A first stream of studies models the effects of for example manufacturer's advertising as an external influence of marketing efforts on trial rates, (e.g., Lilien et al. (1981); Hahn et al. (1994)). In contrast, a second group of studies assumes that marketing affects trial through internal influence, such that it affects the interpersonal communication among physicians who already have adopted the new drug and potential adopters (e.g., Simon and Sebastian (1987)). A third group of studies considers both external and internal effects of marketing on trial; this is known as the mixed influence effect of marketing (Parker and Gatignon, 1994). A fourth stream of research considers the possibility that marketing instruments influence the repeat rate (e.g., Mesak and Berg (1995)). However, there is no consensus on which of the four ways is most appropriate to accommodate the effects of marketing efforts in diffusion models. This paper is the first that does not make a priori assumptions about how marketing efforts should be included in diffusion models. Instead, we empirically investigate the most appropriate location of marketing variables in trial–repeat diffusion models, using data of 34 individual new drugs in three different therapeutic categories.

Most studies in these four research streams model longitudinal effects of marketing. Thus, they employ a within-brand analysis, studying how marketing affects the diffusion process of a new product over time. This is important because it creates opportunities for influencing the diffusion process by reallocating marketing expenditures over time. However, other studies also indicate that cross-sectional variation in sales (i.e., across geographical markets or brands) may be much greater than longitudinal variation (Bronnenberg et al., 2007). However, to the best of our knowledge, marketing diffusion literature has largely neglected between-brand analyses.

Secondly, there is an unresolved debate over the years around the potential impact of pharmaceutical marketing on physicians' behaviors (Lim and Kirikoshi, 2008). Pharmaceutical industry spent billions of dollars to promote its new products to physicians (push marketing) and consumers (pull marketing), expecting that this has positive effects on physicians' prescriptions. These promotional activities can generate two types of effects on prescription behavior: it can help physicians making better and informed decisions (informative effect), but it can also create market power (persuasive effect). These two types of effects are central to the debates on the role of pharmaceutical marketing (Ching and Ishihara, 2012). If one observes the pharmaceutical marketing efforts and the diffusion process of the new drugs over time, it is hard to disentangle the informative and persuasive roles of marketing. Hence, we analyze the cross-sectional effects of marketing expenditures and perform a second-stage analysis on the brand-specific estimation results. This analysis allows us to investigate the informative and persuasive roles of pharmaceutical marketing and whether the observed differences in the diffusion parameters between brands result from differences in their average marketing expenditures.

Hence, in this study we focus on exploring the role of pharmaceutical marketing investment on the diffusion process of new prescriptions using both longitudinal and cross-sectional analyses. Our results support the existence of both longitudinal and cross-sectional diffusion effects for all three categories under study. We determine empirically that marketing efforts mainly affect trial rates of new prescription drugs via external and not internal influence. We allow for heterogeneity in the effects of both push and pull marketing strategies. Specifically, from the cross-sectional analysis, we conclude that marketing expenditures affect not only the trial rate but also the repeat rate of the diffusion process of new prescription drugs. We also find that pharmaceutical marketing has both informative and persuasive effects on diffusion. In a simulation study we illustrate the implications of our results. We conclude that an appropriate reallocation of marketing expenditures over time can have a great influence on sales, market share and ROI. In particular, our simulation study shows that reallocating marketing expenditures over time can have large effects on the speed of the diffusion process and may prolong the maturity stage in the product life cycle. The simulation study also shows that the saturation level is unaffected by the total marketing budget.

The remainder of this article is organized as follows: In the next section, we review marketing issues in the pharmaceutical industry, thereafter we specify our trial–repeat diffusion model. Subsequently, we present the data that are used in the empirical study. Next we discuss the estimation results of our longitudinal and cross-sectional analyses. Finally, we summarize and discuss our conclusions. In Appendix A2 we illustrate the managerial implications of our work with simulation studies.