Manufacturing and Regulatory Barriers to Generic Drug Competition:
A Structural Model Approach

The increasing use of low-cost generics offers relief from the rising health care spending. According to the U.S. Food and Drug Administration (FDA), generic drugs have saved the health care system about $1.67 trillion over the last decade alone (Gottlieb June 21, 2017).

Competition among generic drug manufacturers could significantly reduce the price of generics. According to an FDA report on generic competition and drug prices (FDA 2005), a generic drug could cost as much as its branded version if there were only one generic manufacturer in the market. The second entrant brings the generic price down to 52% of the branded version. The price will further fall to 39% and 21% of the branded version with four or eight competitors, respectively. However, generic drug markets do not always attract a large number of manufacturers. Presently, about 10 percent of branded drugs with expired patents have no generic competition. Further, a quarter of the markets have only one generic manufacturer, and about a half of them have at most three generic manufacturers.

Multiple factors may drive generic manufacturers’ market entry decisions. Besides the market and firm characteristics, the FDA also plays an important role in determining the generic market structure. To obtain an approval to produce generic drugs, manufacturers are required to submit Abbreviated New Drug Applications (ANDAs) and demonstrate to the FDA that the generic products are safe and effective. As more branded drugs have become off-patent over the past decade, there has been substantial growth in the number of generic applications submitted to the FDA. With limited funding and staff at the FDA, its capacity to review applications could not catch up with the number of ANDAs received. As of October 1, 2012, nearly 2,300 generic drug applications were in the queue awaiting FDA’s decisions.
To address this problem, FDA initiated the Generic Drug User Fee Amendments of 2012 (GDUFA), a 5-year act aimed to speed up the ANDA review process. The act enabled the FDA to recruit more staff and keep up with its workload. As a result, the accumulated ANDA filing backlogs was mostly eliminated in 2016 (Woodcock 2016).

In this paper, we examine the following questions: (1) What are the key determinants of a generic manufacturer’s entry decision? and (2) Would a shorter review time necessarily lead to more competitive generic markets?

To answer these questions, we develop a structural model that explicitly captures firm’s decision in a simultaneous entry game. Like all other entry models, the existence of multiple equilibria is the key challenge to identification. To study heterogeneity across manufacturers without making equilibria selection assumptions, we adopt the bound approach proposed in Ciliberto and Tamer (2009). This approach allows us to capture a general form of heterogeneity but at the price of identification complexity: our model is not point identified. In addition, applying this partial identification bound approach requires a non-parametric estimation of the empirical probabilities, which can be challenging when there are a large number of characteristics under consideration. We adopt the random forest approach to estimate such probabilities with sparse models.

Another major challenge in studying entry decisions in the generic pharmaceutical industry is the lack of a unified database. To understand the determinants of a firm’s decision to enter a particular market, one needs to gather data on market conditions, drug forms, product costs, firms’ manufacturing capability and specialization. We overcome the data challenge by gleaning information from six disparate sources to collate a dataset for generic drug entries from 2002 to 2014. In particular, we acquired data from the Annual Editions of the Orange Book, the Clininformatics Data Mart, the National Drug Code (NDC) Directory, the DrugBank database, the
FDA inspection database, and the FDA report on Implementation of the Generic Drug User Fee Amendments of 2012 (Woodcock 2016). The data period is selected to avoid industry-wide merger waves and to correspond with the period of drastic changes in the ANDA review time.

Based on the estimated structural model, we conduct a policy experiment to estimate the effect of regulatory barriers on the level of competition in generic drug markets. Using two performance metrics, viz., the average number of generic entrants and the percentage of markets with at most one entrant, we find that increase in ANDA backlogs significantly reduces the level of market competition. The average number of generic entrants drops by 7% when ANDA backlogs increases from 50 cases (the actual queue length in the early 2000s) to 2,300 cases (the actual queue length in 2012). Interestingly, we find a non-monotone relationship between the percentage of markets with at most one entrant and the length of ANDA approval queue. The fraction of limited entry markets first decreases and then increases in the number of ANDA backlogs. When the ANDA backlogs starts accumulating, multiple medium-sized firms may choose to enter the market when they perceive a low probability of entry from larger manufacturers; however, when the backlog queues continues to get longer, firms may find the markets less attractive regardless of the competitors’ decisions.

To sum, our estimation results demonstrate that manufacturing complexity and the length of ANDA approval queue significantly affect the level of competition in generic drug markets. The policy simulation results reveal that the FDA should continuously monitor its ANDA review process and control the review time at a moderate speed to ensure sufficient competition in the generic markets. While long review time reduces the number of approved manufacturers in the market, too short review time may discourage entries from medium manufacturers in fear of intense post-entry competition with market leaders.