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THE IMPORTANCE OF DOCTORS' AND PATIENTS' PREFERENCES IN THE PRESCRIPTION DECISION*

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This paper studies the contribution of doctor and patient 'habit' to persistence in market shares in prescription drug markets. My unique panel dataset allows me to estimate the probability of switching brands as a function of patient and doctor attributes, with an emphasis on past prescribing behaviour so as to capture the degree of persistence. I find significant evidence of time-dependence in prescription choices for both doctors and patients, which seems to imply that in molecular submarkets in which brands are not allowed to compete on the basis of price, doctor and patient 'habit' at the micro-level can translate into sticky and persistent market shares at the aggregate level.

I. INTRODUCTION

IN THIS PAPER, I study the contribution of doctor and patient 'habit' to persistence in market shares among therapeutically equivalent prescription drugs. While, similar issues have arisen in the recent literature about the competition between generic and branded drugs, they are especially puzzling in the Italian pharmaceutical market. In Italy, regulatory fiat imposes uniform prices across all vendors of drugs which utilize the same active ingredient, thus eliminating price variation as an important avenue of differentiation among otherwise therapeutically equivalent drugs, which is true in drug markets with generic competitors. My unique panel dataset allows me to estimate the probability of switching brands as a function of patient and doctor attributes, with an emphasis on past prescribing behaviour so as to capture the degree of persistence.

This analysis can shed light on several aspects of market structure in the pharmaceutical industry. First, there is a growing body of literature

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that tries to explain observed market segmentation using data on national market shares. Empirical observations of market shares for trade-name and generic drugs in post-patent therapeutic categories in the US market usually indicate a degree of segmentation between branded drugs and their generic equivalents, arising from a finite cross-price elasticity between the two types of drugs (the cross-price elasticity between two homogeneous goods should be infinite). However, these studies ignore individual heterogeneity. The micro dataset at hand allows me both (i) to control for individual heterogeneity and (ii) to explore the degree of time-dependence in drug choices, both of which can be important in explaining the substantial and persistent differences in market shares among therapeutically equivalent drugs.

Second, in recent years, we have witnessed a surge in direct advertising to consumers by pharmaceutical companies for prescription drugs sold in the US market. The amount spent on direct-to-consumer prescription drug advertising rose from US$35m in 1987 to US$357m in 1995, US$610m in 1996, and over US$1 billion in 1997 (NERA [1999]). This spending choice reflects a widespread belief within the pharmaceutical industry that patients should have a role in the choice of *prescription drugs*. This paper directly studies the patient's role in pharmaceutical choice.

Finally, the most important institutional features of the Italian market during the sample period such as the important role of licensed products, limited patient co-payments, and lack of direct financial incentives to doctors to prescribe cheaper drugs characterize almost every EU country (NERA [1999]).

I use a new panel dataset provided by the Italian National Health Institute, which includes all the prescriptions in the anti-ulcer market from 1990–1992 for a 10% random sample of the population of Rome aged 15–85. This dataset allows researchers a glimpse into the dynamics of prescription behavior at the micro level which is not possible with the predominantly aggregate and/or cross-sectional datasets which have been used in most studies of pharmaceutical markets to date.

My main conclusions are as follows. I begin by testing the null hypothesis of whether doctors and/or patients are indifferent between *different* brands of the *same* molecule, as we would expect given their therapeutic equivalence. After rejecting the hypothesis, I attempt to isolate both the patient-level and the doctor-level factors which are responsible for product differentiation. I focus specifically on the degree of time-dependence in doctors' and patients' drug choices by testing whether the patients show state dependence in their purchasing patterns, and whether the doctors exhibit habit persistence. I find significant evidence of doctor and patient 'habit', which imply that in molecular sub markets in which brands are not allowed to compete on the basis of price, habit persistence at the micro-

level can translate into sticky and persistent market shares at the aggregate level.

The paper is organized as follows. In the next section I survey the previous empirical literature. In Section III, I describe the dataset used in the estimation. Section IV describes my empirical specification, while Section V reviews the results. A summary of the results make up the final section.

II. DOCTORS' DEMAND

While the present study focuses on doctors' demand for pharmaceutical products, most of the recent literature on pharmaceuticals (for example, Caves *et al.* [1991], Caves and Hurwitz [1988], Berndt *et al.* [1997], Scott Morton [1997, 2000], and Scherer [1993]) has focused on supply-side issues (e.g., entry, pricing, advertising, R&D races). In his comment on Caves *et al.* [1991], Pakes [1991] argues that a panel following doctors' prescriptions over time would be the only way to understand the major determinants of the demand for pharmaceuticals. The panel data I use allow me to separately identify doctor and patient effects.

Much of the previous work on the demand for pharmaceuticals has used aggregate, market-share data, which are much better suited to measuring the degree of differentiation between various drugs rather than explain its causes. For example, Stern [1995] finds low substitutability between branded and generic drugs, while Ellison *et al.* [1997] find a high elasticity of substitution between generic and branded drugs.

One recent microdata-based analysis of the demand for pharmaceuticals is that by Hellerstein [1998]. She focuses on doctors' choices between branded and generic versions of drugs for which a patent has recently expired. Significantly, she finds some evidence of habit persistence in the prescription behavior of physicians, even after controlling for observable characteristics of physicians and patients. Unfortunately, her dataset does not allow her to test for patients' effects owing to data limitations, while her dataset allows for an analysis of financial incentives due to third-party payer variation. My dataset, on the other hand, has multiple observations for doctor-patient interactions, prescription of the same molecule by a single doctor to many patients, and prescriptions of the same drug by many doctors.

Gorecki [1986, 1987] analyzes competition between patent holders and licensees in Canada: an institutional setting very similar to the Italian market. He only observes aggregate data, but he is able to take advantage of the regulatory variation among Canadian provinces to identify competitive effects in his empirical analyses. Gorecki's conclusions in [1986] are consistent with my results: '... Since physicians still write, by and large, brand name prescriptions for the pioneering

brand, unless an element of price competition is introduced at the level of the pharmacist the pioneering brand will continue to dominate the market [...]. Hence it is the combination of attempting to nullify quality differences between the pioneering and late entrant brands *and* introduction of price competition that results in the late entrants capturing market share'.

Pharmaceutical markets are subdivided into therapeutic classes. Following most of the recent economic literature on pharmaceuticals (e.g., Stern [1995]), I regard a therapeutic class as having several sub-markets. I define a *therapeutic market* as a 4-digit ATC code (for example, A02B contains all the anti-ulcer drugs), and a *sub-market* as a specified molecule (for example, *ranitidine*). The ATC code is an international classification scheme which classifies drugs by target part of the anatomy, mechanism of action, and chemical and therapeutic characteristics. This is a natural definition of demand because a 4-digit ATC code includes all the molecules which can theoretically be prescribed for a certain diagnosis. The molecules themselves differ according to side effects, interactions with other drugs, specific indications and prices. In the markets I study, a physician typically decides the appropriate molecule for the diagnosis and then she decides which trade-name[1] version of the molecule to prescribe to the patient.

My work focuses on a particular therapeutic market: anti-ulcer drugs (A02B). I analyze this market because it accounts for a considerable proportion of world-wide expenditure on pharmaceuticals (around 5%, IMS International [1996]). Ulcers also required repeated treatment in the early 1990s,[2] a key feature of my analysis. I analyze six molecule submarkets (*famotidine*, *ranitidine*, *nizatidine*, *roxatidine*, *omeprazole* and *misoprostole*), which represent more than 90% of the prescriptions during the sample period (1990–1992). I restrict my sample to these six molecules because the other molecules represent more 'mature' and smaller submarkets, where some of the prices for identical brands differ.[3] In each submarket there is a patent-holder and licensees marketing the molecule. Much of the literature on trade-name drugs versus generics is concerned with the dimensions (among others, 'perceived quality' or name recognition) according to which these products 'differ'. In my analysis I focus on competing drugs based on the same active ingredient and

[1] All the drugs sold under a license or a patent in the Italian market have a trade name.

[2] It has recently been found that approximately 80% of peptic ulcers can be cured by eradicating *Helicobapter Pylori*, a bacterium responsible for the recurrence of ulcers, by using a combination of antibiotics and anti-ulcer drugs (Graham [1993]).

[3] Producers of older molecules had their prices equalized only upon applying for a price revision, which happened much later. Moreover, some of the producers in these excluded submarkets are very small firms for whom the assumption of identical quality might not hold.

marketed by important producers entering the market at the same time.[4]

III. THE DATA

The main dataset (provided by the *Istituto Superiore della Sanita'*) records, for a 10% sample of the population of the Metropolitan Area of Rome aged 15–85, all the prescriptions in the anti-ulcer (A02B) drug market during the period 1990–1992. The sample is stratified according to age and gender; so that the results are representative of the Rome population.

This patient-level dataset contains over 310,000 observations. An observation records the identity of the prescribing doctor, the identity of the patient, the year and month, and the particular presentation form of the drug prescribed (for example, 1 package of ZANTAC 20 tablets, 150 mg each). An observation indicates exactly the drug bought by the patient, because the records are collected from pharmacies. In the patient-level dataset there are more than 3,400 doctors prescribing at least once to one of the in-sample patients. A supplementary dataset from the same source records all the prescriptions that 350 of these doctors wrote for any of their patients during the same period. The supplementary doctor-based dataset contains over 710,000 prescriptions and each observation records exactly the same information as the patient-level dataset. The final dataset used in my estimations has more than 75,000 observations; it retains all the observations in the patient-level dataset for the patients who received at least one prescription from one of the 350 doctors whose entire prescription history is known.

Italian Market Three important characteristics of the Italian pharmaceutical industry are: (i) there is no price and third-party payer variation, (ii) the over-the-counter (OTC) market was tiny in the period of interest, and direct advertising to patients for prescription drugs had not yet started,[5] and (iii) during the sample period, the pharmacist had no power to substitute generics for trade-name drugs, as he does in many American states.[6]

Doctors' Prescribing Behavior Doctors heavily prescribe across brands:

[4] By doing this I believe I have effectively controlled for all 'objective' dimensions of differentiation between drugs; therefore I can proceed with my tests of doctor or patient indifference fairly confident that I have controlled for a large share of drug-specific heterogeneity.

[5] It is currently illegal throughout the EU and will remain so for several years even though the subject is now occasionally raised.

[6] Hellerstein's dataset, therefore, potentially contains a large amount of measurement error in the prescription variable for states where substitution with generics is mandatory.

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